AN ANALYSIS OF RURAL CONSUMPTION PATTERNS IN SIERRA LEONE AND THEIR EMPLOYMENT AND GROWTH EFFECTS

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ABSTRACT

AN ANALYSIS OF RURAL CONSUMPTION PATTERNS
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AND GROWTH EFFECTS

By

Robert Philip King

The importance of consumer demand in the process of economic growth has gained increasing recognition in the development literature. Several strategies of economic development which rely heavily on consumption based employment effects and intersectoral linkages have been proposed. However, relatively few studies designed to test the validity of the hypothesized consumption effects upon which these strategies depend have been undertaken. This study focuses on growth and employment effects associated with rural consumption patterns in Sierra Leone. In particular, the factor intensity of rural consumer demand at different income levels is examined in light of the hypothesis that the labor intensity of consumer demand decreases as incomes rise, while the capital intensity and foreign exchange requirements increase.

The objectives of the study are: (1) to describe current consumption patterns and to provide a basis for the projection of consumer demand in the rural areas of Sierra Leone; (2) to analyze the impact of consumption patterns at different income levels on employment, capital requirements, and import demand; (3) to determine the nature and strength of consumption based intersectoral and rural-urban market linkages; and (4) to formulate a methodological approach to consumption research in the rural areas of developing countries designed to address specific theoretical and empirical issues.

Data for the study were obtained from a survey conducted over a twelve month period from May 1974 through April 1975. In addition to information on cash expenditures, data on household production and sales were collected for the sample of 203 households for the determination of households' subsistence consumption. To permit analysis of the factor intensity of consumer demand and of associated intersectoral linkages, commodity groupings were kept highly disaggregated during data collection, and the origin of purchased goods was recorded.

Average and marginal propensities to consume and total expenditure elasticities by income class for a disaggregated set of commodity groupings, as well as average and marginal labor, capital, and foreign exchange requirements for each of the six income classes, are estimated.

Particular emphasis is placed on the choice of estimation procedures suited to the objectives of the study.

The factor intensity results of this study are consistent with the hypothesis that capital and foreign exchange requirements per unit of consumption expenditure increase and labor requirements decrease as incomes rise. Variation in factor intensity is not as pronounced as that reported in Latin American and Asian studies, however. The strength of intersectoral and interregional market linkages is found to be relatively invariant with respect to changes in income. Rural-urban linkages are quite weak, which indicates the impact of rural development programs on urban sectors may be limited.

The methodology developed in this study is based on the premise that data collection, data analysis, and the application of research results to theoretical and empirical problems are interrelated processes. The survey design and statistical estimation procedures were developed to facilitate the testing of particular hypotheses concerning consumer behavior. In addition to this general approach, two methodological findings are of particular interest. First, the effects of substituting small positive values for zero observations in statistical models with logarithmic dependent variables are investigated. Parameter estimates are found to be quite sensitive to the size of the substituted value which indicates such models should not be used when zero

observations are present. Second, expenditure elasticities based on cash and on total expenditure data are compared. Cash expenditure elasticities are found to be reasonable estimates of total expenditure elasticities for commodities not produced by households for their own consumption.

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CHAPTER 1

INTRODUCTION

1.1. Consumption Research in Developing Countries: The Problem Setting

Consumer demand has long been recognized as an important factor in the process of economic growth. Information on consumption patterns is a major input to economic planning and development program design. Only in recent years, however, as interest in questions relating to income distribution has increased, have the effects of variations in consumer demand associated with differences in income been incorporated into growth models and development strategies used in developing countries. As the distinction between growth and development has evolved in the theoretical literature, the nature of the employment and growth effects associated with a movement toward a more equitable distribution of incomes--effects which are manifested through consumer demand--has become an important empirical question. Many believe that trade-offs among the multiple goals of equity, employment, and economic growth are minor. Attention has also focused on the role of consumer demand as a medium through which the multiplier effects of growth in the rural areas can be transferred to other sectors of the

economy. When this occurs in economies characterized by sharp social and economic divisions between rural and urban sectors, rural consumption patterns can be viewed as a much needed integrative force.

Despite widespread interest in consumption patterns and their employment and growth effects, relatively little consumption research has been undertaken in developing countries. Most studies that have been conducted have not addressed the central issues identified in the theoretical literature. Often consumption data are collected only for use in the construction of price indices. While this is an important objective, it is also a rather limited one. A more comprehensive knowledge of consumption can contribute in a number of other ways to planning and program design.

At a minimum, consumption research should be designed to include the description of current consumption patterns and estimates of income or expenditure elasticities which can be used for projecting future consumer demand for specific commodities. In many developing countries, projections of consumer demand for even major commodities are based on general estimates of income elasticities, such as those provided by the Food and Agriculture Organization (FAO). In other cases, elasticities estimated from inaccurate or incomplete time series data are used. In cases where relatively reliable estimates of income elasticities are available for major commodities, income elasticities or average budget shares for commodities of lesser importance are often

not available, even when such information would be quite valuable. For example, despite increasing interest in appropriate technology and the encouragement of small-scale industry, little is known about the nature of consumer demand for the products of small-scale industrial firms. Hymer and Resnick [1969] in a widely recognized theoretical paper have hypothesized that the income elasticity for such products is near zero or negative in rural areas. This hypothesis should dampen the interest of governments in the development of small-scale industry, but it has not been empirically examined.

As stated above, consumption patterns have important implications for employment and growth. The hypothesis[1] that the labor intensity of goods consumed decreases as incomes rise while the capital intensity of consumption and demand for imports increases, has been widely accepted in the development literature. The implications for economic planning and development strategy of this intuitively attractive idea are great. It implies there need be no trade-off between equity on the one hand and growth and employment on the other, since a redistribution of incomes is expected to result in higher employment and fewer leakages to imported capital and consumer goods. Few empirical studies designed to test the validity of these assertions or the magnitude of the postulated effects have been undertaken.

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[1]First explicitly stated in Towards Full Employment [1970], the I.L.O. study on Colombia.

Results that have been reported to date tend to support the hypothesis,[2] but no studies addressing this question have been conducted in Africa where the applicability of development strategies based on Latin American and Asian experiences may be questionable.

Finally, investigation of the role of consumption patterns in the creation of intersectoral linkages as suggested by Mellor [1976] should be another objective of consumption research. While earlier studies have emphasized the aggregate effects of current or projected consumption patterns, Mellor focuses on the growth and employment impacts of consumption patterns for specific sectors of the developing economy and on the integrative effects of growth realized through increased market interaction. He sees new foodgrain technologies as a major impetus for growth in the agricultural sector and rural consumption expenditures as the primary means by which the multiplier effects of this growth are initiated. In an earlier paper written with Uma Lele [Mellor and Lele, 1970, p. 7], Mellor states:

> . . . the new foodgrain technologies normally require increased purchase of current inputs and may stimulate greater purchase of fixed capital goods from other sectors. Far more important, however, is the large increase in consumption expenditure which is likely to occur. It is the large aggregate increase in net agricultural income and consequent purchase of consumption goods which offer a large potential stimulus to other sectors.

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[2]Studies by Soligo [1973] in Pakistan and Sunman [1974] in Turkey are supportive, while a more recent study by Ballentine and Soligo [1975] using Colombian data indicates its long-run validity may be questionable.

Consumption linkages between agricultural and other sectors of the economy have not been explored in this light in most developing countries.

