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NON-PRICE FACTORS AFFECTING
HOUSEHOLD FOOD CONSUMPTION
IN SIERRA LEONE

By

Victor E. Smith, John Strauss,
Peter Schmidt and William Whelan

Working Paper No. 12 1980

Department of Agricultural Economics
Michigan State University
East Lansing, Michigan 48824

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NON-PRICE FACTORS AFFECTING HOUSEHOLD FOOD CONSUMPTION IN SIERRA LEONE

By

Victor E. Smith,* John Strauss,**
Peter Schmidt* and William Whelan**

Report No. 3

CONSUMPTION EFFECTS OF ECONOMIC POLICY PROJECT

Contract No. AID/DSAN-C-008

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1980

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PREFACE

This report examines the influence of a number of non-price factors that affect household food consumption in rural Sierra Leone. It constitutes the third stage of a study of the effects of economic policy on consumption behavior and household nutrient intake levels. 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 second to "Household Food Consumption in Rural Sierra Leone," by Victor E. Smith, Sarah Lynch, William Whelan, John Strauss and Doyle Baker (Working Paper No. 7 in the same 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 N. AID/DSAN-C-0008 with the United States Agency for International Development (USAID). The data were collected in Sierra Leone during 1974-75 by the Rural Employment Research Project at Njala University College, Sierra Leone (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 data collection was under the direction of Dunstan S. C. Spencer and Derek Byerlee of the Njala Rural Employment Research Team. Dr. Spencer is now with the West Africa Rice Development Association, Liberia, and Dr. Byerlee with the International Wheat and Maize Improvement Center, Mexico. Both men 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 been assisted by Mr. Tom Roberts, Department of Agricultural Economics and Extension, Njala University College, Njala, and Joseph Tommy, Acting Head of that department, both members of the Njala Rural Employment Research Team. Mrs. Agnes Becker, graduate student from Sierra Leone in the Department of Family Ecology at Michigan State University has been a valuable source of information. Susan Chu, who did most of the programming for this report, has been extremely helpful. To these and to many others who have helped in various ways, we express our appreciation.

INTRODUCTION

Development policies and the development process often have unforeseen consequences for the nutritional status of people in a developing country. Only when we are able to predict the nutritional consequences of development programs will we be able to take account of them in the planning process. 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 effects of economic policies. The purposes of the research project from which this report derives are to develop methods for obtaining such information and to estimate the consequences of various economic policies for food consumption (and, ultimately, household nutrient intake).

We concentrate upon households that produce large portions of their own food, for across the world these households comprise the greater number of those at risk from malnutrition. For such 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 household 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.

The first requirement for a study of the household firm is access to data on both the consumption and the production aspects of a household's activities. Such data are rare, but the African Rural Employment Survey collected both kinds of information for each household in its expenditure sample.

The data were collected in highly disaggregated form, extremely valuable for anyone interested in the nutritional consequences of food behavior. From these data, we have developed estimates of the complete set of food quantities consumed by each individual household in the sample (140 households). The estimates were first presented in our second project report [Smith, Lynch, Whelan, Strauss and Baker, 1979, hereafter cited as Smith et al.]. The present report presents revised estimates plus a series of two-way cross-tabulations investigating the effects of ten different non-price variables upon consumption per adult male consumer equivalent, for six commodities: rice, other cereals, cassava, palm oil, groundnuts and alcoholic beverages. The next report will present single equation regression analyses of food purchase behavior for 14 foods and six groups of foods, drawing upon a set of some 40 variables, including the price variables. A still later report will give the results of systems estimation using a household-firm model.

CHAPTER I

THE AFRICAN RURAL EMPLOYMENT SURVEY[1]

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.

Purposes

The project consisted of a number of interrelated studies, at the core of which was a nationwide survey of rural household farm and nonfarm activities in Sierra Leone. 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

---

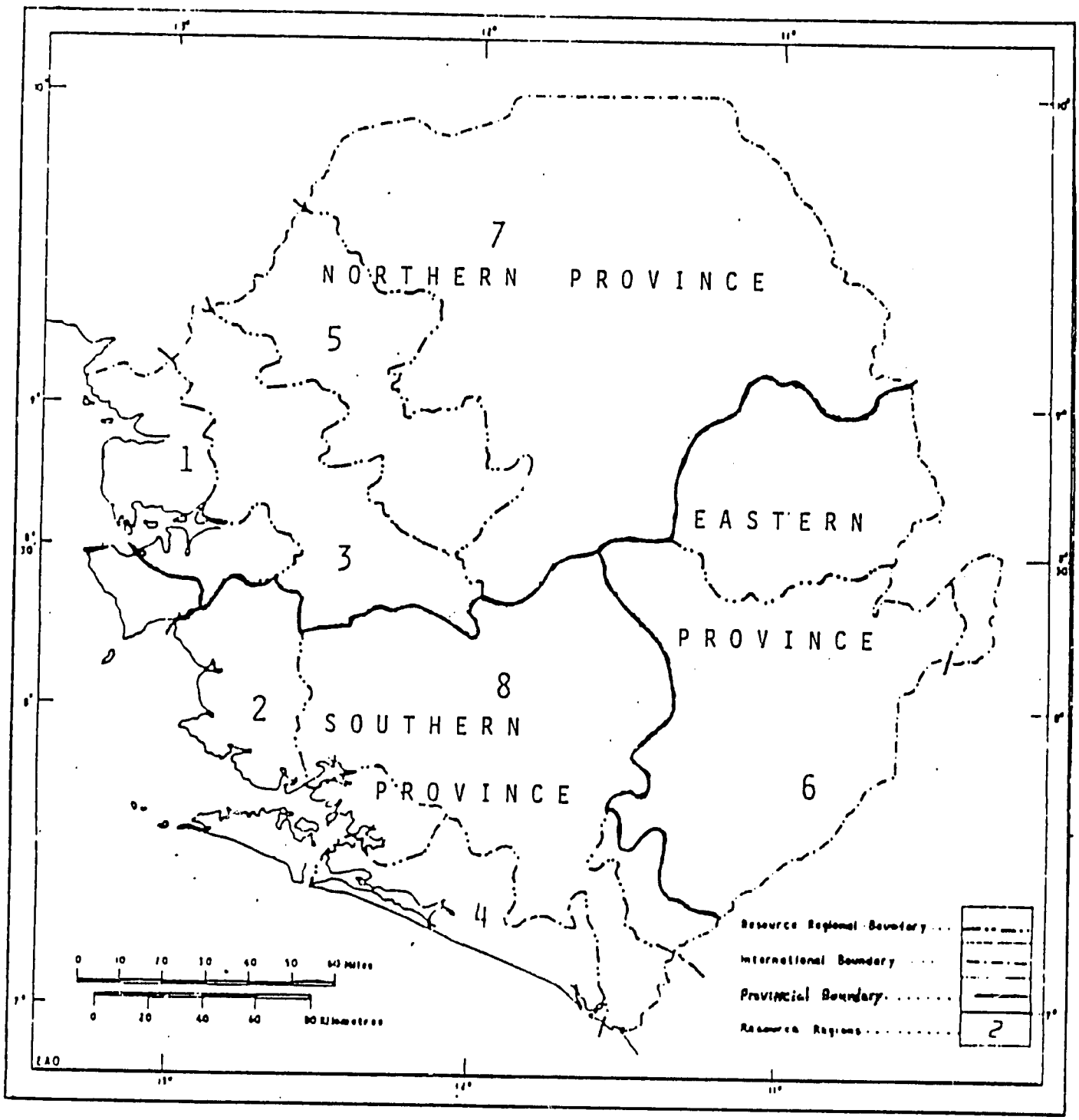
[1]The material in this chapter is largely repeated from Chapter III of Smith *et al.*, [1979]. The material will be helpful for the understanding of what is to come, but that report is now out of print.

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 are based upon materials drawn 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 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, p. 7, 9].

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. (There were large differences in the total population of each resource region). The range in percentage of



Resource Region Code

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

FIGURE 1

SIERRA LEONE: ECOLOGICAL ZONES

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 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 expenditure survey were administered two questionnaires. To reduce the bias in response due to memory decay, different reference periods were used with the two questionnaires. One 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 other 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. 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 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 estimates of annual food consumption reported here consist of the quantities of foods purchased by each household (estimated from the expenditure data collected for one week each month) and the quantities produced by the household and available for home consumption. Quantities available for home consumption were defined as quantities produced less the quantities used for seed (in the case of rice only), paid out as wages to hired labor, or used for processing. They were then adjusted for storage losses. For more details see Smith et al. [1979, pp. 33-35].

CHAPTER II

THE CONSUMPTION SAMPLE

The consumption sample draws its market expenditure material from the expenditure survey and its material on home-produced consumption from the production survey, so a household in the final consumption sample must be a member in good standing of both the final production and the final expenditure samples.

The Sample as Drawn versus the Usable Sample

The Production Sample

The production sample was designed to given good representation of the production activities carried on in rural Sierra Leone. Stratification by ecological zone ensured that the sample would contain representatives of each important type of farming. Households in the Western Area and in the mining country--the northern part of the Eastern Province--were not included.

The sample does not purport to represent the frequency of occurrence of various activities in the rural population as a whole. Of course, by appropriate weighting we can estimate the characteristics of the population. We are not doing that here, but shall do it later; this report simply describes the behavior of the households in our sample.

The production sample as planned was to consist of 576 households. Because of enumerator failure or dishonesty, however, Byerlee and Spencer had to drop all households in three enumeration areas,

one of which included the mangrove swamp farms in Ecological Zone 1, the Scarcies area. Mangrove swamp farms from other parts of Sierra Leone are included in the sample [Spencer, Byerlee and Franzel, 1979, p. 17-19].

Other households were dropped because of missed interviews, possibly because of lack of enterprise on the part of the interviewer, but also as a result of deaths, movement from the village, or other factors. One consequence is that cattle ranching in the Northern Plateau area is underrepresented. Most cattle are owned by nomadic cattlemen, but when such households fell into the sample they were dropped during analysis because the frequent movement of the households caused gaps in the data [Spencer and Byerlee, 1977, p. 18]. Because of these and other problems, the number of households for which substantially complete data were available for the production sample dropped to 443.

Of the 443, Byerlee and Spencer judged 115 to be unsuitable for estimating income; thus 328 households became the final production sample. (Income estimates were essential to many of the production studies.) In addition, "unsuitable for estimating income" often meant that output figures were missing, inconsistent or obviously erroneous, so some households could not be used in many studies even when income figures were not required. For example, in some households where yield plot estimates were sought, certain crops were harvested before the scales had arrived on which the crops were to be weighed.

This attrition altered the proportions in which ecological zones were presented in the production sample. Yet even though most

or all of the households were lost from one enumeration area in five of the eight ecological zones, each ecological area was still represented in the sample.

The Expenditure Sample

As the African Rural Employment Survey was planned, the expenditure sample, drawn by selecting half the households randomly in each enumeration area, was to be a subset of the production sample. If the attrition that took place in the production sample had affected the expenditure subset exactly as it did the remaining households, the expenditure sample might have consisted of 164 households. Obviously this did not occur. Moreover, missing information was more common in the expenditure survey than in the production survey. Also, households for which the expenditure data were satisfactory were sometimes missing from the production sample, and households for which the production data were satisfactory sometimes had to be dropped from the expenditure sample. As the households in the consumption sample had to be satisfactory for both production and expenditure analyses, the final consumption sample consisted of 140 households, 43 instead of 50 percent of the final production sample. Again each ecological zone was represented in the final sample, although not all were represented equally.