The importance of consumption patterns in the development process and the relative paucity of research addressing current theoretical and empirical questions point to the need for an intensification of consumption research efforts. This study, which focuses on rural consumption patterns in Sierra Leone, is directed toward both the estimation of empirical relationships and the testing of theoretical assertions. In addition, a methodology for consumption research in developing countries which integrates data collection, data analysis, and hypotheses testing will be formulated.

Sierra Leone is a West African country of approximately 2.7 million people which borders on Liberia and Guinea. Its economy is dominated by the agricultural sector, which employs 77 percent of the work force and produces 32 percent of the GDP [Central Statistics Office, 1972b]. Mining is also important, contributing 16 percent of GDP but only 5 percent of employment. Approximately 25 percent of the population lives in urban areas, where most employment is in the government, trading, and large-scale industry sectors. As is the case in many West African countries, Sierra Leone is plagued with high unemployment in urban centers, balance of payment problems, and stagnation in the agricultural sector.

This study was undertaken as one component of an integrated nationwide survey conducted in rural and urban areas of Sierra Leone in 1974 and 1975. The survey was designed to provide comprehensive information on output, employment, and income in rural areas for use in evaluating the implications of various policy alternatives on the rural sector of the economy and on the larger national economy and to develop a research methodology applicable to similar studies in other African countries.[3] Agricultural production and processing, small-scale industry, migration, and the fisheries industry were other foci of the study. The results from the separate studies, in addition to addressing particular empirical, theoretical, and policy questions, have been incorporated into an aggregate macroeconomic model designed for use in planning and policy evaluation.

1.2. Relationship of This Study to Previous Research

Several household budget studies have been conducted in Sierra Leone, though relatively little research has been undertaken in rural areas. A household survey of Freetown and the surrounding Western Area was conducted between 1966 and 1968 [Central Statistics Office, 1968]. Similar surveys were conducted in the urban areas of all three provinces of Sierra Leone [Central Statistics Office, 1971a, 1971b, 1971c]. Because these surveys did not contain data on rural

[3]See African Rural Employment Research Network [1974] for a more detailed statement of the survey's objectives.

consumers, a final household survey was conducted in rural areas between 1969 and 1970 [Central Statistics Office, 1972a]. While all of these studies provide average consumption data for a highly disaggregated set of commodities and some information on variations in budget shares at differing income levels, no income elasticities or marginal propensities to consume are given. Therefore, findings are of little use for the projection of commodity demands or for analyzing the impacts of rising rural incomes on the economy.

Snyder [1971] and Levi [1976], both working with data collected in and around Freetown, do estimate income elasticities for a number of goods. There is no a priori reason to believe, however, that rural and urban consumers behave in a similar fashion, especially when subsistence consumption is important in rural areas.[4] Massell's studies in Kenya [1969] and Uganda [Massell and Parnes, 1969] provide the most comprehensive analysis of rural consumption patterns in African countries. Other rural consumption studies include those by Hay [1966] in Nigeria and Leurquin [1960] in Rwanda-Urundi. These studies, especially those of Massell and Hay, have made considerable contributions to the methodology of estimating income elasticities for rural African consumers. None, however, have analyzed the

[4]Massell and Parnes [1969] compare estimated elasticities for Nairobi with those for rural Kenya and rural Uganda and find both striking similarities and marked dissimilarities.

employment and growth effects of variation in rural consumption patterns by income group. Elsewhere, outside of Africa, Soligo [1973], Sunman [1974], and Ballentine and Soligo [1974] have investigated the nature of these effects in Pakistan, Turkey, and Colombia respectively. In all of these studies variation in the factor intensity of consumption across income classes and its impact on employment and capital requirements were analyzed. Ballentine and Soligo [1974] carry this work the farthest, examining the direct and indirect effects of consumption patterns under different income distributions. None of these studies, however, develop a unified methodology in which data collection and analysis are designed to test specific hypotheses. The studies referred to above which focus on the factor intensity of consumption patterns at different income levels have been based on income elasticities and marginal propensities to consume generated by other researchers, and little is said concerning the estimation of consumption-income relationships. The need for a more integrated methodology of consumption research stems from the fact that decisions made when data are being collected or when income elasticities and marginal propensities to consume are being estimated often preclude the testing of hypotheses relevant to theoretical or policy questions.

1.3. Objectives of the Study

The general objectives of this study are fourfold. The first three are synonymous with the major contributions of consumption research discussed above: (1) to describe current consumption and to provide a basis for the projection of consumer demand in the rural areas of Sierra Leone; (2) to analyze the impact of consumption patterns at different income levels on employment, capital requirements, and import demand; and (3) to determine the nature and strength of consumption based intersectoral and rural-urban market linkages. A fourth objective is to formulate a methodological approach to consumption research in the rural areas of developing countries designed to address specific theoretical and empirical issues.

1.4. Plan for Remaining Chapters

In Chapter 2, the distinction between cross section and time series data is discussed and the relevance of each form of data to research oriented toward the objectives of this study is examined. The data collection process for this study is then described, particular attention being given to the influence of research objectives on choices relating to the survey methodology.

Economic and demographic characteristics of the sample population are described in Chapter 3. Income classes and commodity groups to be used throughout the study are

defined and budget shares for each commodity are presented for each income group.

Methodological issues relating to the estimation of income elasticities and marginal propensities to consume are examined in Chapter 4. Special attention is given to the statistical and analytical problems particular to data from rural areas in developing countries. Two statistical models, both suited to the needs of this study, are specified in this chapter. The performance of these two models is tested in Chapter 5, and estimated expenditure elasticities and marginal propensities to consume are presented.

The capital and labor intensity of rural consumption patterns at different levels of income are estimated in Chapter 6, and the results are analyzed to determine the employment, capital, and foreign exchange requirements associated with both current and projected rural consumer demand. Finally, these results are used along with information on the breakdown by origin of goods consumed in each income class to identify potential growth linkages based on rural consumer demands. The results of the study are summarized in Chapter 7, and additional research requirements are outlined.

CHAPTER 2

SURVEY METHODOLOGY

2.1. Data for the Study of Rural Consumption Patterns

The analysis of consumer demand can be based on either time series or cross section data.[1] Time series data consist of periodic observations on aggregate variables taken over a relatively long time frame. It is assumed that different time periods are homogenous and that variation in consumption patterns can be explained by variables such as commodity prices, income, and population. Cross section data, gathered in household budget surveys, consist of observations on a number of households over a relatively short period of time. In effect, time, prices, and other market variables are held constant, and the association between consumption levels and variables such as household income, household size, and location is examined.

It has been argued by Howe [1966], among others, that the data requirements for any extensive analysis of consumption in developing countries can be met only by the initiation of household budget surveys designed to address specific theoretical and empirical questions. Time series data are not appropriate for the analysis of the employment and growth effects of consumption patterns at different

[1]Much of this discussion is based on a comparison of cross-section and time series data in Klein [1972].

income levels because they are usually not disaggregated by income subgroups. Even in the projection of consumer demand, time series data may be too highly aggregated to be of use in answering questions relevant to the design of localized development projects. Perhaps the greatest drawback in the use of time series data in developing countries, however, is that they must be collected over a long period of time. Household budget studies can be completed in a relatively short period of time and can provide immediate answers to policy questions. While price effects are not easily analyzed in a cross section framework, household budget data can be supplemented by available time series data; and when collected over an extended period of time, they can become a source of time series data.

The basis for this study is cross section data collected in a national rural household budget survey of Sierra Leone conducted between March 1974 and May 1975. Expenditure data were collected for a highly disaggregated set of commodities and information concerning the origin of goods purchased (used in the classification of goods by factor intensity and in the analysis of intersectoral linkages) was also included in the data set. The survey data were supplemented with household-specific data from an ongoing agricultural production survey and with information on the capital and labor intensity of goods from various sources.