The Consequences of Attrition

Unfortunately, much attrition occurred in arriving at the final production and expenditure samples, but since the processes involved were apparently random, there appears no obvious reason for believing that the final consumption sample was a biased selection

from the set of households originally surveyed. We know that information was lost concerning the mangrove swamp farms in the Scarcies area and concerning the migrant cattle growers of the Northern Plateau. We know also that the eight ecological zones are not equally represented, as had originally been planned. However, we have good coverage of the principal ethnic groups, the Mende, Temne and Limba peoples. We have almost no coverage of the Loko people (the dominant ethnic group in one enumeration area) or of the non-Limba peoples in the Northern Plateau. We can adjust for differences in the representation of ecological zones from the sample, but not, of course, for the absence of the smaller ethnic groups and pastoral households.

The possibility remains that other biasses exist that could create an unrepresentative sample of food consumption behavior among rural households in Sierra Leone. To test this we compare relevant characteristics of the consumption sample households with those of the largest group of households for which we have reasonably complete data.

Testing for Bias

In predicting the consumption behavior of rural households the crucial question is whether the households in the consumption sample adequately represent the larger group of households from which the consumpton sample was drawn. We have identified 21 characteristics possibly relevant to household food consumption decisions and have used a t-test to determine whether the mean values of these characteristics in the consumption sample differ significantly from the means for households not in the consumption sample. Table

2.1 lists the characteristics examined.

We have data sufficient to permit such comparisons for 443 households.[1] Three principal groupings of the total sample are of interest. They are shown in the following diagram.

<table>
<tr><td colspan="3">Total Sample (443 cases)</td></tr>
<tr><td colspan="2">Production Sample (328 cases)</td><td>Non-Income Households (115 cases)</td></tr>
<tr><td>Consumption Sample (140 cases)</td><td>Remaining Production Sample (188 cases)</td><td>Non-Income Households (115 cases)</td></tr>
<tr><td>Consumption Sample (140 cases)</td><td colspan="2">Non-Consumption Households (303 cases)</td></tr>
</table>

The production (or income) sample contains 328 households. The remainder of the total sample (the non-income) sample consists of 115 households. These are the households excluded from use in production analysis because of serious gaps in the data or evidence that the information needed for estimating household income was unreliable. The consumption sample, 140 households, is a subset of the production sample. We shall compare the consumption sample with the remainder of the total (the 303 non-consumption households), the consumption sample with the remainder of the production sample, and the 328 households in the production sample with the 115 non-income households.

Differences among Means

We tested the significance of the difference between the two means separately for each characteristic. If an F-test rejected the

[1]Data concerning three characteristics were missing for a few households.

TABLE 2.1

HOUSEHOLD CHARACTERISTICS

Net household income
Size and composition
Household size
Number of adult male consumer equivalents
Number of dependents (persons 0-15 or over 65 years of age)
Number of adults aged 16-65
Age of the household head
Number of wives of the household head
Size of enterprise
Total acreage devoted to all crops
Total quantity of labor used or sold out during the year
Production characteristics
Value of output of
Onions, peppers and chillies, and tomatoes
Cocoa and/or coffee
Oil palm products
Fishing
Other non-farm activities
Value of total output (exclusive of income from trading or from labor sold out)
Value of labor
Sold out
Hired
Type of rice production (total amount of annual labor devoted to)
Upland rice[a]
Mechanically cultivated rice (including mixed boliland[b] rice)
Other rice
Market orientation
Value of total sales

[a]Rain-fed.

[b]Grown in water standing in shallow "boli" depressions during the wet season.

hypothesis that the variances of a characteristic were equal in the two samples--at the 10 percent level or less[1] (the two-tail probability), we used an approximation to the t-test that was based on both sample variances. Otherwise we used the standard t-test, which assumes variances to be equal.

Comparing the consumption sample with the non-consumption households revealed a significant difference between the means (at the level of 10 percent or less) in only one of the 21 instances. The total value of labor sold out is higher for the households in the consumption sample than for those in the remainder of the total sample. The finding is significant at the one percent level. The mean value of labor sold out for households in the consumption sample was 30 Leones per year; among all non-consumption households the mean value reported was Le 20. We know from regression analyses that we have run (for 14 foods and six groups of foods)[2] that the value of labor sold out is not an important determinant of quantities consumed. The variable involving the value of labor sold was useful in the regressions for only three of the commodities and was statistically significant at the 10 percent level for only one. This difference between the two groups of households is not important.

Comparing the consumption sample with the remainder of the households in the production sample revealed essentially the same difference between the two subgroup means for the value of labor sold out, at a two percent level of statistical significance. (The mean for the

---

[1]The probability of a difference this large occurring by chance is not more than ten in 100.

[2]To be presented in our next report.

rest of the production sample was 21 Leones per year.) In addition, the means for two other characteristics among the 21 differed significantly: the mean total labor used was 5,900 hours per year in the consumption sample vs. 5,000 for the remainder of the production sample (the difference being significant at the one percent level); the age of the household head was 51 years for the consumption sample vs. 48 years for the rest of the production sample (statistically significant at the four percent level). In calculating the latter figure, five households had to be dropped from the remainder of the production sample because the data for this characteristic were missing. The age of the household head was a useful variable for ten foods or food groups among the 20 we studied by regression analysis. (Three of the ten are foods of some importance--rice, palm oil and groundnut.) In most cases this variable was statistically significant. Total labor used was not a variable in the regression analysis. (The quantity of household labor available appeared in the form of variables for the number of persons in specified age and sex categories. Those variables were often useful in the regression analysis, but none of their analogs here--"household size" through "number of adults" in Table 2.1--had differences between the means that were statistically significant, even at the 10 percent level.)

While total labor used and the value of labor sold out differed significantly between the two samples, the differences were not significant (even at the 10 percent level) for two other variables closely related to labor availability and use: the number of adults between the ages of 16 and 65, inclusive, and the value of labor hired.

Table 2.2 gives the mean values of a number of variables related

TABLE 2.2

LABOR AND INCOME COMPARISONS

Variable	(1) Consumption Sample	(2) Remainder of Production Sample	(3) Ratio (1) ÷ (2)
Size (number of persons)	6.55	6.35	1.03
Number of adults aged 16-65 years	3.47	3.34	1.04
Total labor used (hours per year)[a]	5900[b]	5000[b]	1.18
Value of labor hired (Leones per year)	61	57	1.07
Value of labor sold out (Leones per year)	30[c]	21[c]	1.43
Net household income (Leones per year)	560	489	1.15
Net household income per capita (Leones per year)	85.50	77.01	1.11

[a]In manhour equivalents:. One hour of female labor = .75 hours of male labor and one hour of labor by a person under 16 = .50 hours of male labor.

[b]The difference is significant at the one percent level.

[c]The difference is significant at the two percent level.

to labor use and household income. According to these means, households in the consumption sample use 18 percent more labor than the remaining households in the production sample, but this is only partially accounted for by the extra seven percent of labor hired by consumption sample households. The remainder of the extra labor used plus the extra labor sold out comes to more than can be explained by the fact that the consumption sample households have four percent more adults; therefore these households must be providing more labor per adult.[1] They also have larger incomes, on the average, and larger incomes per capita than the households in the remainder of the production sample. Neither of the latter differences is statistically significant, however.

Such differences in labor use and availability, if they do indeed exist, might affect food consumption behavior, but the principal influences are likely to be through income. Yet the differences between the income variables are not significant. We conclude that the differences that are noted between the two groups of households--with respect to the value of labor sold out and the total quantity of labor employed--are not important for study of food consumption behavior.

Possibly the most important difference between the two samples is the fact that heads of households in the consumption sample average about three years older than in the rest of the production sample. This variable was useful in the regression analysis, but it is hard to find intuitive support for the proposition that a

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[1]Should the reader wish to convert value of labor in Leones into labor hours he may use Le 0.09 as the hourly wage rate (for rural Sierra Leone as a whole). [Spencer and Byerlee, 1977, Table 9.1, p. 60.]

difference of three years in the average age is likely to be associated with important differences in the food consumption behavior of the two groups. Furthermore, age data in developing countries are necessarily suspect, so a difference of three years in average ages may not be meaningful. In short, we expect the food consumption behavior of households in the consumption sample to be reasonably representative for the production sample as a whole.

While the consumption sample does not differ greatly from the rest of the total group of households, or from the rest of the production sample, the production sample differs appreciably from the 115 households not considered suitable for income calculation. For nine of the 21 characteristics the differences between the means of these two groups are statistically significant at the ten percent level, the highest of the probabilities being 7 1/2 percent. In addition to the three characteristics already discussed, significant differences exist for two variables that describe household size and composition (the number of consumer equivalents and the number of adults aged 16-65) and for four describing production characteristics. On the average, the households excluded from the production sample are somewhat larger (they have more consumer equivalents and more adults), the household heads are a little older, and the total volume of labor used is a little larger--if the data for the non-income households can be considered useful. In short, these households are more like those in the consumption part of the production sample. Those in the non-income group reported less income from labor sold out; in this respect they are the opposite of those in the consumption sample.

As for production characteristics, the averages differ significantly for three categories of output (in value terms): onions, peppers and chillies, and tomatoes; cocoa and/or coffee; and oil palm products. Likewise the means differ significantly for the amount of labor devoted to the production of "other rice": hand cultivated rice, river terrace rice, mixed[1] inland swamp rice and mangrove swamp rice. In general the households excluded from the production samples reported larger production of oil palm products, much lower outputs of onions, peppers and tomatoes, and much larger quantities of labor devoted to the production of "other rice." (Remember that these were the households excluded from the production sample because their data--including their output figures--were unreliable.)

These comparisons of the means of individual characteristics suggest that the production sample differs in several ways from the households deleted from that sample. The differences in household size and composition may indicate that the two groups of households are in fact different, if the data can be taken at face value, but the differences in production characteristics cannot be taken at face value and do not warrant the conclusion that the two groups of households are actually different. The differences recorded may not measure differences actually existing among the households but rather differences between good and bad measures of their characteristics.

The consumption sample does not differ from the remaining 303 households in the total sample in any important way. The 303 households consist of two somewhat dissimilar components, the non-consumption part of the production (income) sample and the non-income households.

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[1]Both hand and mechanically cultivated.

The consumption sample is more like the average of these two parts than it is like the production part of that average. Still, even the differences between the consumption sample and the remainder of the production sample are not likely to be associated with non-representative food consumption behavior among the consumption sample households. The consumption sample may be more representative of all 443 households than is the production sample of which it is a part, but one cannot be sure of this, for the data for the non-income portion of the total sample are unreliable, especially those relating to income (including such data as the value of labor sold out and output quantities or values).

In sum, the consumption sample represents well the total group of 443 households and is reasonably representative of the smaller group of 328 households in the production sample. There are definite differences, possibly important ones, between the households in the production sample and those excluded from the production sample because of the quality of their data. The latter households would not be satisfactory for use in studies of either the production or consumption behavior of rural households in Sierra Leone. Either the consumption or the production sample, however, can be used with some confidence. As we have already seen, the consumption sample is more representative of the total of all 443 households than is the production sample.

Hotelling's T^2

The conclusions stated above are based partly on the fact that few statistically significant differences exist between the means of individual characteristics (one out of 21 when comparing the consumption sample with the rest of the entire sample and three out of 21 when comparing it with the rest of the production sample) and

partly upon the judgment that such differences as exist are unlikely to be associated with important differences in food consumption behavior.

If we were willing to assume that the covariance matrices were the same for each pair of samples we could advance further support for these conclusions. Hotelling's T^2 test, which makes this assumption, indicates that the sets of differences between the means[1] (taking all characteristics as a group) are not satistically significant at the 10 percent level for the comparison between the consumption sample and the rest of the 143 households and not statistically significant at the five percent level for the comparison between the consumption sample and the remainder of the production sample.[2] However, there is no reason to assume that the covariance matrices are the same in either of these comparisons, so our conclusion does not rest on these results.

It is possible that using a modified T^2 test that takes account of differences in the covariance matrices would further confirm

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[1] In this test there are only 20 means because the value of one of the 21 characteristics is already determined by the values assigned to two of the others. (Household size is equal to the sum of the number of adults and the number of dependents.)

The number of cases compared is also slightly different for the T^2 test than when testing individual characteristics. In examining an individual characteristics it is only necessary to delete households for which there is a missing value for the characteristics involved. To analyze the whole set of characteristics it is necessary to delete every household for which any characteristics has a missing value, so for the T^2 test the consumption sample numbers 131 households and the non-consumption households 279.

[2] For the comparison with all other households the significance level is 16 percent; comparison with the remainder of the production sample yields a six percent significance level.

the judgments already made, but to pursue the matter further would not be a wise use of time. Such differences as may exist between the samples are not likely to have important effects upon food consumption behavior.

Differences among Variances

Comparing the means of the characteristics of the various samples led us to conclude that the consumption sample is unbiased and reasonably representative. Comparing the variances of the distributions of the several characteristics shows the variances to differ significantly for 12 or 13 of the 21 characteristics, whether the comparison is between the consumption sample and all other households, the consumption sample and the rest of the production sample, or the production sample and the households excluded because the data were unsuitable for the determination of income levels. Evidently, estimates of mean values will be more reliable than estimates of the distributions of the values of characteristics, whether in the production or the consumption samples. Estimates of the distributions are likely to be affected by the choice between the production or the consumption samples.

Conclusion

In our judgment the consumption sample is reasonably representative of the larger samples from which it was drawn. Estimates of the distributions of the values of characteristics will be less reliable than estimates of their means.

CHAPTER III

TABULAR ANALYSIS

In the second report from this research project [Smith et al., 1979], we presented the food consumption patterns of the households in our sample with some tabulation of consumption by a number of relevant variables. In this report we extend the analysis, beginning with three tables which repeat much of the information given in Tables 5.1 to 5.3 of the earlier report. The information is included here because it is useful background for the present study and because these estimates are improvements on those presented earlier. We have done a modest amount of additional editing (primarily with respect to the estimates of food consumed from home production) and we have dropped one household from the earlier sample of 141 households because the data were not suitable for income analysis. We have chosen here the better of the two estimates for rice consumption given in the second report, namely, that which used rice pounded in estimating the quantity of rice produced at home. We omit the entry for palm kernel, not used as a food, and we combine the entries for omole and local gin, as these are the same commodities. In addition, the data for fish consumption here include estimates of consumption by the ten households in Enumeration Area 13, a commercial fish-producing area.[1] As before, we describe only the

[1] In EA 13, calculating the quantities of fish consumed by each household by subtracting sales from production separately for the fresh and dry forms of each species yielded unreliable figures, although the totals of these gave reasonable estimates for the sum of all species, including both fresh and dried fish. Therefore, in this EA we based our estimates of each household's home-produced fish consumption on the total value of such fish consumed, allocating that value to fresh and dried saltwater fish in

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characteristics of the sample. Food consumption estimates for the population as a whole will be the subject of a later report.

Household Consumption Patterns

After presenting food consumption levels in detail for 100 foods, we group the 100 into 26 categories. We report quantities per household, per capita, and per adult male consumer equivalent, as well as the percentage of households consuming and the percentage of consumption that is produced by the consuming household.

Mean Household Consumption Levels--100 Foods

Table 3.1 shows the quantities of each of 100 different foods consumed annually by the 140 households in the sample. The most important were rice, palm oil, dried fish and cassava; every household consumed rice, nearly every household consumed dried fish and palm oil, and eighty-two percent of the households consumed cassava. Annual rice consumption per household, 612 kg per year, is equivalent to .56 lb or 924 calories per person per day. This is consistent with Central Statistics Office estimates of rural rice consumption in 1969/70 of .56 and .53 pounds per day [Sierra Leone, Central Statistics Office, 1972, pp. 45, 48, 51]. For a more detailed analysis of the household consumption figures see [Smith *et al.*, 1979, pages 37-45]. Table 3.1 here is a revised version

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(continued from page 1)

the proportion in which aggregate market purchases of fresh and dried fish were allocated by the ten households as a group. Consequently, all consumption of bonga by these households is included with "other" saltwater fish and the division between fresh or dried is the same for each household in this location. In this process we lost the detail on household-to-household variation in the division of fish consumption between bonga and other species and between the fresh and dried forms, but we retained household-to-household variation in the total quantities of fish consumed.

TABLE 3.1

MEAN ANNUAL HOUSEHOLD CONSUMPTION IN SAMPLE, BY COMMODITY--RURAL SIERRA LEONE

Commodity	Quantity Consumed, Mean over All Households (Kilograms)	Percentage Produced by Consuming Household[a]	Quantity Consumed, Mean over Consuming Households (Kilograms)	Percentage of Households Consuming
Rice, clean	612	74	612	100
Benniseed	12	96	34	36
Fundi	33	97	153	21
Millet	14	77	70	20
Maize, shelled	3	72	12	26
Sorghum	54	88	81	66
Rice flour	0	0	3	5
Agidi	0	0	11	1
Cakes	1	0	7	11
Bread	2	0	6	37
Biscuits (NATCO)	0	0	3	15
Cereal, processed, unspecified	1	0	9	7
Cassava	343	80	418	82
Gari	16	95	90	18
Foofoo	17	57	71	24
Cassava bread	0	3	3	6
Yam	0	0	11	2
Water yam	2	100	20	12
Chinese yam	0	100	2	1
Cocoyam	1	3	34	4
Sweet potato	2	42	20	10
Ginger	2	100	76	3
Root crop, unspecified	0	0	1	1
Palm oil	83	52	86	96
Palm kernel oil	1	25	3	29
Groundnut oil	0	0	1	1
Coconut oil	0	52	3	7
Cocoa butter	9	100	152	6
Margarine	0	0	2	4
Cooking oil	0	0	1	1
Oil, unspecified	0	0	1	1

TABLE 3.1--Continued

Commodity	Quantity Consumed, Mean over All Households (Kilograms)	Percentage Produced by Consuming Household[a]	Quantity Consumed, Mean over Consuming Households (Kilograms)	Percentage of Households Consuming
Groundnut, shelled	68	81	91	74
Groundnut balls	0	100	16	1
Blackeyed bean, shelled	1	99	23	3
Broadbean, shelled	9	100	25	37
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	3	0	13	25
Other	99	72	141	70
Fish, saltwater, dried				
Bonga	61	0	67	90
Other	79	4	88	90
Fish, frozen or iced	11	0	73	16
Fish, freshwater, fresh	16	0	55	29
Fish, tinned	0	0	1	8
Beef	1	70	16	9
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	36	62	55	66
Okra	3	86	6	42
Peppers and chillies	24	72	28	84
Cabbage	0	100	5	1
Eggplant	1	83	7	12

TABLE 3.1--Continued

Commodity	Quantity Consumed, Mean over All Households (Kilogram)	Percentage Produced by Consuming Household[a]	Quantity Consumed, Mean over Consuming Households (Kilograms)	Percentage of Households Consuming
Greens	4	91	28	14
Jakato	1	94	2	34
Pumpkin	5	48	45	11
Tomato	4	95	11	36
Tomato paste	0	0	1	24
Watermelon	1	6	24	2
Cucumber	0	100	2	9
Egusi (the fresh melon)	3	100	88	4
Vegetables, other	0	9	0	19
Orange	15	93	45	34
Lemon	0	100	0	1
Pineapple	2	53	11	14
Banana	0	100	0	21
Plantain	0	17	3	6
Avocado	0	0	4	2
Pawpaw	0	100	3	3
Mango	3	84	26	13
Guava	0	100	-6	1
Breadfruit	0	0	9	1
Coconut	11	97	70	16
Fruit, unspecified	0	76	4	4
Salt	14	0	15	93
Sugar	3	0	6	52
Condiments, unspecified	0	0	4	8
Maggi cubes	1	0	1	79
Kola nut	10	96	17	61
Coffee	6	95	26	22
Tea	0	0	1	2
Soft drinks, bottled	0	0	4	12
Ginger beer, local	0	0	8	1
Palm wine	114	94	306	37
Raffia wine	1	30	11	8
Beer, Star and Heineken	0	0	4	2

TABLE 3.1--Continued

Commodity	Quantity Consumed, Mean over All Households (Kilograms)	Percentage Produced by Consuming Households[a]	Quantity Consumed, Mean over Consuming Households (Kilograms)	Percentage of Households Consuming
Omole	4	14	16	23
Liquor (rum, etc.)	0	0	5	1
Food, other	0	0	5	1
Meals	-35[b]	...	-35[b]	99

[a]Total quantity consumed from own household production divided by total consumption. Less than 1/2 of 1 percent is recorded as zero.

[b]Meals, measured in numbers, are the meals paid or received by the household in exchange for labor. A negative number means the meals were paid out.

Glossary of Food Names

Agidi: A paste made from the starch of maize.

Benniseed: *Sesamum indicum*. An oilseed.

Blackeyed bean: *Vigna sinensis* or *Vigna unguiculata*. Cowpea.

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

Foofoo: A paste made from fermented cassava root, 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". The tangerine is also called "lemon".

Maggi Cubes: Bouillon cubes. "Maggi" is a brand name.

Omole: A locally distilled hard liquor. Usually made from palm wine and sugar.

Pawpaw: *Carica papaya*. Papaya.

Tangerine: Also called "lemon".

of Table 5.1, on which the 1979 analysis was based, but the revisions do not alter the results in any important way, although the ten households in EA 13 were omitted when calculating the fish data for the earlier table. We include them here, but note that their consumption of bonga is included with "other" fish and that the division between fresh and dried saltwater fish for those households is an estimate based upon market purchases.

Consumption per Capita and per Consuming Unit--26 Categories

Tables 3.2 and 3.3 are revised versions of Tables 5.2 and 5.3 of the earlier report. Table 3.2 converts the figures on quantities consumed per household into quantities per capita and per adult male consumer eqivalent. The latter measure is the more relevant to questions of nutritional adequacy, but the per capita quantities are included because food adequacy is often discussed in per capita terms. In Table 3.2 all households are included when calculating the quantities per capita or per consumer equivalent, but obviously not all households consume all foods. Therefore, Table 3.3 presents the per capita and per consumer equivalent quantities — calculated over only those households that consume a given good. Except for rice, where all households are consumers, the figures are higher for consuming households than for the total of all households in the sample. Averages for all households underestimate the quantities of individual foods consumed by consuming households, but they may be the better measures to use in estimating the total intake of all foods because the lower figures take account of the fact that many households consume zero amounts of many foods. (See the right-hand column in Table 3.3).

TABLE 3.2

MEAN ANNUAL CONSUMPTION, ALL HOUSEHOLDS IN SAMPLE, BY COMMODITY GROUP--RURAL SIERRA LEONE (Kilograms)

Commodity Group	Quantity per Household	Quantity per Capita	Quantity per Consumer Equivalent
Clean rice	612	93	126
Other cereals	116	18	24
Cassava	343	52	71
Cassava products	34	5	7
Yams	4	1	1
Other root crops	4	1	1
Palm oil	83	13	17
Palm kernel oil	1	0	0
Other oils and fats	9	1	2
Groundnuts	68	10	14
Other legumes	24	4	5
Fish: saltwater, fresh or frozen	114	17	23
Fish: saltwater, dried	140	21	29
Other fish	16	2	3
Game	8	1	2
Other meat	8	1	2
Other animal products	2	0	0
Vegetables	81	12	17
Citrus fruits	17	3	3
Banana, plantain and avocado	0	0	0
Other fruits	15	2	3
Sugar	3	0	1
Salt and other condiments	15	2	3
Kolanut	10	2	2
Beverages, non-alcoholic	6	1	1
Beverages, alcoholic	118	18	24
Meals	-35[a]	-5[a]	-6[a]

[a]Meals measured in numbers. A negative entry means meals paid out.