2.2. Sampling Procedures

The rural consumption survey in Sierra Leone was closely integrated with an agricultural production survey, which was another component of the integrated research project. In the rural household production survey, farm management data were collected in the eight resource regions indicated on the map in Figure 2.1. A total of five hundred randomly chosen households[2] were surveyed in the rural household production study. One-half of these were chosen at random for the consumption study. For these households, data on labor use, production practices, output, and sales, as well as consumption expenditures, were available. This unified sampling approach facilitated the estimation of the value of subsistence production, which has proved difficult in other surveys.

The rural household production survey sample was stratified by resource region. For the purposes of the consumption study, stratification by income group to allow the separation of income effects from those attributable to regional factors would also have been desirable. Such stratification was not possible, however, since comprehensive data on household income or even proxy variables, such as farm size, were not available prior to the initiation of the study. In practice, one-half of the sample households assigned to each farm management enumerator

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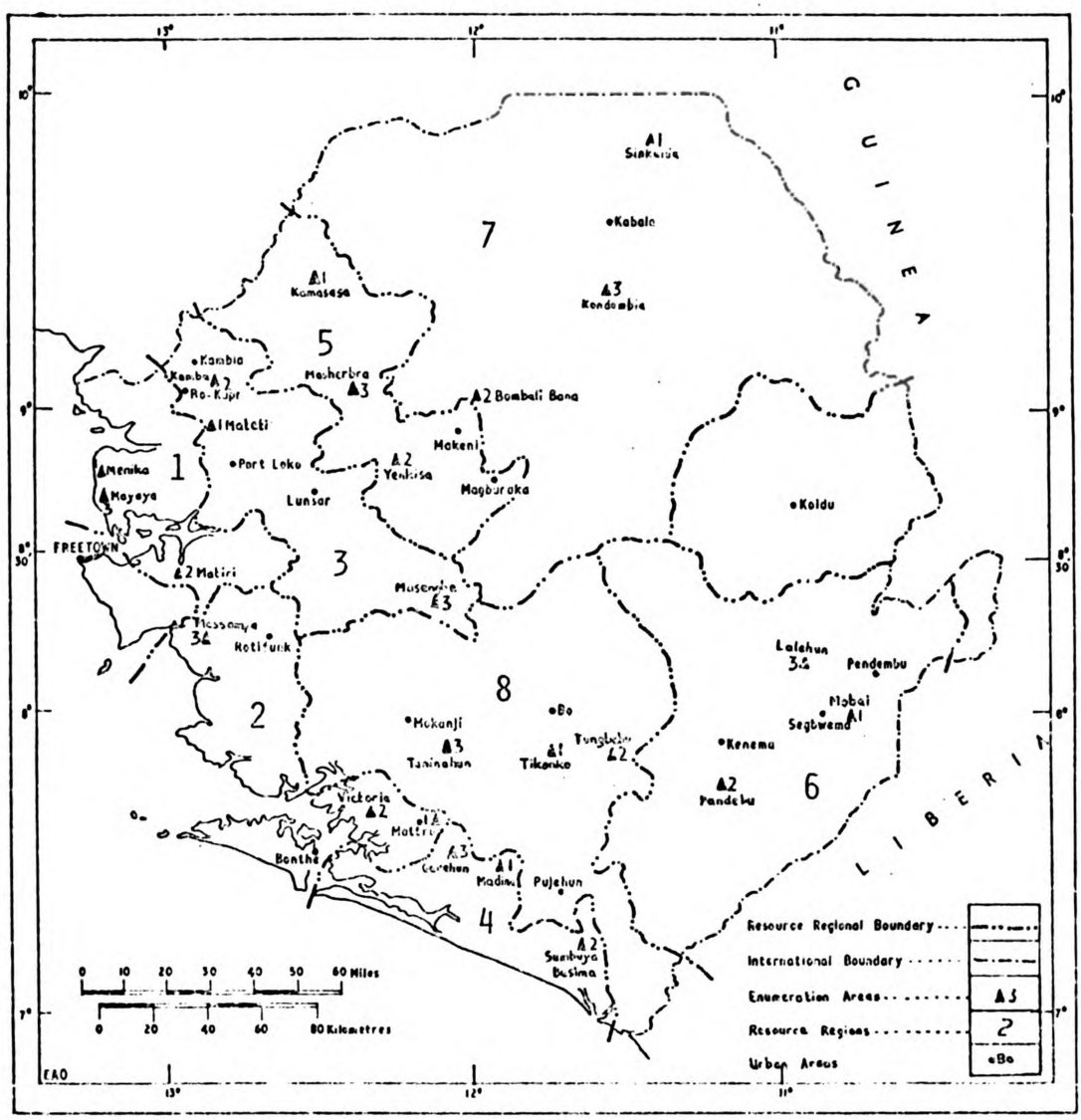
[2]A household is defined as a group of persons who eat from the same pot.



NOTE: (1) Scarcies, (2) Southern Coast, (3) Northern Plains, (4) Riverain Grasslands, (5) Boliland, (6) Moa Basin, (7) Northern Plateau, (8) Southern Plains

FIGURE 2.1
SIERRA LEONE RURAL RESOURCE REGIONS

were selected at random. A number of the initial sample of 250 households were dropped from the sample prior to analysis due to inadequacies in data, deaths, or movement of the respondent from the region, leaving a final sample of 203 households.

2.3. Reference Periods for Survey Interviews

The accuracy of consumption expenditure data is dependent on the length of the reference period used in the survey questionnaires. The reference period is the length of time over which interview respondents are required to recall events from memory. The ability to remember events, such as consumption expenditures, diminishes as the length of the reference period increases. This problem of reduced recall capacity is most severe for events that occur frequently, such as the purchase of food, tobacco, beverages, and regularly consumed household goods.

Another source of bias is what Prais and Houthakker [1971] call the end period effect. This occurs most often for durables and other less frequently purchased commodities. Respondents tend to include expenditures from earlier time periods in their reporting of consumption, especially for items for which there has been no expenditure during the time period under inquiry. Therefore, short reference periods can lead to some overestimation of expenditures for goods of this sort.

In order to reduce biases caused by these effects, two questionnaires with different reference periods were used.[3] A questionnaire with a reference period of four days (RER/C1) was used to record all consumption expenditures made by a household within the recall period. This questionnaire was intended as a source of data on expenditures for food, beverages, tobacco, and other commonly purchased items. The second questionnaire (RER/C2) had a reference period of one month and was used to record only expenditures on durables and less frequently purchased goods. Expenditures on food, tobacco, beverages, and other non-durable personal items were not recorded on the survey forms for this questionnaire.

In both the weekly and monthly questionnaires, information on commodity purchased, its origin, the place of purchase, quantity, and cost were collected. Both survey forms were partially pre-coded by commodity to remind enumerators to ask about certain commonly purchased items. Origins were grouped into five categories: rural, large urban, smaller urban, imported, and undetermined[4] location. This information was gathered for the analysis of the locational impacts of rural consumption patterns. All quantities were measured in local units.

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[3]See Appendix 1 for copies of both questionnaires.

[4]This category included expenditures on school fees, medical services, transportation, etc., which could not be attributed to a particular location.

Enumerators were instructed to be as specific as possible concerning the nature of commodities. In this way a minimum of information relating to consumption of rather specific commodity groupings and to the factor intensity of total consumption was lost.