TABLE 3.3

MEAN ANNUAL CONSUMPTION, CONSUMING HOUSEHOLDS IN SAMPLE, 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	612	93	126	100
Other cereals	143	21	29	81
Cassava	418	67	89	82
Cassava products	94	12	16	36
Yams	23	5	6	17
Other root crops	31	4	6	14
Palm oil	86	13	18	96
Palm kernel oil	3	0	1	29
Other oils and fats	55	8	11	16
Groundnuts	91	13	18	74
Other legumes	50	8	10	47
Fish: saltwater, fresh or frozen	146	22	30	78
Fish: saltwater, dried	144	22	29	97
Other fish	40	7	9	40
Game	14	2	3	56
Other meat	23	3	4	34
Other animal products	11	1	2	20
Vegetables	84	13	17	96
Citrus fruits	44	6	9	38
Banana, plantain and avocado	1	0	0	26
Other fruits	47	8	10	31
Sugar	6	1	1	52
Salt and other condiments	15	2	3	97
Kolanut	17	3	3	61
Beverages, non-alcoholic	19	3	4	33
Beverages, alcoholic	215	35	46	55
Meals	-35[a]	-5[a]	-7[a]	99

[a]Meals measured in numbers. A negative entry means meals paid out.

Non-Price Factors Affecting Consumption per Consuming Unit

In the second report from this project [Smith et al., 1979, pp. 49-60] the model underlying the analysis regarded the quantity of food consumed per adult male consumer equivalent as determined in part by the following seven variables: income per consumer equivalent, two variables representing household composition (number of consumer equivalents and dependency ratio), two representing environmental conditions (region and population density), and two representing aspects of the farming system (the percentage of labor employed in the production of upland rice[1] and market orientation). Although the dependent variable was expressed as a quantity per consumer equivalent, to test the hypothesis that consumption per consumer equivalent falls as the number of consumer equivalents rises, we used the number of consumer equivalents also as an independent variable. The dependency ratio (in essence, the ratio of non-producing to producing members of the household) was included to test the hypothesis that a high ratio of dependents results in lower levels of food intake. Population density was in the list to test the hypothesis that consumption levels fall as population density increases, while the regional variable was included to test whether there were consumption differences associated with physical environment or other factors related to location.

We used the proportion of labor devoted to upland rice as a variable because it is widely believed that households that grow upland rice have more varied diets than others and consume larger quantities of nutritionally desirable foods other than rice. Upland rice, in contrast to rice produced under other systems of cultivation, is usually grown as a mixed crop,

[1] Rain-fed rice.

along with cassava, benniseed, millet, sorghum, melon, etc. Market orientation was included to test the opinion that production for the market is damaging to the diet because it diverts resources away from food production for home consumption.

The effects of each variable were examined singly for each of twenty-nine foods or groups of foods. As one would expect, the consumption of most foods rose with increases in income per consumer equivalent. Alcoholic beverages were an interesting exception. For several important foods, consumption per consumer equivalent fell as the number of consumer equivalents rose. (The economist would say there were "economies of scale;" the nutritionist would say people were less well fed). Higher dependency ratios also were generally associated with lower levels of consumption per consumer equivalent.

The report also revealed marked regional differences in consumption patterns. The Southern Region consumed large quantities of cassava and palm oil; the North consumed small quantities of these but large quantities of vegetables and alcoholic beverages; Eastern region households were small consumers of rice, other cereals and cassava but large consumers of palm oil (yet not as large as Southern households) and of citrus fruits and kola nut. The data did not support either hypothesis relating to farming orientation, nor did they reveal a relationship between population density and food consumption per consumer equivalent.

Cross-Tabulation Analysis

The relationships shown in Tables 5.4 through 5.10 of the earlier report reflect responses to changes in one variable at a time and are averages over the entire sample. But if more than one variable has an influence, the response to Variable A may depend upon the level of

Variable B. Using two-way cross-classification tables we can examine the effects of two variables operating simultaneously. We cannot go beyond the two-way classification, for even that modest degree of cross-classification leaves us with so few households in some categories that the cell-to-cell variation observed is more likely to represent random differences peculiar to individual households than a systematic response common to many.

Looking at the data in tabular form is useful because we actually see how the quantities are affected by changes in relevant variables. It provides a readily understood introduction to the analysis and frees us from the necessity of relying exclusively upon results that may be impossible to reproduce except by complicated analyses that can only be fully understood by the highly trained specialist. However, in a world where many variables have an effect, only the strongest relationships are likely to be detected by cross-tabulation, and what we learn by examining the contents of such a table is contaminated by the fact that the levels of variables not treated explicitly are liable to change from cell to cell. Such changes may be by chance, or systematic, as when variables not controlled for in the analysis are correlated with variables explicitly considered. If there is chance variation, it may not be distributed randomly, and the effects may not cancel. Indeed, if the number of observations is small, the chance that random variations will offset each other is itself small.

In this report we delete population density from the set variables used in our previous report and extend the model to include four additional ones: ethnic group, number of wives of the household head, PCTOUT -- the percentage of the total value of output plus labor sold out that

comes from any or all of the following sources (onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; and labor sold out), and, for certain crops, SHCPH--the percentage of the quantity consumed that is produced at home. Adding ethnic group and number of wives tests the hypothesis that these variables affect consumption patterns. The variable PCTOUT represents another attempt to determine whether production for the market is deleterious to the diet. SHCPH approaches the same problem from another point of view: Is producing a large part of the household consumption of a particular food conducive to consuming more of that food?

In each case we look at only two variables at a time, making no attempt to consider all possible combinations of these variables, since doing so would create such masses of data as to be beyond comprehension. We shall consider the joint effects of large numbers of variables when we turn to the regression analysis in a later report.

In this part of our work we study six commodities: rice, other cereals, cassava, palm oil, groundnuts and alcoholic beverages--all the major items of food consumption except fish and vegetables. We omit vegetables because the group is too heterogeneous to make the analysis worthwhile. Fish are excluded because the detailed data for the consumption of fish produced at home proved unreliable for the 10 households in Enumeration Area (EA) 13, a commercial fish-producing area. For those households we have made estimates that are satisfactory for some purposes, but in the process we have reduced the amount of variation among households in EA 13 with respect to the division of consumption between fresh and dried fish. Under the circumstances, we shall not do cross tabulation analyses for fish.

As in the earlier report, the dependent variable is the quantity consumed per adult male consumer equivalent.[1] Using this ratio permits us to adjust for the effect of household size and composition without having to divide our 140 households into the smaller groups that would be necessary if we were to use grouping to control for the effects of household size. In this way, although we use only two-way cross-tabulations, we are actually examining the effects of three variables at once rather than two.

We also could have adjusted for household size by using quantity per capita as the dependent variable, but quantity per adult male consumer equivalent is undoubtedly more relevant to the nutritional needs of the household. However, using this ratio is not the best adjustment for household size and composition that is available. If the quantity--consumer equivalent relationship were strictly linear, we could adjust for it completely by dividing household consumption by the number of consumer equivalents in the household, but we saw in our earlier report [Smith et al., 1979, p. 51] that for a number of important foods the relationship is not linear--a further relationship remains after making the adjustment. In addition, as we shall see from the regression analysis, the

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[1]To calculate the number of consumer equivalents, each member of the household was assumed to be equivalent as a consumer to a specified fraction of an adult male, according to the following scale:

Sex	Age (in Years)			
	0-5	6-10	11-15	16 and over
Male	.2	.5	.75	1.0
Female	.2	.5	.70	.9

relationship differs by age and sex, as it does from one food to another.

The present sample contains only 140 households because income figures for one household in the earlier sample had been found to be unreliable. In addition, this report looks at the behavior of consuming households, in contrast to the earlier report, which looked at averages calculated over all households in the sample. Rice is the only commodity consumed by all households; five households consume no palm oil, 25 no cassava, 26 no "other cereals" (cereals other than rice), 36 no groundnuts and 63 no alcoholic beverages.

We include only consuming households when calculating the dependent variable--the average quantity consumed per consuming equivalent--because this gives us a more representative average for the households that do consume the commodity (eliminating the extreme effect that even one zero in a series of consumption figures may have), and recognizes the fact that a household that consumes none of a particular commodity may be one whose response is different in kind and not simply in degree.

The Important Variables

Household income, region and the number of consumer equivalents are important[1] in the cross-tabulation analysis, as they were in the earlier report, but the dependency ratio is useful here in only two cases. Three of the four new variables also prove to be important: ethnic origin, the percentage of the value of output plus labor sold out that is obtained

[1]We term a variable "important" if, for at least four of the six commodities being studied, the variable has a clear effect upon the quantity consumed per consumer equivalent. As the number of consumer equivalents and the variable for percentage of household consumption from home-produced goods are used for only four commodities, three instances will suffice for either of these.

from any or all of a specified group of activities,[1] and the share (percentage) of household consumption that is produced at home--SHCPH. The regional variable has an evident effect for all commodities except groundnuts. SHCPH is useful for three of the four variables to which it was applied. (The exception is rice). The percentage of the value of output that comes from specified activities is a more effective measure of the orientation of the farming enterprise than either of the farming orientation measures used in our previous report (labor devoted to the production of upland rice and market orientation).

Caution is required in interpreting these results. The apparent effectiveness of a single variable depends partly upon the variable with which it is paired in setting up the tables. (To reduce the confounding of the effects of two variables we chose pairings intended to keep intercorrelation between the independent variables at a low level). One could, of course, examine all possible combinations of the variables two at a time, but that would be an inefficient way of obtaining results derived more easily by regression analysis.

A given variable may also have connotations that do not appear at first glance. The regional variable, which distinguishes among households in the Southern, Northern and Eastern Regions, represents differences in ecological zones, but it also picks up the influence of other variables. A high correlation exists between the regional variable and various combinations of other explanatory variables (including many not

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[1]Producing onion, peppers, and tomatoes; cocoa and/or coffee; or oil palm products; non-farm activities other than fishing; and working for others (labor sold out). For convenience, we shall refer to this variable as the percentage of value product from specified sources--PCTOUT.

used in the present analysis). In particular, some of the price variables, calculated for eight geographical areas, enter into combinations that are very highly correlated with regions. Region is also closely associated with ethnic origin. The Mende people constitute the dominant ethnic group in both the Southern and Eastern Regions while the Temne and the Limba are almost all located in the Northern Region.

The Quantity Averages

In the earlier report, quantities consumed per consumer equivalent were calculated by dividing the total annual consumption of all 141 households in the sample by the total number of consumer equivalents in those households (ibid., Tables 5.4 through 5.10). The present analysis uses the same ratio--the annual quantity consumed per consumer equivalent--as the dependent variable, but examines the ratios for individual households. The averages reported in these tables are unweighted averages of the household ratios of consumption per consumer equivalent (each household weighted equally). In the previous report the averages were, in effect, weighted averages of the ratios for the individual households where the weights were the number of consumer equivalents in each household. In the present report each household ratio is weighted by the number of households in the cell in which the household occurs. The resulting averages are not always the same.

There are other reasons why the quantity averages differ in the two reports. (1) The samples are not identical: (a) In this report we look only at consuming households. (b) One of the households included in the previous sample was dropped because its income figures (and, presumably, related variables important to the analysis) were unreliable.

(c) Additional editing of data used in the earlier report has been done (in particular, editing the estimates for consumption of home-produced foods).

(2) This report, for the most part, groups the households into different classes than did its predecessor because the objectives of the two analyses differ. Where households are unevenly distributed within a class, altering the position of a class limit can greatly affect the average value for the class. Moreover, in this report many classes are broader than those used in the earlier report. To study two variables operating simultaneously, it is desirable to have classes broad enough to leave at least a modest number of households in each subgroup defined by the two-way classification. Consequently we cannot always define our highest and lowest groups narrowly enough to reveal clearly the full differences between behavior at the extremes and behavior nearer the center of the distribution. The narrower classes at the extremes in the one-way distributions of the earlier report illuminate behavior at the extremes to a greater extent than is possible in the present report.