2.4. The Scheduling of Interviews

Interviewing for the consumption study was conducted over an entire cropping year in conjunction with the farm survey, using the same enumerators. Enumerators interviewed in each household on a twice weekly basis in connection with the farm survey, but it was felt that such repetitive collection of consumption data might quickly lead to fatigue on the part of both enumerators and respondents, which could have resulted in standardization of responses. To avoid this problem, the short reference period questionnaire was administered only twice each month for successive four-day reference periods. It was assumed that consumption of commonly purchased goods is relatively constant during a month.

The scheduling of consumption interviews was established by grouping the sample for each enumeration area into four groups, each corresponding to a week of the month. In general, each group consisted of three households. For a given week of a month the three households in the associated group were administered the short reference period questionnaire. The long reference period

questionnaire was administered to each household in the sample during the last week of the month.[5] In this way, the enumerator's work load was distributed evenly throughout the month and continuous data within each enumeration area were obtained.

2.5. Preparation of the Data for Analysis

Because the purchases of commonly consumed goods were recorded for only one week in four, it was necessary to "puff up" the data. This was done under the assumption that consumption of these goods is relatively consistent from day to day. Therefore, if data were available for seven days out of thirty in a given month, recorded expenditures for a particular good were multiplied by 30/7 to estimate expenditure for that good for that month.

Missing data were also a problem in some cases. When the amount of data present for a household met certain minimum standards,[6] months for which no data were available were filled in using the indexing procedure described in Appendix 2.

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[5]Observations that were obviously recorded on both questionnaires were screened at the time of coding to avoid duplication.

[6]At least three months of consumption data, a valid month being defined as having at least three days of data from the short reference period questionnaire and the presence of the long reference period questionnaire.

2.6. The Estimation of Subsistence Consumption

The data collected through the administration of the two survey questionnaires provide an accurate representation of cash expenditures in consumption goods, but they do not measure the value of subsistence consumption, i.e., the value of goods produced and consumed by a household without entering the market. Data on output and sales from the farm management survey were used to estimate households' consumption of home produced goods. Subsistence consumption was defined simply as the difference in the value of what a household produced and what it sold. Both output and sales were valued at farm gate prices. This method of estimation caused some difficulties since sales data were apparently underestimated in a number of cases.[7] In general, though, this approach seems to have yielded satisfactory results. Total consumption for a given commodity, then, was defined as the sum of cash expenditures and the value of subsistence consumption for that good.

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[7]Subsistence consumption of coffee and cocoa, which are not generally consumed in rural households in any quantity, for example, was estimated to be quite high by this method. Similar problems were encountered with small-scale industry products. Because of these obvious difficulties, subsistence consumption for these goods was set at zero. The accurate measurement of sales has been a difficult problem in many studies.

CHAPTER 3

A DESCRIPTIVE ANALYSIS OF RURAL CONSUMPTION PATTERNS

3.1. The Measurement of Income: Some Conceptual Problems

In the theory of consumer behavior, levels of consumption for distinct goods or sets of goods are determined to a large extent by their respective prices and by the income of the consumption unit. Other factors such as tastes and preferences, household size and composition, and environmental constraints also affect consumption decisions. Since prices are assumed constant in this study, income becomes an even more important variable for exploring differences in consumption.

Net household income can be considered to be a reasonable measure of current income for the households in the survey sample. It is defined by the following functional relationship:

$$I = S + M - F + W \qquad (3.1)$$

where I is net household income, S is the value of subsistence consumption, M is the value of total farm and nonfarm sales, F is the value of purchased and nonpurchased factors of productivity excluding unpaid family labor, and W is the value of wages received from off-farm employment. A measure of current income such as net household income is often used as an explanatory variable in the analysis of consumption behavior. It can be argued, however, that

another measure of income, total consumption expenditure, may, if the time period over which data extend is sufficiently long, be a better indicator of permanent income, which Modigliani and Bromberg [1954] and Friedman [1957] hypothesize to be the true determinant of consumption behavior.[1]

Total consumption expenditure, Y, is the measure of household income used in this study. It can be defined as the sum of the value of subsistence consumption, S, and cash expenditures:

$$Y = S + C \ . \qquad (3.2)$$

Cash expenditures and the quantity (M - F + W) cannot be expected to be equal, though they can be expected to be highly correlated. To the extent that they differ, so will total consumption expenditure and current net household income.

To facilitate the description of consumption patterns and the discussion of analytical results, sample households were grouped into income classes on the basis of household consumption expenditure per person. As Kuznets [1976] points out in the following passage from his recent essay on the demographic aspects of income and distribution, this is the only valid form of income measurement for the

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[1]Prais and Houthakker [1971] note that in surveys conducted over a very short period, a single expenditure on a major durable may cause total expenditures to grossly overrepresent permanent income. Since households in this survey were observed over an entire year, this should not be a problem here.

analysis of income distribution among households of varying sizes [Kuznets, 1976, p. 87]:

> It makes little sense to talk about inequality in the distribution of income among families or households by income per family or household when the underlying units differ so much in size. A large income for a large family may turn out to be small on a per person or per consumer equivalent basis, and a small income for a small family may turn out to be large with the allowance for size of the family. Size distributions of income among families or households by income per family or household, reflecting as they do differences in size, are unrevealing--unless the per family or household income differences are so large as to overshadow any reasonably assumed differences in size of units, or unless the latter differences are minor. Neither of these conditions is realistic. It follows that, before any analysis can be undertaken, size distributions of families or households by income per family or household must be converted to distributions of persons (or consumer equivalents) by size of family or household income per person (or per consumer).

Classification of households by consumption expenditure per person, while clearly superior to a grouping based on consumption expenditures unadjusted for household size, fails to take the composition of a household into account. This factor can also affect consumption decisions. Given two households, each with the same income and the same number of members, for example, a household composed entirely of adults may be expected to meet minimum caloric requirements less easily than a household made up of only two adults and several small children. Ideally some consumer equivalent scale should be used to adjust household size in order to compensate for differing percentages of children and for other compositional factors such as the ratio

of males to females and the proportion of elderly persons in the household.

Several consumer equivalent scales have been used in African consumption studies. Massell [1969] treats all adults, male and female, as equal consumer units, and weighs children at one-half a consumer unit. Howe [1966], in a Nairobi consumption study, uses the following weights: males, sixteen and older, 1.0; females, sixteen and older, 0.8; and children under sixteen, 0.6. The difficulty with such consumer unit scales is, as Prais and Houthakker [1971] note in their excellent discussion of this topic, that in actuality consumer unit scales should be commodity specific. They present a formulation in which, conceptually, "household size" or the number of unit consumers is different for each commodity. The measure of household size to be used in the determination of total per capita consumption expenditure is based on the sum of commodity specific "household sizes" weighted by appropriate average propensities to consume.

While the approach outlined by Prais and Houthakker is theoretically attractive, it can prove to be difficult and expensive to implement. Also, it can lead to a definition of the average consumer that may not be in accordance with that of policymakers and planners. It was decided, therefore, to use unadjusted household size in describing consumption patterns and to make appropriate adjustments for household consumption in the regression

equation used to estimate expenditure elasticities and marginal propensities to consume.

3.2. Definition of Income Classes for the Sierra Leone Consumption Study

Using unadjusted annual per capita consumption expenditures as a criterion for grouping, six income classes were established. The first and sixth comprise, respectively, the lower and upper 10 percent of households ranked by per capita consumption expenditures. Classes two through five are made up, respectively, of households in the second and third, fourth and fifth, sixth and seventh, and eighth and ninth deciles of the ranked sample population. This classification accentuates the difference between the highest and lowest income class and so should facilitate the analysis of the effect of income on consumption. Lower and upper bounds, as well as mean expenditure levels for the six income classes, average household size, the percentage of the members in a household who are less than sixteen, and the percentage of total value of goods consumed attributable to subsistence consumption are given in Table 3.1.