We can usually adjust the number of households in a group by adjusting the class limits if the variable is continuous, but when the variable is discrete this is not possible, for the limits are defined by the nature of the classification. Ethnic origin and region are such cases. In the case of region, although many of the ecological characteristics on which the classification is based change continuously, the variable itself is discrete because it is not feasible to change regional boundaries in order to provide better balance among the number of households in each region.

The Commodity Tables

Rice

Table 3.4 gives the cross-classification results for rice. We study it closely, not only because rice is the most important food in Sierra Leone but because this table is a model for others to come. In Section A the quantities of rice consumed per consumer equivalent are classified by household income per consumer equivalent and by region.[1] The data cover only consuming households, but in the case of rice, each of the 140 households in the sample is a consumer. The right-hand column, headed "Row," provides a one-way classification of households by income per consumer equivalent. In the upper left-hand corner of each cell is the average quantity consumed per consumer equivalent for the households in that cell. As we see, quantity rises with income at income levels less than 106 Leones per year and remains stable at approximately 158 kilograms at income levels above 106 Leones.[2] If households with incomes of at least Le 169 per consumer equivalent were classified into narrower groups, we would observe that the quantity of rice consumed continues to rise as incomes grow. The narrower class limits of Table 5.4 of our previous report [ibid, p. 50] show this clearly.

In the center of the cell is the number of households. The central items in the "Row" column constitute a frequency distribution of the 140 households by income classes, as specified in the stub. As class limits have been chosen with an eye to dividing the total sample into groups large enough to permit further analysis, the reader must note the variable

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[1] In this section we shall often use "quantity" instead of "quantity consumed per adult male consumer equivalent." Should the word be used with any other meaning, we shall make that explicit.

[2] In 1974-75 one Leone equaled U.S. $1.10 [Spencer and Byerlee, 1977, p. 24].

X		
	Y	
		Z

X = Quantity Cons. MPC
Y = No. of HH
Z = St. Deviation

TABLE 3.4

RICE CONSUMPTION PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE
(Kilograms)

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region									Row		
	North			South			East					
Less than 70	73	16	61	138	10	99	40	5	30	89	31	79
70 or more, but less than 106	134	16	65	134	18	60	61	5	24	125	39	63
106 or more, but less than 169	195	8	83	168	23	136	85	7	79	159	38	121
169 or more	159	11	75	183	16	127	78	5	37	158	32	105
Column	130	51	80	158	67	112	68	22	51	133	140	98

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group									Row		
	Limba[b]			Temne			Mende					
Less than 10	124	4	28	119	14	77	190	20	131	157	38	111
10 or more, but less than 20	120	7	61	127	11	115	158	24	117	144	42	109
20 or more, but less than 45	117	4	54	143	10	100	111	27	69	119	41	75
45 or more	96	3	48	159	4	92	73	12	73	95	19	79
Column	116	18	48	132	39	93	138	83	108	133	140	98

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.4--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	132	4	90	72	6	58	138	12	103	140	8	66	125	30	85
10 or more, but less than 49	54	3	16	107	23	83	103	10	57	53	5	59	95	41	73
49 or more, but less than 61	94	2	94	187	18	123	135	9	75	135	8	76	158	37	103
61 or more	163	3	138	168	18	131	152	11	97	...	0	...	162	32	116
Column	114	12	92	143	65	113	133	42	85	117	21	75	133	140	98

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio									Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	136	8	60	127	16	73	104	12	66	94	13	55	114	49	65
3.5 or more, but less than 8.5	170	4	191	196	14	139	153	9	92	101	8	85	160	35	125
8.5 or more, but less than 22.5	125	10	129	193	5	125	126	10	111	174	2	113	142	27	117
22.5 or more	41	4	23	138	9	91	144	9	89	137	7	80	126	29	85
Column	122	26	114	158	44	108	130	40	89	111	30	73	133	140	98

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

TABLE 3.4--Continued

E. Classified by Percentage of Consumption Derived from Home Production and Number of Adult Male Consumer Equivalents

Percentage of Consumption Derived from Home Production	Number of Consumer Equivalents												Row		
	Fewer than 3.5			3.5 or more, but fewer than 5.5			5.5 or more, but fewer than 7.5			7.5 or more					
Less than 50	141	9	148	127	8	109	124	8	69	129	5	55	131	30	103
50 or more, but less than 87	124	18	111	145	15	90	73	2	42	75	2	76	123	40	96
87 or more, but less than 99	200	14	119	144	13	80	148	8	69	131	10	91	159	45	96
99 or more	140	8	115	139	6	103	67	7	75	68	4	19	108	25	94
Column	151	49	122	140	42	89	107	28	72	113	21	74	133	140	98

width of each class in order to visualize how the frequency distribution would look if it were plotted against class intervals of equal width.

The quantity in the lower right-hand corner of each cell is the standard deviation of the items in the cell. It indicates how closely the quantities for individual households are grouped around the average for the cell and thus provides a means of judging how well the mean represents the individual households in the cell. A large standard deviation may indicate that variables not controlled by the two-way tabulation have important effects on household behavior. In this case, not surprisingly, standard deviations are higher at income levels above Le 106 than below that figure.

The bottom section of Table 3.4.A, headed "Column," presents analogous information by regions. The regional classifications, while based upon ecological zones, approximate fairly well the boundaries of the Northern, Southern and Eastern Provinces, but the sample does not include households from the mining area of the Eastern Province. Households in the South consume more rice than households in the North, but the most conspicuous feature of the regional classification is the low level of rice consumption in the households from the Eastern Region.

The cells in the body of the table show income and region operating simultaneously. (For the most part, in analyzing these results we have ignored cells in which there are fewer than eight households. The averages for these cells are likely to be heavily influenced by chance events affecting the individual households. On the other hand, as in the data for the Eastern Region, consistency across cells may be such as to warrant consideration. The average for the group of cells is much less subject to accidental variation than the average for any single cell).

Looking at the upper left-hand figure in each cell and reading down the column reveals that the overall pattern, rice consumption rising with income for the three lower income classes, is not consistent across regions. In the South, rice consumption remains essentially the same in the two lowest income classes. Furthermore, in two of the three regions rice consumption in the highest income class is less than in the class just below it. Nor does the Southern Region consistently consume more rice than each of the other regions at each income level. The highest consumption level in Table 3.4.A (195 kilograms per year) is among Northern Region households with incomes per consumer equivalent between 106 and 169 Leones per year.

When we look at the two variables operating simultaneously, the relationships are neither as simple nor as consistent as would be convenient, but it is generally true that households with annual incomes of 70 or more Leones per consumer equivalent consume more rice than those with lower income levels and that households in the East consume considerably less rice than those in the South and the North. With only one exception, the lowest consumption levels (between 40 and 85 kilograms per year) are in the East. Note, however, that in that region the number of households in each cell is so small that in any one cell the mean value may be heavily influenced by either chance events or the influence of some uncontrolled variable that affects only one or two households in the cell.

For the sample as a whole, Table 3.4.B shows that as there is an increase in the percentage of value product derived from our list of specified activities,[1] rice consumption falls. For Limba[2] households, however, the effect is small, and for Temne households consumption rises.[3] We know from other data that only 14 percent of the households in the sample as a whole obtained more than 45 percent of their value product from the potentially market-oriented activities on our list and that 27 percent obtained less than 10 percent from these activities.

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[1]The specified activities are either primarily engaged in for market sale or can be largely oriented toward the production of money income (the production of onions, peppers, or tomatoes in Ecological Zone One near the urban area of Freetown, or the production of oil palm products).

[2]One Loko household is included with those of Limba origin.

[3]All the Limba and almost all the Temne households are in the Northern Region. There are a few Temne households in the South, but aside from those, all the households in the South and East are Mende. There are no Mende in the Northern Region.

The highest consumption level in the classification (190 kg) occurred among Mende households that obtained less than 10 percent of their value product from the specified sources; the lowest (73 kg) occurred among the 12 Mende households that obtained at least 45 percent of their value product from such sources.

Table 3.4.C tells us that for households whose head has one wife, rice consumption generally increases with the percentage of labor devoted to upland rice, but that for other households either high or low percentages of labor spent on upland rice are associated with high rice consumption.[1] Obviously the one-variable analysis in the earlier report (ibid, p. 58, Table 5.9) could not detect the pattern existing among one-wife households, so the report indicated no clear relationship between the percentage of labor devoted to upland rice and the volume of rice consumption, except where households devoted at least 72 percent of their labor to upland rice. For those households, rice consumption was notably higher than for any of the other classes in the table (or in any of the cells of the present analysis).

Incidently, data not included in these tables show that only 9 households in the sample produced no upland rice at all; only one (which applied 87 percent of its labor in this way) used more than 80 percent of its labor for this purpose.

The number of wives in itself seems to have no consistent relationship to the quantity of rice consumed per consumer equivalent.

The highest consumption levels in Table 3.4.C occurred in the cells where households devoted at least 49 percent of their labor to upland rice and the head of the household had fewer than three wives. The lowest occurred where households devoted at least 10 percent but less than 49

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[1] Two households in the sample were headed by women

percent of total labor to upland rice. The average consumption level was 95 kilograms per consumer equivalent for the 41 households in this category, an average pulled down, however, by the eight households with either no wives or more than two. Possibly these figures were heavily influenced by chance variation.

Table 3.4.D classifies rice consumption by the dependency ratio (the ratio of the number of household members less than sixteen or more than sixty-five years old to the number between sixteen and sixty-five inclusive) and by market orientation (the ratio of scales to the value of total output from farm and non-farm activities, not including the value of labor sold out). No clear relationship appears between market orientation and rice consumption. From data not presented in this table we know that only seven households sold more than fifty percent of their total product, and fifteen reported zero sales; sixty percent of the sample households sold less than 8 1/2 percent of their product.

Twenty-six of the 140 sample households reported no dependents. For those with dependents, if the household sold less than 8 1/2 percent of its product, there was a clear downward effect upon rice consumption as the dependency ratio increased. As this tabulation does not control for income, however, what we see may be the effect of a higher dependency ratio upon income per consumer equivalent. In our regression analysis we can control for all these variables at once. For the households most oriented to the market the dependency ratio had little effect.

The rice consumption level was highest for a group of households that sold from 3 1/2 to 8 1/2 percent of the total product and had a dependency ratio between 0.13-0.70. (Five households selling from 8 1/2 to 22 1/2 percent of their product consumed almost as much). Consumption

was least for households selling less than 8 1/2 percent of their product and with dependency ratios of 0.70 or more.

Table 3.4.E, which looks at the percentage of rice consumption derived from home production and the number of adult male consumer equivalents, reveals no clear relationship between consumption and the percentage produced at home. The relatively low level of consumption associated with producing at least 99 percent of home consumption is an average based on 11 households with very low consumption levels (around 67 kilograms per year) and 14 with levels slightly above the mean for the 140 households in the entire sample. For the sample as a whole, rice consumption per consumer equivalent is greater for households with fewer than 5 1/2 consumer equivalents than it is for larger households, but again this result depends upon a small number (15 households) with very low consumption figures (in the neighborhood of 70 kilograms per year).

The larger rice consumption figures are associated primarily with households containing fewer than 5 1/2 consumer equivalents and deriving at least 87 percent of their rice consumption from home production.

Data not presented in this table show that while 21 percent of the households produced less than half of the rice they consumed, only 10 percent produced less than one quarter. At the other extreme, 21 households (15 percent of the sample) consumed only home-produced rice. Three households produced none of the rice consumed.

While many of the factors considered here affect rice consumption, in no case did the average whole-sample response to a single variable hold consistently for each subgroup in the sample. To understand the effect of a single variable we must control for the effects of other variables; to do that effectively requires more than two-way cross-classifcation analysis.

Other Foods

Rice, the most important food in Sierra Leone, has been discussed in detail. Tables 3.5 through 3.9 present similar cross-tabulation analysis for five additional foods: other cereals (cereals other than rice), cassava, palm oil, groundnuts and alcoholic beverages. The reader who desires detailed information about these products will find it in these tables, but our discussion of them will be limited to a brief comparison of the overall consumption patterns of Northern and Southern households.