Examination of the figures given in Table 3.1 reveals a consistent trend in household size and in the percentage of children in a household across the range of incomes. Both decline steadily as per capita consumption expenditures rise.[2] A simple economic explanation for this

[2]Kuznet's [1976] results indicate a similar pattern for households in the United States, Germany, Israel, Taiwan, and the Philippines.

TABLE 3.1
DEFINITION OF INCOME CLASSES AND THEIR ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

Income Class	Number of Households	Lower Expenditure Bound (Leones)[a]	Upper Expenditure Bound (Leones)	Mean Annual Per Capita Expenditure (Leones)	Average Household Size	Percentage Children	Subsistence Ratio[b]
1. Lower deciles	20	20.46	42.99	33.62	10.4	.50	.51
2. Second and third deciles	42	43.00	68.99	55.61	9.7	.44	.49
3. Fourth and fifth deciles	41	69.00	103.99	88.89	7.5	.37	.52
4. Sixth and seventh deciles	40	104.00	142.99	122.02	5.3	.29	.47
5. Eighth and ninth deciles	41	143.00	209.99	171.69	5.2	.28	.48
6. Upper decile	19	210.00	432.31	264.88	3.2	.11	.38
Entire sample	203	20.46	432.31	116.28	6.9	.34	.48

SOURCE: Survey data.

[a]1 Leone = $1.10 in 1974/1975.

[b]Percentage of total consumption expenditure attributable to goods produced and consumed in the household.

inverse relationship can be given. The productivity of children, and therefore the income generating capacity, is expected to be less than that of adults. It follows that households with a larger percentage of members being children (households which also tend to be larger) can be expected to have lower per capita incomes.

To a large extent this relationship is also attributable to regional differences. Fifteen of the nineteen households in the highest income class are located in the southern portion of Sierra Leone, where incomes are high because of tree crop cultivation and where households are relatively small and nucleated.[3] Thirteen of the twenty households in the lowest income class, on the other hand, are located in the poorer northern regions where incomes are lower and where households are composed of extended families rather than nuclear units. These generally accepted regional differences are confirmed by the figures in Table 3.2. Clearly average per capita income tends to be higher in the southern region (i.e., the Southern Coast, the Riverain Grasslands, the Moa Basin, and the Southern Plains), while household size and the percentage of children per household are higher in the northern region (i.e., the Scarcies, the Northern Plains, the Bolilands, and the Northern Plateau). The income classification used in this study, then, is not free of regional effects. In the

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[3]See Spencer and Byerlee [1977] for a discussion of regional differences in Sierra Leone.

TABLE 3.2
DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS OF SAMPLE HOUSEHOLDS GROUPED BY REGION

Region[a]	Number of Households	Mean Annual Per Capita Consumption Expenditure	Average Household Size	Average Percentage Children	Subsistence Ratio
1. Scarcies	10	108.62	8.3	.37	.23
2. Southern Coast	33	149.15	6.9	.33	.52
3. Northern Plains	21	105.10	8.0	.44	.39
4. Riverain Grasslands	24	158.45	4.8	.21	.50
5. Bolilands	34	72.17	9.4	.41	.66
6. Moa Basin	31	114.87	5.4	.35	.44
7. Northern Plateau	21	100.06	6.9	.33	.38
8. Southern Plains	29	119.71	6.4	.29	.48

SOURCE: Survey data.

[a]See the map of Sierra Leone, Figure 2.1, for the delineation of regional boundaries.

estimation of total expenditure elasticities of demand, however, these effects can be separated out by the introduction of regional dummy variables in the regression equation.

With respect to the figures given in Tables 3.1 and 3.2, the importance of subsistence consumption for households in all income classes and all regions should be noted. As defined in Chapter 2, subsistence consumption is the value of goods which are produced and consumed by a household without entering the market. Among households in the survey sample the percentage of total consumption expenditure accounted for subsistence consumption is 48 percent, or nearly one-half. There is a tendency for this percentage to be higher for households in the lower income classes. Among studies which have measured this component of consumption, Massell [1969] finds that it comprises 32 percent of total expenditures made by a sample of rural households in Kenya. Dutta-Roy [1969] reports that 25 percent of total consumption for a group of rural Ghanaian households comes from own production, while Hay [1966] reports a figure of 16 percent. Higher estimates of the subsistence component of consumption for Sierra Leonean households may reflect greater accuracy in data collection due to the integration of the consumption and agricultural production surveys as well as behavioral differences. The results from all of these studies, however, provide strong evidence for the need to collect data on subsistence

consumption as well as on cash expenditure when studies are made of rural consumption patterns in African countries.

A Lorenz curve was constructed as a measure of income distribution in rural areas of Sierra Leone (see Figure 3.1) using the average per capita consumption expenditure and the sample population size for each income class. The associated Gini ratio of .31 is relatively low[4] for developing countries and is considerably lower than Paukert's [1973] estimated figure of .56 for all Sierra Leone. This reflects the uniformity of income distribution in rural areas relative to that in urban centers, due largely to the fact that access to land is not severely constrained at low income levels, while the range of available technology is limited, as well as the fact that urban per capita incomes tend to be appreciably higher than those in rural areas.[5] This pattern of income disparities between rural and urban areas and more inequitable income distribution in urban areas is also evident in the results of a household budget survey conducted in the Eastern Region of Ghana by Dutta-Roy [1969] and can probably be generalized to most of West Africa.

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[4]The Gini ratio is slightly underestimated when such a crude linear approximation is used as Riemenschneider [1976] points out.

[5]Fatoo, in a forthcoming paper, estimates per capita income in large and small urban areas to Le 282.

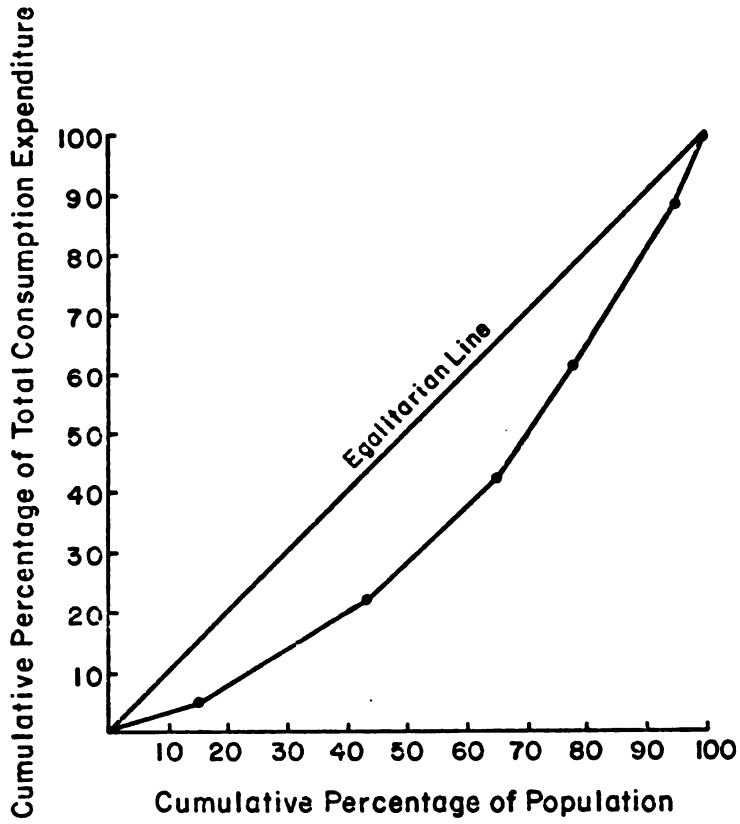

FIGURE 3.1
LORENZ CURVE FOR RURAL HOUSEHOLDS

3.3. The Definition of Commodity Groups

In preparing the data for analysis, 265 possible commodity-origin combinations were established after some preliminary aggregation of commodities had been carried out. Of these, 112 had a non-zero annual expenditure level for at least 1 household in the sample. Ideally, the commodities could have been kept disaggregated for descriptive and analytical purposes. This was impractical, however, due to the statistical problems that large numbers of zero observations would have caused.

In defining commodity groups, an effort was made to maintain factor intensity and locational characteristics and to group commodities together where demand characteristics were judged to be relatively similar. Because of the special interest in this study in the demand for products of small-scale industry, these goods were kept at a rather high level of disaggregation.

The result of this aggregation process is a set of twenty-nine mutually exclusive and exhaustive commodity groups. These preserve distinctions in factor intensity and, at the same time, are roughly comparable to categories used in other African consumption studies. Because locational distinctions could not be perfectly preserved by this classification of goods, separate grouping by origin was also performed.

3.4. Description of Expenditure Patterns in Rural Areas

Average budget shares for each commodity group at varying levels of income are presented in Table 3.3. As expected, expenditures on food items are a major part of consumption expenditure, representing more than 60 percent of the total even for the highest income class. Rice predominates within the aggregate category of food items. Imports and large-scale industry products represent the second largest aggregate component of rural expenditure. Within this larger group, expenditures on fuel and light (mostly kerosene), cloth, and household and personal goods are of particular importance.

Variations in budget shares across the range of incomes are not large for most individual commodities, though some rather large changes do occur, e.g., for rice, palm oil, wood work, cloth, and services. While the budget share devoted to all food does vary considerably, it does not vary as widely as in Asian countries. Sunman [1974], for example, reports that 72.7 percent of total expenditures are devoted to food by low income rural households in Turkey, while high income rural households spend only 29.0 percent of their income on food. This greater variation in the Turkish case is also apparent for other goods. On the basis of this observation, it can be hypothesized that the variability of the factor intensity of rural consumption

TABLE 3.3
BUDGET SHARES FOR COMMODITIES BY INCOME CLASS

Commodity Group	Percentage of Total Expenditure						
	Mean for Entire Sample	Income Class					
		Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Rice	39.4	39.6	45.9	40.0	42.6	35.6	32.5
Cereals and root crops	8.2	8.4	7.8	6.7	9.9	9.7	5.0
Fruits and vegetables	2.9	4.2	2.2	3.3	3.3	2.6	2.7
Palm oil	7.5	4.4	6.2	7.2	8.5	7.4	9.9
Rural salt and other oil	0.3	0.3	0.3	0.3	0.3	0.2	0.3
Imported salt and condiments	1.4	1.8	1.8	1.3	1.2	1.2	1.7
Meat and livestock products	1.6	1.9	1.3	1.1	1.5	2.0	2.0
Fish	8.4	7.0	7.4	10.8	7.7	8.4	7.5
Processed food	0.3	0.6	0.4	0.2	0.5	0.2	0.2
All food	70.0	68.2	73.3	70.9	75.5	67.3	61.8
Rural beverages and tobacco	1.9	4.0	2.0	3.3	0.9	1.0	1.9
Urban and imported beverages and tobacco	1.7	2.2	1.9	1.7	1.9	1.3	1.8
All beverages and tobacco	3.6	6.2	3.9	5.0	2.8	2.3	3.7
Bread	0.1	0.1	0.2	0.1	0.2	0.1	0.1
Metal work (SSI)[a]	0.2	0.3	0.2	0.0	0.3	0.2	0.1
Wood work	0.3	0.1	0.4	0.3	0.2	0.4	0.6
Gara cloth	0.8	0.4	0.7	0.7	0.6	1.1	0.8
Tailoring	0.4	0.3	0.4	0.4	0.3	0.4	0.4
Other household and personal goods (SSI)[a]	0.5	0.6	0.5	0.7	0.4	0.4	0.6
All small-scale industry products	2.3	1.8	2.4	2.2	2.0	2.6	2.6

TABLE 3.3 - CONTINUED
BUDGET SHARES FOR COMMODITIES BY INCOME CLASS

Commodity Group	Percentage of Total Expenditure						
	Mean for Entire Sample	Income Class					
		Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Fuel and light	3.1	4.4	3.7	3.0	3.0	2.7	2.7
Metal work (LSI)[b]	1.4	0.9	1.2	1.2	1.1	2.0	1.2
Clothing	1.9	1.7	2.9	1.8	1.8	1.5	1.6
Cloth	3.0	1.4	2.3	3.1	2.2	4.0	3.6
Shoes	0.9	1.1	1.2	0.8	0.7	1.1	0.6
Other household and personal goods (LSI)[b]	3.1	2.8	2.9	2.1	3.5	3.6	3.8
All large-scale industry and imported products	13.4	12.3	14.2	12.0	12.3	14.9	13.5
Transport	2.2	2.7	1.6	1.6	1.3	2.6	4.4
Ceremonial and entertainment	3.6	1.7	1.3	4.1	1.9	4.9	6.5
Other services	0.7	0.6	0.7	0.3	0.6	1.0	1.1
All services	4.3	2.3	2.0	4.4	2.5	5.9	7.6
Education	1.4	4.3	0.9	1.4	0.7	1.6	1.9
Institutional saving	1.0	1.0	0.5	0.8	2.1	0.5	1.3
Miscellaneous	1.8	1.2	1.2	1.7	0.8	2.3	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Survey data.

[a]SSI indicates small-scale industry.

[b]LSI indicates large-scale industry.

patterns in Sierra Leone may be relatively small when compared to that for countries such as Turkey. This hypothesis will be investigated in Chapter 6, where factor intensities of both average and marginal expenditures are presented.

Budget shares by income class for commodities grouped by origin are given in Table 3.4. In general, they are relatively constant across the range of rural incomes. This is especially true for products from large urban centers, which take a small share of the household budget in all income classes, indicating that the potential for market based growth linkages between rural and large urban sectors of the economy may be limited. The percentage of total expenditure allocated to imported goods does increase as incomes rise, which lends support to the hypothesis stated in Chapter 1 concerning the increased foreign exchange requirement associated with higher incomes. A more complete discussion of the implications of the budget shares given in Table 3.4 will be presented in Chapter 6 in conjunction with the analysis of capital and labor requirements at different income levels.

TABLE 3.4
BUDGET SHARES FOR COMMODITIES GROUPED BY ORIGIN

Origin	Percentage of Total Expenditure						
	Mean for Entire Sample	Income Class					
		Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Rural	76.1	73.6	75.3	78.3	78.8	75.0	73.0
Small urban	5.1	7.1	5.9	4.7	5.4	4.5	4.9
Large urban	1.6	1.3	1.5	1.3	0.8	2.6	1.5
Imported	13.3	11.8	14.9	11.8	11.5	14.4	14.3
No location	3.9	6.2	2.4	3.9	3.5	3.5	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Survey data.