Food-by-food comparison of particular classes of households shows that high income households in the South are large consumers of all six foods. The greatest consumption of cassava in the South occurs in the next-to-the-highest income class (with incomes between 106 and 169 Leones per consumer equivalent). In the North the highest consumption levels for all foods are found in that same income class, (except for cassava). (Some cells, however, contain so few households as to raise a question about the representativeness of their means). The average consumption of alcoholic beverages in the South is essentially the same for the six households with incomes below Le 70 as for those in the highest income class. (See Section A of Tables 3.4 through 3.9).

Low income households in the North (incomes below Le 70 per consumer equivalent) economize on the consumption of every food except cassava and alcoholic beverages. In that region those households are the largest consumers of cassava and the second largest consumers of alcoholic beverages. In the South, however, households at that income level consume average quantities of palm oil and well-above-average quantities of alcoholic beverages. They are not the lowest consuming class

TABLE 3.5

CONSUMPTION OF OTHER CEREALS PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE
(Kilograms)

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region			Row
	North	South	East	
Less than 70	17 13 25	12 9 18	1 3 1	14 25 21
70 or more, but less than 106	35 13 43	21 13 25	3 4 1	24 30 34
106 or more, but less than 169	72 5 70	26 22 35	25 6 32	33 33 43
169 or more	22 9 24	68 13 109	14 4 10	44 26 81
Column	31 40 41	32 57 60	13 17 21	29 114 50

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group			Row
	Limba[b]	Temne	Mende	
.ess than 10	73 3 50	20 12 33	26 18 32	28 33 36
0 or more, but less than 20	46 5 23	47 9 70	36 18 89	41 32 76
0 or more, but less than 45	70 4 42	14 8 21	19 25 36	24 37 37
5 or more	... 0 ...	20 3 21	15 9 24	16 12 22
Column	60 12 36	26 32 44	26 70 53	29 114 50

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

Other cereals are cereals other than rice.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.5--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	28	4	47	16	2	16	34	7	66	12	7	20	23	20	45
10 or more, but less than 49	7	3	16	14	19	22	27	10	35	31	5	35	19	37	28
49 or more, but less than 61	35	2	51	72	14	104	27	8	24	49	6	36	53	30	75
61 or more	1	3	0.4	16	15	20	32	9	46	...	0	...	20	27	31
Column	17	12	33	31	50	62	30	34	42	30	18	33	29	114	50

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio									Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	53	5	75	29	12	27	67	11	43	36	9	43	45	37	45
3.5 or more, but less than 8.5	8	4	15	47	13	104	9	9	9	4	5	11	24	31	69
8.5 or more, but less than 22.5	19	9	32	8	5	14	26	7	30	17	1	0	19	22	27
22.5 or more	3	1	0	9	8	12	31	8	60	19	7	22	19	24	37
Column	25	19	45	28	38	64	36	35	45	22	22	32	29	114	50

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

TABLE 3.6

CASSAVA CONSUMPTION PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE
(Kilograms)

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region			Row
	North	South	East	
Less than 70	54 11 137	153 10 91	5 2 6	93 23 123
70 or more, but less than 106	2 12 11	152 18 131	2 4 3	81 34 121
106 or more, but less than 169	39 3 30	218 23 240	7 5 7	166 31 224
169 or more	12 7 9	182 16 204	14 4 22	113 27 177
Column	25 33 81	182 67 187	7 15 12	114 115 169

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group			Row
	Limba[b]	Temne	Mende	
Less than 10	5 3 5	85 10 163	269 19 234	187 32 224
10 or more, but less than 20	10 2 7	26 11 37	165 23 185	114 36 163
20 or more, but less than 45	2 1 0	10 7 17	102 25 129	80 33 119
45 or more	24 1 0	22 4 3	33 9 44	29 14 35
Column	9 7 9	40 32 95	155 76 187	114 115 169

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.6--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head .

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	19	3	17	1	5	42	47	11	67	23	7	39	29	26	53
10 or more, but less than 49	38	2	46	94	19	126	108	8	104	21	4	37	85	33	111
49 or more, but less than 61	157	2	96	261	14	290	142	7	158	51	4	74	191	27	235
61 or more	54	3	55	171	17	201	147	9	180	...	0	...	152	29	184
Column	61	10	69	152	55	210	106	35	132	30	15	48	114	115	169

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio												Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	141	7	208	229	13	247	71	8	129	67	5	132	148	33	205
3.5 or more, but less than 8.5	91	4	83	178	13	207	132	6	181	52	6	54	130	29	168
8.5 or more, but less than 22.5	151	10	257	94	5	96	37	9	64	108	2	138	97	26	173
22.5 or more	133	4	194	55	8	68	80	8	106	44	7	90	71	27	106
Column	135	25	204	159	39	198	75	31	119	59	20	92	114	115	169

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

TABLE 3.6--Continued

E. Classified by Percentage of Consumption Derived from Home Production and Number of Adult Male Consumer Equivalents

Percentage of Consumption Derived from Home Production	Number of Consumer Equivalents									Row		
	Fewer than 3.5			3.5 or more, but fewer than 5.5			5.5 or more, but fewer than 7.5			7.5 or more		
Less than 1	16	3	8	89	7	168	15	9	9	8	5	6	35	24	93
1 or more, but less than 90	196	9	260	35	5	23	87	4	111	38	4	45	111	22	183
90 or more	194	32	228	103	22	110	134	8	114	40	7	57	142	69	179
Column	182	44	228	90	34	116	74	21	97	30	16	44	114	115	169

TABLE 3.7

PALM OIL CONSUMPTION PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE
(Kilograms)

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region			Row
	North	South	East	
Less than 70	3 15 5	28 10 44	14 5 14	13 30 28
70 or more, but less than 106	7 16 5	16 18 13	22 5 14	13 39 12
106 or more, but less than 169	15 8 16	27 20 32	29 7 27	25 35 28
169 or more	11 11 5	47 15 49	41 5 32	33 31 39
Column	8 50 9	29 63 36	27 22 24	21 135 29

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group			Row
	Limba[b]	Temne	Mende	
Less than 10	3 4 3	8 12 5	17 19 16	12 35 13
10 or more, but less than 20	2 7 2	14 10 19	21 24 33	16 41 27
20 or more, but less than 45	6 4 6	12 10 15	41 27 37	30 41 34
45 or more	14 3 5	12 3 4	31 12 42	25 18 35
Column	5 18 6	11 35 13	28 82 34	21 135 29

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.7--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	23	4	26	16	5	23	18	12	30	11	8	6	16	29	23
10 or more, but less than 49	47	3	32	23	23	20	31	9	48	13	5	15	25	40	29
49 or more, but less than 61	23	2	30	22	18	32	19	9	33	5	8	5	18	37	29
61 or more	53	3	83	23	16	30	10	10	6	...	0	...	22	29	34
Column	36	12	44	22	62	26	19	40	32	10	21	9	21	135	29

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio									Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	36	7	54	10	15	14	16	11	20	6	12	4	15	45	26
3.5 or more, but less than 8.5	33	4	28	24	14	27	26	9	34	12	8	12	23	35	26
8.5 or more, but less than 22.5	44	10	45	12	5	4	23	10	30	9	2	12	28	27	35
22.5 or more	14	3	22	26	9	27	13	9	7	26	7	48	21	28	29
Column	36	24	42	18	43	22	20	39	24	12	29	25	21	135	29

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

TABLE 3.7--Continued

E. Classified by Percentage of Consumption Derived from Home Production and Number of Adult Male Consumer Equivalents

Percentage of Consumption Derived from Home Production	Number of Consumer Equivalents									Row		
	Fewer than 3.5			3.5 or more, but fewer than 5.5			5.5 or more, but fewer than 7.5			7.5 or more		
Less than 19.5	16	19	20	12	22	10	17	13	36	6	9	5	13	63	20
19.5 or more, but less than 94	30	17	23	31	9	45	22	7	16	9	9	11	25	42	27
94 or more	32	10	47	35	11	41	27	7	39	11	2	15	30	30	40
Column	25	46	29	22	42	31	21	27	32	8	21	9	21	135	29

TABLE 3.8

GROUNDNUT CONSUMPTION PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE
(Kilograms)

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region			Row
	North	South	East	
Less than 70	12 14 10	11 8 21	1 1 0	11 23 15
70 or more, but less than 106	16 13 19	19 14 20	8 4 11	17 31 18
106 or more, but less than 169	25 6 33	13 13 21	15 5 7	16 24 22
169 or more	15 11 20	34 12 57	46 3 59	27 26 45
Column	16 44 19	20 47 34	19 13 30	18 104 28

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group			Row
	Limba[b]	Temne	Mende	
Less than 10	38 3 18	16 13 18	18 15 20	19 31 20
10 or more, but less than 20	19 6 12	22 9 43	12 16 16	16 31 26
20 or more, but less than 45	23 4 28	14 8 30	15 18 27	16 30 27
45 or more	2 1 0	56 4 80	13 7 19	26 12 49
Column	23 14 19	22 34 39	15 56 21	18 104 30

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.8--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	58	3	67	51	5	72	10	9	10	18	7	23	27	24	43
10 or more, but less than 49	9	3	13	3	14	6	23	9	28	28	5	18	14	31	20
49 or more, but less than 61	23	2	0.4	19	14	33	18	8	13	24	5	24	20	29	25
61 or more	-2	3	8	13	11	15	16	6	22	...	0	...	11	20	17
Column	22	11	40	16	44	33	17	32	19	23	17	21	18	104	28

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio									Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	5	6	9	19	13	17	35	9	40	19	11	21	21	39	25
3.5 or more, but less than 8.5	0	1	0	12	13	17	12	6	18	33	5	47	16	25	26
8.5 or more, but less than 22.5	8	7	13	2	2	0.2	11	7	12	16	1	0	9	17	11
22.5 or more	70	3	89	21	8	33	19	6	25	4	6	4	23	23	40
Column	18	17	41	16	36	21	21	28	28	18	23	27	18	104	28

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

TABLE 3.8--Continued

E. Classified by Percentage of Consumption Derived from Home Production and Number of Adult Male Consumer Equivalents

Percentage of Consumption Derived from Home Production	Number of Consumer Equivalents												Row		
	Fewer than 3.5			3.5 or more, but fewer than 5.5			5.5 or more, but fewer than 7.5			7.5 or more					
Less than 5	7	10	5	5	4	5	6	10	7	5	6	8	6	30	6
5 or more, but less than 100	16	2	9	22	6	19	61	2	4	51	3	14	34	13	23
100	33	19	51	11	22	21	17	12	14	21	8	16	20	61	33
Column	24	31	42	13	32	20	16	24	18	21	17	20	18	104	28

TABLE 3.9

CONSUMPTION OF ALCOHOLIC BEVERAGES PER CONSUMER EQUIVALENT, CONSUMING HOUSEHOLDS IN SAMPLE

A. Classified by Income per Adult Male Consumer Equivalent and Region

Household Income per Consumer Equivalent (Leones per Year)	Region									Row		
	North			South			East					
Less than 70	88	8	83	39	6	68	2	3	2	56	17	75
70 or more, but less than 106	60	7	109	14	12	22	1	4	2	25	23	64
106 or more, but less than 169	256	5	250	10	15	17	-1	2	9	65	22	153
169 or more	27	3	44	38	11	85	-8	1	0	33	15	74
Column	108	23	154	22	44	51	0	10	4	45	77	101

B. Classified by Percentage of Value Output from Specified Sources[a] and Ethnic Group

Percentage of Output (by Value) from Specified Sources	Ethnic Group									Row		
	Limba[b]			Temne			Mende					
Less than 10	15	4	21	27	3	44	33	12	82	29	19	66
10 or more, but less than 20	74	7	75	23	2	32	5	16	12	26	25	50
20 or more, but less than 45	175	4	147	86	1	0	22	17	44	53	22	91
45 or more	345	3	282	...	0	...	7	8	16	99.	11	202
Column	129	18	168	35	6	40	17	53	47	45	77	101

NOTE: Proceeding down the diagonal, the entries in each cell are as follows: mean quantity per consumer equivalent, number of households, and standard deviation.