3.5. Seasonal Variation in Consumption Patterns

Because households were observed for an entire year, it is possible to examine seasonal variation in expenditure patterns. Using monthly indices of cash expenditures on rice, other food, and nonfood items, the graph in Figure 3.2 was constructed.[6]

Rice expenditures are uniformly high during the cultivation season and in the months immediately prior to harvest (May through September). They drop to a much lower level in November, when the harvest is well under way, and in the five months which follow. During this period household rice stocks can be maintained at a higher level, since dry weather facilitates storage, and households consume rice from their own harvested reserves rather than that purchased in markets. It should also be noted, however, that because the graph in Figure 3.2 is based on indices of cash expenditures, the product of price and quantity, part of the dichotomous character of rice expenditure patterns is attributable to price changes. Not only is post harvest market demand for rice lower due to subsistence consumption, but also the price of the rice purchased in this period is lower than in the cultivation and preharvest seasons.

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[6]See Appendix 2 for a description of the indexing procedure. For Figure 3.2, monthly indices are scaled so that an index of one hundred represents the average monthly expenditure level.

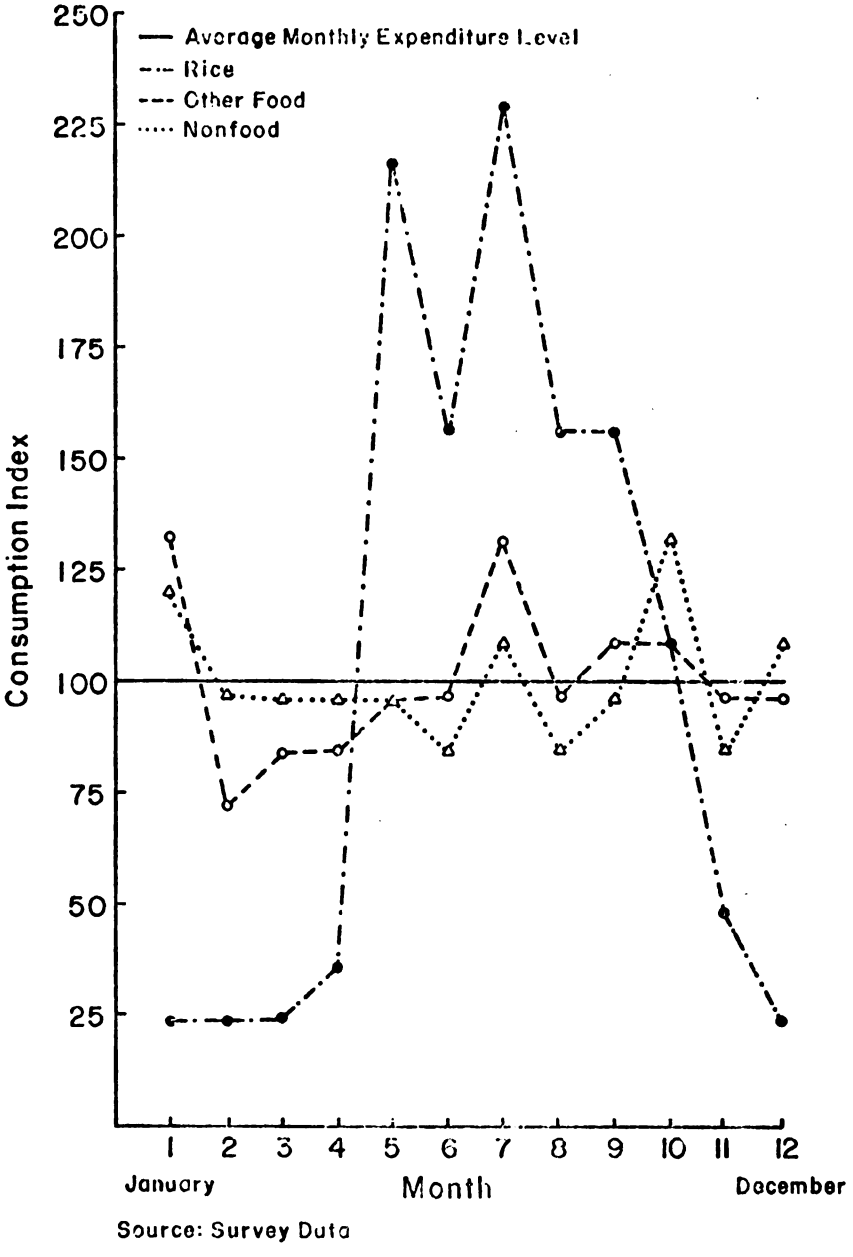

FIGURE 3.2
SEASONAL VARIATION IN CASH EXPENDITURE
ON RICE, OTHER FOOD, AND NONFOOD
COMMODITIES

Variation in expenditures on other food items is much less pronounced, primarily due to the diverse nature of the commodities in this category, which include other cereals and root crops, palm oil, condiments, meat, fish, and processed food. There is a rather large increase in expenditures on these commodities in January, a month of greater ceremonial activity, and in July, when the lack of private rice reserves and the higher market price of rice may cause households to substitute other foods for their primary food in the rural diet.

Expenditures on nonfood items also exhibit a regular pattern. While the uniformity of the expenditure level for these goods is attributable in part to aggregation, nevertheless, it is noteworthy because it is commonly believed that expenditures on durable goods, ceremonial services, and transport should make nonfood expenditure levels higher in the post-harvest season.

Information on seasonal variations in consumption patterns can be of value in the design of household surveys which collect data over a more limited time period of only one or two months. Ideally such a survey should be conducted during periods when the ratio of expenditures within a category to annual expenditure on that collection of goods is the same for each aggregate category. For rural consumers in Sierra Leone no month or pair of months fits this criterion exactly. October is the single month which comes closest to meeting this requirement.

Among pairs of months which satisfy it approximately are July and January, August and December, and September and November. In each case, high rice expenditures in one month balance out low rice expenditures in the other.

CHAPTER 4

METHODOLOGICAL APPROACHES TO THE STATISTICAL ANALYSIS OF RURAL CONSUMPTION PATTERNS

4.1. Engel Curve Analysis

The statistical estimation of the relationship between income and consumption expenditure is central to the analysis of household consumption behavior. From this relationship, generally referred to as the Engel curve, marginal propensities to consume and income elasticities of demand can be derived.[1] Income elasticities are of use in the projection of commodity demand, and, since they are not expressed in monetary units, they allow the international comparison of consumer behavior. Marginal propensities to consume are employed chiefly in the analysis of specific effects attributable to a measurable change in income. While average propensities to consume represent the percentage of total expenditure devoted to particular commodities, marginal propensities to consume indicate how an additional unit of expenditure will be allocated.

Since the publishing of Allen and Bowley's Family Expenditure in 1935, the statistical methods employed in estimating Engel curves have received considerable attention in the econometric literature. Linkages between empirical work and the theory of consumer behavior have been

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[1]Defined symbolically, the marginal propensity to consume is $\partial C_i/\partial Y$ and the expenditure elasticity is $(\partial C_i/\partial Y)\ (Y/C)$, where C_i is expenditure on the i^{th} commodity, Y is total consumption expenditure, and $C_i = f(Y)$.

strengthened as specified functional forms have been related to underlying utility functions, and important advances in statistical estimation procedures have been made. The bulk of this consumption research has, however, been conducted in developed countries. As a result, the methodology that has evolved is best suited to the analysis of household consumption behavior in industrial economies having well developed market systems. Much of this methodology is also applicable to the study of consumption in developing countries, but it does not address certain commonly encountered problems, such as those presented by substantial amounts of subsistence consumption, in an adequate fashion. In addition, the theoretical questions around which consumption research in developing countries centers have often not received much attention in the literature on consumer behavior in industrialized countries.