[a]Percentage of value of output plus labor sold out that is derived from the following: onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]One Loko household is included with this group.

TABLE 3.9--Continued

C. Classified by Percentage of Total Labor Devoted to Upland Rice and Number of Wives of Household Head

Percentage of Total Labor Devoted to Upland Rice	Number of Wives									Row		
	0			1			2			3 or more					
Less than 10	1	1	0	2	2	2	40	2	54	8	2	11	15	7	29
10 or more, but less than 49	62	2	22	46	17	161	62	6	121	46	2	a	50	27	137
49 or more, but less than 61	174	1	0	32	9	51	53	6	68	122	6	128	69	22	89
61 or more	6	2	8	32	12	83	9	7	17	...	0	...	22	21	63
Column	52	6	67	36	40	115	40	21	75	84	10	108	45	77	101

D. Classified by Market Orientation[c] and Dependency Ratio[d]

Market Orientation (Percentage)	Dependency Ratio												Row		
	0.00			0.13 or more but less than 0.70			0.70 or more but less than 1.45			1.45 or more					
Less than 3.5	11	5	8	29	8	61	167	7	246	55	8	60	68	28	138
3.5 or more, but less than 8.5	101	3	159	40	8	106	34	5	40	28	3	35	46	19	91
8.5 or more, but less than 22.5	42	5	75	-3	5	11	51	6	83	a	1	0	30	17	65
22.5 or more	4	3	2	25	6	34	2	2	1	a	2	a	13	13	25
Column	36	16	79	26	27	67	83	20	160	37	14	51	45	77	101

[c]Total sales ÷ value of total output (farm and non-farm).

[d]$\frac{\text{Household members less than 16 or more than 65 years old}}{\text{Members 16-65 years old}}$.

for any foods except "other cereals" and groundnuts. Economizing behavior varies among regions as well as among foods.

The Findings

Each variable considered has proven to be associated with household food consumption in some instances. In general, consumption rises with income except for alcoholic beverages, where no clear pattern is evident. The regional variable makes a difference: households in the Southern Region consumed large quantities of cassava; those in the South and East used large quantities of palm oil. Northern households consumed small amounts of cassava and palm oil, but large amounts of vegetables and alcoholic beverages. In the East the consumption of rice, other cereals and cassava was low; these households were large consumers of citrus fruit and kola nut as well as of palm oil. For the sample as a whole, when the percentage of output from specified sources (PCTOUT) increases, the consumption of rice and cassava falls, but the consumption of palm oil generally rises.

Ethnic origins also make a difference: Limba households are high consumers of alcoholic beverages[1] and cereals other than rice, while Mende households are high consumers of cassava and palm oil.[2] The ratio of dependents to adult workers influences the consumption of cassava and palm oil: the larger the dependency ratio the lower the consumption level.

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[1]As all Limba households are in the North, this must be part of the explanation for the high alcoholic beverage consumption in that region.

[2]The South, a high-consuming region for these two foods, consists almost entirely of Mende households.

Where the household head has only one wife, large rice consumption is associated with devoting more than 49 percent of total labor to the production of upland rice. This is true for cassava consumption for the entire sample. Palm oil consumption tends to be low if less than ten percent of household labor is devoted to upland rice.

Market orientation is sometimes associated with consumption levels. The consumption of cereals other than rice is usually high for households that sell less than 3 1/2 percent of their output; the consumption of cassava is low for households that sell more than 8 1/2 percent, and the consumption of alcoholic beverages falls with a rise in the percentage of total output marketed. Households producing large portions of their own consumption consume more cassava, palm oil and groundnuts than do others.

The number of consumer equivalents affects household consumption per consuming equivalent in three of the four cases for which this variable was used. (Remember that any linear relationship between consumption and the number of consumer equivalents was removed by expressing the dependent variable as a quantity per consumer equivalent). Cassava consumption per consumer equivalent falls as the number of consumer equivalents rises. Rice consumption per consumer equivalent is higher when the household has less than 5 1/2 consumer equivalents, but palm oil consumption per consumer equivalent is higher when the household has fewer than 7 1/2 consumer equivalents.

The number of wives of the household head has an effect in two instances: palm oil consumption per consumer equivalent falls as the number of wives rises, and cassava consumption is higher in households with

one or two wives than in households with more wives or in which no wife is present.

Tables 3.10 and 3.11 summarize situations in which the joint effects of two variables (in two instances, the effects of a single variable) resulted in unusually high or low levels of consumption. Southern households with incomes of at least Le 169 were high consumers of rice, "other cereals," cassava, palm oil and groundnuts. (The highest rice consumption levels were observed in Northern households with incomes between 106 and 169 Leones). Incomes as low as 106 Leones per year per consumer equivalent in the South were consistent with annual consumption of more than 180 kilograms of cassava. High consumption levels for rice and cassava were found in Mende households devoting less than ten percent of their production to activities in the specified list. Mende households that devoted between 20 and 45 percent of the value of their output to these activities (which include the production of palm oil products) were heavy consumers of palm oil.

Households that devoted between 49 and 61 percent of their labor to producing upland rice were large consumers of rice and cassava if the household head had one wife; if there were two wives such households were large consumers of "other cereals." Households that sold less than 3 1/2 percent of the value of their output and had a dependency ratio between 0.70 and 1.45 were large consumers of "other cereals" and groundnuts; the households were large consumers of cassava if the dependency ratio was between 0.13 and 0.70. The largest consumers of rice were households that sold between 3 1/2 and 8 1/2 percent of their product and had a dependency ratio between 0.13 and 0.70.

TABLE 3.10

SITUATIONS RESULTING IN HIGH LEVELS OF MEAN HOUSEHOLD CONSUMPTION PER CONSUMER EQUIVALENT

Commodity and Level (Kilograms per Year)	A. Income per Consumer Equivalent (Leones)		Region	B. Specified Outputs[a] (Percentage)		Ethnic Group	C. Labor Devoted to Upland Rice (Percentage)		Wives (Number)
Rice above 182 if	106 but < 169	and	North	Less than 10	and	Mende	49 but < 61	and	1
	At least 169	and	South						
Other Cereals above 66 if	At least 169	and	South				49 but < 61	and	2
Cassava above 180 if	At least 106	and	South	Less than 10	and	Mende	49 but < 61	and	1
Palm Oil above 40 if	At least 169	and	South	20 but < 45	and	Mende			
Groundnut above 30 if	At least 169	and	South						

Commodity and Level (Kilograms per year)	D. Market Orientation[b] (Percentage)		Dependency Ratio[c]	E. Consumption Derived from Home Production (Percentage)		Adult Male Consumer Equivalents (Number)
Rice above 182 if	3.5 but < 8.5	and	0.13 but < 0.70	87 but < 99	and	fewer than 3.5
Other Cereals above 66 if	Less than 3.5	and	0.70 but < 1.45	d		d
Cassava above 180 if	Less than 3.5	and	0.13 but < 0.70	At least 1	and	fewer than 3.5
Palm Oil above 40 if	8.5 but < 22.5	and	zero			
Groundnut above 30 if	Less than 3.5	and	0.70 but < 1.45	100	and	fewer than 3.5

NOTE: No instances are recorded if there are fewer than eight households in the cell. Alcoholic beverages are not listed because the number of consuming households is too small to lead to dependable results.

[a]Onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]Total sales ÷ value of total output (farm and non-farm).

[c]$\frac{\text{Household members less than 16 or older than 65 years old}}{\text{Members 16-65 years old}}$.

[d]These classifications were not used for Other Cereals.

TABLE 3.11

SITUATIONS RESULTING IN LOW LEVELS OF MEAN HOUSEHOLD CONSUMPTION PER CONSUMER EQUIVALENT

Commodity and Level (Kilograms per Year)	A. Income per Consumer Equivalent (Leones)		Region	B. Specified Outputs[a] (Percentage)		Ethnic Group	C. Labor Devoted to Upland Rice (Percentage)		Wives (Number)
Rice below 95 if	Any level	and	East	45 or more	and	Mende			
	Under 70	and	North						
Other Cereals 15 or below if	Under 70	and	South	45 or more	and	Mende	10 but < 49	and	1
				20 but < 45	and	Temne			
Cassava 30 or below if	70 but < 106	and	North	10 but < 20	and	Temne			
Palm Oil 7.5 or below if	Under 106	and	North				49 but < 61	and	3 or more
Groundnut below 8 if							10 but < 49	and	1

Commodity and Level (Kilograms per Year)	D. Market Orientation[b] (Percentage)		Dependency Ratio[c]	E. Consumption Derived from Home Production (Percentage)		Adult Male Consumer Equivalents (Number)
Rice below 95 if	Less than 3.5	and	1.45 or more			
Other Cereals 15 or below if	3.5 but < 8.5	and	0.70 but < 1.45	d		d
	22.5 or more	and	0.13 but < 0.70			
Cassava 30 or below if				Less than 1	and	5.5 but < 7.5
Palm Oil 7.5 or below if	Less than 3.5	and	1.45 or more	Less than 19.5	and	7.5 or more
Groundnut below 8 if				Less than 5	and	any level

NOTE: No instances are recorded if there are fewer than eight households in the cell. Alcoholic beverages are not listed because the number of consuming households is too small to lead to dependable results.

[a]Onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; non-farm activities other than fishing; labor sold out.

[b]Total sales ÷ value of total output (farm and non-farm).

[c]$\frac{\text{Household members less than 16 or older than 65 years old}}{\text{Members 16-65 years old}}$.

[d]These classifications were not used for Other Cereals.

We calculated the percentage of consumption derived from home production for rice, cassava, palm oil, and groundnuts, but not for the two groups of foods labeled "other cereals" and alcoholic beverages. When this variable was used we paired it with the number of consumer equivalents. Households consuming large quantities of rice, cassava and groundnuts had fewer than 3 1/2 adult male consumer equivalents per household. The large consumers of groundnuts produced 100 percent of their consumption. The largest consumers of rice produced between 87 and 99 percent of their consumption, but those that produced all their own consumption consumed less. The home production category for large consumers of cassava, however, included all households producing not less than one percent of their own consumption.

Table 3.11 summarizes combinations of variables associated with the smallest levels of consumption. Northern households were low consumers of palm oil if their annual incomes were below 106 Leones per consumer equivalent, of cassava if the income level was between 70 and 106 Leones, and of rice if the income level was below 70. Households in the Eastern Region were low consumers of rice at any income level. The lowest consumers of other cereals were Southern households with incomes below Le 70. Mende households were low consumers of rice and other cereals if they derived at least 45 percent of their value product from the list of specified outputs. Temne households were low consumers of cassava if between 10 and 20 percent of their value product came from the specified activities; they were low consumers of "other cereals" if between 20 and 45 percent of the value product came from the output specified activities. Households with one wife and with between 10 and 49 percent of total labor devoted to upland rice were low consumers of "other cereals" and groundnuts. Households with three or more wives and with 49 and 61 percent of

their labor given to upland rice were low consumers of palm oil. Dependency ratios of 1.45 or more in households that sold less than 3 1/2 percent of their total output were associated with low consumption of rice and palm oil. The consumption of "other cereals" was low for households with dependency ratios between 0.70 and 1.45 if market sales were between 3 1/2 and 8 1/2 percent of their output (by value), or for households with dependency ratios between 0.13 and 0.70 if they sold at least 22.5 percent. Low consumption of cassava, palm oil and groundnuts was associated with low levels of consumption derived from home production and with households consisting of consumer equivalents between 5.5 and 7.5 (for cassava) and 7.5 or more (for palm oil). Groundnut consumption was low for consuming households that produced less than five percent of what they consumed, regardless of the number of consumer equivalents in the household.

Non-Consuming Households

Non-consuming households were not simply a random sample of the whole group; they differed from consuming households in a variety of ways. How they differed varied with the food under discussion.

All households consumed rice, but there were 26 that did not consume other cereals. They constituted 19 percent of the households in the sample as a whole, but 37 percent of those devoting 45 percent or more of their production to our list of specified activities,[1] 33 percent of the Limba households and 33 percent of the households devoting less than 10 percent of total labor to the production of upland rice. Producing upland rice appears to be conducive to consuming cereals other than rice, while

[1]Onions, peppers and tomatoes; cocoa and/or coffee; oil palm products; fishing and other non-farm activities; and labor sold out.

producing products for the market is not. At the other extreme, there were no non-consumers of "other cereals" among households whose head had no wife.

Twenty-five households, 18 percent of the entire sample, reported no cassava consumption. All 25 were non-producers, but these were also 23 consuming households that produced no cassava. In the North thirty-five percent of all households were non-consumers; in the South, none. Thirty-nine percent of the Limba households were non-consumers. Sixty-four percent of the households consuming no cassava were among the 35 percent in the sample that sold less than 3.5 percent of the value of their output. Seventy-six percent of the non-consuming households had dependency ratios of 0.70 or more, but only 50 percent of the sample had dependency ratios this large. The image of cassava as a food largely consumed by households with large numbers of children and produced primarily for subsistence is weakened by these last two observations. The majority of the households in each of these two categories consumed no cassava at all.

The five non-consuming households produced no palm oil, as one would expect. Four are from the South where palm oil consumption is normally high, but four are also from Temne areas. (There is a small Temne area in the Southern Region). Four of the five households also sell less than 3.5 percent of their output.

Thirty-six households in the sample of 140 consumed no groundnuts. None of these produced the crop. Only one of the 36 (three percent) was a household with an unmarried head, although nine percent of the sample consisted of such households.[1] With these exceptions non-consuming households seemed to be scattered through all classifications.

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[1]Two households were headed by women.

Sixty-three households (45 percent of the sample) reported no consumption of alcoholic beverages. Thirty-three of these households were from the Temne areas; 30 were Mende; there were no non-consumers among the Limba households. Eighty-five percent of the Temne households were non-consumers, but only 36 percent among the Mende.

The factors related to non-consumption are varied, the most common of them being ethnic origin and producing none of the commodity. In two of the five cases examined here non-consumption was less common among households whose head was unmarried; in another two it was more common among households marketing less than 3.5 percent of their total output. In the two cases in which a regional pattern appeared it seems likely that ethnic origin was the fundamental determinant.

Evaluation of Cross-Tabulation Analysis

Tabular analysis has advantages not easily matched by other methods. Perhaps the most important is that the results are easily understood. One can see the magnitudes involved (how much rice is consumed by the average household in a given classification), observe the relationships that exist between the dependent variable and the independent variables singly or jointly and judge for himself their strength and consistency. Tabulation and cross-tabulation provide realistic and intimate knowledge of the data--knowledge not easily obtained in other ways.

In addition, tabular analysis is not restricted by prior decisions about the form of the function that relates the dependent variable to the independent variables. The form revealed by the data will be whatever the data require--a real advantage indeed.

Yet disadvantages are many. If each cell of a cross-classified table must encompass enough observations to justify believing that the average value recorded for that cell represents the systematic rather than the non-systematic components of the observations, many observations are needed. With only 5 or 6 households in a cell, chance elements in the readings for those households can easily be the principal determinants of the mean value printed in that cell. Hence we have limited the analysis of our sample of 140 households to the use of two-way classification.

Moreover, while tabular analysis imposes no restrictions as to the form of the functional relationship between the dependent and the independent variables, the results obtained are dependent, in ways not always evident, upon arbitrary decisions of a different sort. The levels of the reported values for mean consumption per consumer equivalent and the shapes of the functional forms implied by these values can be seriously affected, at least in the case of continuous variables, by decisions concerning the widths of classes and the location of class limits. Moreover, while the functional form implied by the values of the dependent variable in the various cells is a function that weights the cell means equally, the means are not of equal importance, for one cell may represent 82 households, another 17 and a third only six.[1]

Some variables fall naturally into discrete classes (ethnic group and number of wives of the household head, for instance), so the question

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[1] In addition, the form of the relationship depends only upon the values of the cell means. Within-class variation of the observations has no effect upon the form of the relationship.

of an appropriate choice of class intervals and limits does not arise. But in the case of continuous variables grouped for tabular analysis, establishing a class interval defines a range of values of the independent variable for which all households are characterized by the mean value of the dependent variable for the whole class. Narrow class intervals are desirable, because the narrower the interval the greater the chance that the mean value for the class is representative of each of the observations within the class. Also, the narrower the intervals the better the chance that tabulation will reveal changes in the form of the functional relationship that may occur in different parts of the distribution. (At the high and low ends of the frequency distribution, narrow class intervals may be especially useful). However, the narrower the class intervals the fewer the number of households in a cell, so having enough households to warrant treating the mean for the cell as the result of systematic rather than random factors may require choosing classes of considerable width. For this tabulation we tried to choose intervals that would usually result in at least thirty households per class in the one-variable classifications.[1] Unfortunately, this means that the opportunity to identify changes in functional form that occur at the extremes of the frequency distribution may have been lost, for class limits at the extremes may have to be far apart in order to enclose enough households to permit further subdivision by the value of a second variable. The farther apart the class limits, the less representative the mean value.

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[1] In most cases this is allowed for a reasonable balance of households across classes.

The means may also be affected by the location of the class limits. Where the dependent variable fluctuates widely, a shift of a class to the right or left may move a few high or low observations from one class to another, creating large changes in the means. The location of the limits may also affect the extent to which the mean value is representative of the households within the cell. If the observations are equally distributed throughout the cell, the mean may be quite representative, but if they pile up at one end of the cell the average is less representative of the majority of the households in the group. If the frequency distribution is regular, at the upper end of the frequency distribution observations will cluster toward the lower limit of the class.

Even if the means of each cell are representative, the relationship one sees in a two-way tabulation may not be caused by the variable to which it is attributed, but by another variable or variables not controlled in the two-way classification. Each of the ten different variables has shown an association with consumption on one or more occasions. The consumption of a two-way classification fixes the value of one independent variable (or holds its variation within the range specified by the width of the class interval), but meanwhile eight other variables fluctuate freely. The relationship observed might not appear at all if the variable truly responsible for the change were to be held constant. (Or we may observe no relationship when one exists, because an unobserved independent variable exactly offsets the effect of the observed variable). What we need to know is the effect of one variable when all the others are held constant. Two-way cross-tabulation gives the effect of one variable when only <u>one</u> other variable is held constant, all the others varying in undefined fashion.

Here we have been able to extend the power of the classification analysis somewhat by expressing the dependent variable (the quantity consumed by the household) as a ratio to the number of consumer equivalents in that household. As we have pointed out, this imposes upon the data an assumption of the existence of a linear relationship between the household consumption and the number of consumer equivalents--an assumption that the data have shown is not always correct--but the procedure did allow us in effect to examine three independent variables at a time and still stay with the bounds imposed by the cross-classification method.

Some of the objections just presented would be reduced in importance if the sample available for study included enough observations to permit cross-classification in terms of larger numbers of independent variables. Even when this is possible, however, the output of an analysis in which a given sample has been classified and subclassified many times over becomes difficult to comprehend and summarize.

Many of the problems encountered in tabular analysis disappear when one turns to regression analysis. With multiple regression we can analyze a much larger number of variables with a sample of given size, consider all variables simultaneously, and examine the effect of a change in a single variable when the other variables are held constant. Instead of treating each cell mean as an observation, we treat each household as a single observation and thus may weight each observation equally (or according to some other deliberately chosen weighting scheme). Because each household is a distinct observation, we need not ask whether the cell mean is representative of the households within the cells or whether households are evenly distributed within the cell. We take account of the exact value of each of the variables for each household and lose no

information by treating different households as though they were identical. Furthermore, the regression analysis gives a direct numerical measure of how the dependent variable changes in response to a one-unit change in the level of the independent variable. Our next report will present the results of single-equation regression analysis of consumption behavior, looking at 14 foods and six groups of foods.

Summary

The tabulation analysis has provided a mass of detailed information about relationships between income and a variety of non-price variables that affect food consumption. Household composition, ethnic group, orientation toward the market and type of farming all have their effects, but the effects differ among foods and among classes of households. The prevalence of non-consuming households is also affected by some of these variables.

What the cross-tabulation analysis has not enabled us to do satisfactorily is disentangle the many relationships that exist so that we can isolate the effects of a single variable when other variables are held constant. We shall proceed with that problem in our next report.

CHAPTER IV

CONCLUSION

The sample described in this report consists of 140 households, although the survey had originally been planned to provide a sample of 250. Our tests show that despite the high attrition rate the 140 households are not a biased sample and represent quite well the food consumption behavior in rural Sierra Leone.

A number of opinions about the influence of non-price factors on household food consumption receive partial support from the data--partial in the sense that the relationship anticipated holds for some foods but not for others or for some groups of households but not for others. The income relationship holds the most generally: except for alcoholic beverages, and for cassava in the North, consumption tends to rise with income per consumer equivalent, but the relationship is not consistent among subgroups of households.

Region and/or ethnic group are often important. Cassava is most heavily consumed in the South and palm oil in the South and East; in these regions all households are of the Mende group except a few Temne households in the South. Alcoholic beverages are most heavily consumed in the North or by the Limba people.

The hypothesis that the household tends to consume less per consumer equivalent if the number of consumer equivalents is large was supported by the data for rice, cassava and palm oil, but not by the groundnut data. (In this report the variable was used in only these four cases). The related hypothesis, that high dependency ratios are associated with low consumption, was supported for only two of the six foods: cassava and palm oil. Clear relationships between consumption levels and the number of

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wives of the household head were few--and surprising. Palm oil consumption is higher in households with one or two wives than where there are no wives or more than two.

In three out of four cases (for cassava, palm oil and groundnuts), the data supported the belief that producing large proportions of the foods consumed encourages greater consumption, but the exception, rice, was important. The belief that production for sale tends to lower food availability within the household was usually borne out by the data (but in this report there was no control for the effects of production for sale upon household income). For palm oil, however, and for rice production among the Temne, the effect is the reverse.

Two hypotheses found lacking in support in our earlier report now show more promise. The percentage of labor devoted to the production of upland rice appears to be positively associated with cassava consumption and a low percentage of labor devoted to upland rice appears associated with low palm oil consumption. At higher levels of upland rice production each of these relationships becomes less clear. (See also Table 5.9 of Smith _et al_. [1979, p. 58]).

The hypothesis that food consumption is reduced by greater market orientation (as measured by the ratio of market sales to the value of total output) is also supported for three foods: "other cereals," alcoholic beverages and cassava, although in the latter case the relationship is consistent only for households with dependency ratios between 0.13 and 0.70. Only the alcoholic beverages case is clearly evident when households are grouped into the classes used in the second report [_ibid_., Table 5.10, p. 60].

Progress has been made toward identifying non-price relationships important for understanding food consumption behavior in rural Sierra Leone, but much more is needed. All the hypotheses examined in this report have proven useful in some instances, but different foods and different classifications of households are affected in different ways. Many variables that appear relevant are associated with income or other variables not fully controlled in this analysis. These relationships will be sorted out (at least in part) in the regression analysis to be described in our next report. That report will also examine price relationships, the effects of which are likewise mingled with those of other variables. However, many interesting and important behavior patterns have already been identified. Some of them, to be sure, have their roots in non-economic mechanisms that we can only fully understand with the help of scientists from such other disciplines as nutrition, human ecology and anthropology.

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