Few studies of consumer behavior in Africa have addressed methodological issues in any depth. Massell, in his three East African studies, has developed an analytical approach that yields consistent estimates of expenditure elasticities and incorporates variables, such as farm size and percentage of total consumption expenditure represented by subsistence consumption, which are not generally considered important determinants of consumption behavior in developed countries. Massell fails, however, to incorporate the capacity to test hypotheses concerning the effects of income level on expenditure elasticities into the

models used in his two rural studies.[2] This limits the applicability of the results for analyzing current theoretical questions. In addition his approach requires cash income data, which are often difficult to obtain for African consumers.

Two statistical models suited to the objectives of this study and designed to estimate expenditure elasticities despite deficiencies in data will be presented in this chapter and tested in Chapter 5. In discussing these models, problems relating to subsistence consumption and its inclusion in the estimated relationships, the treatment of household size, and the frequent occurrence of zero observations for some commodities will be given particular emphasis.

4.2. Variables Included in the Analysis

The primary variables in the Engel curve relationship are income and total expenditure on a particular commodity or group of commodities. The latter is treated as the dependent variable. As stated in Chapter 2, total expenditure for a commodity is defined in this study as the sum of the value of subsistence consumption and cash expenditure associated with it. Total consumption expenditure, defined as the sum of total expenditures on all commodities

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[2] In both his Kenyan study [Massell, 1969] and that conducted with Parnes in Uganda [Massell and Parnes, 1969], a constant elasticity double-log function is used. In an urban study [Massell and Heyer, 1969], double-log and ratio semi-log models are used. The latter has variable elasticities.

is used as the measure of income in this study. It is the basic independent variable in the functional relationship.

In accordance with the use of per capita consumption expenditure as a basis for the classification of households, the statistical models presented below will be specified originally in per capita terms under the assumption that income and consumption goods are allocated equally among the members of a household. Per capita expenditure on a particular commodity group and total per capita consumption expenditure, then, are the initial dependent and independent variables. Under this assumption, however, the fact that the household is generally considered to be the economic unit for which consumption decisions are made is ignored. Also, economies and diseconomies of scale and household composition effects cannot be analyzed in this framework. Therefore, household size and the percentage of children present in a household, an indicator of compositional differences, will also be incorporated into the model.

Results reported in Chapter 3 indicate that the amount of subsistence consumption and the regional location of a household may also be related to consumption decisions. These effects, too, will be incorporated explicitly into the model.

4.3. The Choice of Functional Form

No single functional form can be considered best for the fitting of Engel curves for a particular set of commodities. Rather, the choice of functional form depends on the theoretical and empirical hypotheses the researcher wishes to test, the nature of the data under analysis, and the goodness of fit obtained with a given form. In specifying a statistical model for use in this study, the extent to which estimated marginal propensities to consume and expenditure elasticities could be expected to be within reasonable bounds over the range of sample incomes was considered an important factor, since they are to be calculated for each income class. Because the same model is to be fitted for all commodity groups, a form flexible enough to represent quite dissimilar income-consumption relationships was also desirable.

A function's conformability with the criterion of additivity, whereby the sum of marginal propensities to consume for all commodities is required to equal one, was another factor which was considered. When expenditure elasticities are estimated for only a few commodities at the mean level of expenditure, additivity is not usually considered to be important. In this study, however, the entire pattern of consumer demand at six different income levels is to be investigated. Even small deviations from perfect additivity make comparisons between income classes impossible unless marginal propensities to consume and

expenditure elasticities are arbitrarily adjusted to meet this criterion.

A final factor in the choice of a functional form was the extent to which the effects of household size and composition, subsistence consumption, and regional locations could be adequately described.

4.3.1. The Income-Consumption Relationships

The specification of the functional relationship between consumption expenditure on a particular good or set of goods and income or total expenditure is the starting point of Engel curve analysis. The merits of several different functional forms are discussed by, among others, Leser [1963], Hay [1966], and Prais and Houthakker [1971]. In light of the requirements of this study, two functional forms have been chosen for testing: the log-log inverse function, which has been used in a number of studies, and the ratio semi-log inverse function (RSLI), a functional form suggested by Leser [1963]. These two income-consumption relations are expressed in per capita terms in equations 4.1 and 4.2.

$$\ln \bar{c}_{ij} = a_i + b_{1i} \ln \bar{y}_j + b_{2i}/\bar{y}_j + u_{ij} \qquad (4.1)$$

$$\bar{c}_{ij}/\bar{y}_j = a_i + b_{1i} \ln \bar{y}_j + b_{2i}/\bar{y}_j + u_{ij} \ , \qquad (4.2)$$

where $\bar{c}_{ij}$ is total per capita expenditure by household j on commodity i; $\bar{y}_j$ is total per capita consumption expenditure by the j^{th} household; a_i, b_{1i}, and b_{2i} are parameters to be

estimated for the i^{th} commodity; and u_{ij} is the disturbance term for the i^{th} commodity and the j^{th} household.

The widely used double-log function, which differs from the log-log inverse function 4.1 in that $b_{2i}/\bar{y}_j$ is not included, was not considered for use in this study because it restricts the expenditure elasticity for a commodity to a constant, b_{1i}. The log-log function is frequently used because of the generally good fit it provides and the ease with which elasticities are derived from it. Other commonly used functions which were not considered include the semi-log and inverse functions. These are similar to the RSLI function 4.2, but they are not as flexible and, in their commonly used form, do not conform to the additivity criterion.

Both income-consumption relations specified above allow considerable flexibility in the shape of the estimated Engel curve. The log-log inverse function allows the testing of hypotheses concerning the consistency of expenditure elasticities across the range of incomes, while the RSLI function permits testing for a constant marginal propensity to consume. These properties can be seen by examining the expressions for expenditure elasticities derived from equation 4.1 and equation 4.2 respectively:

$$\frac{\partial \bar{c}_{ij}}{\partial \bar{y}_j} \frac{\bar{y}_j}{\bar{c}_{ij}} = \left[b_{1i} \left(\frac{\bar{c}_{ij}}{\bar{y}_j} \right) - b_{2i} \left(\frac{\bar{c}_{ij}}{\bar{y}_j^2} \right) \right] \frac{\bar{y}_j}{\bar{c}_{ij}}$$

$$= b_{1i} - b_{2i}\left(\frac{1}{\bar{y}_j}\right) \tag{4.3}$$

$$\frac{\partial \bar{c}_{ij}}{\partial \bar{y}_j}\frac{\bar{y}_j}{\bar{c}_{ij}} = \left(a_i + b_{1i} + b_{1i} \ln \bar{y}_j\right)\frac{\bar{y}_j}{\bar{c}_{ij}} . \tag{4.4}$$

When b_{2i} of the log-log inverse function is not different from zero at the relevant level of significance, its elasticity given in equation 4.3 reduces to a constant--b_{1i}. When b_{1i} of the RSLI function is not significantly different from zero, the term $(a_i + b_{1i} + b_{1i} \ln \bar{y}_j)$ in equation 4.4, the expression for the marginal propensity to consume, reduces to the constant term a_i.

Examination of the second partial derivatives of both functions and the partial derivatives of the elasticity expression (all derivatives being with respect to per capita total consumption expenditure, $\bar{y}$) indicates that the elasticity of the log-log inverse function increases or decreases monotonically, depending on whether the sign of b_{2i} in equation 4.1 is positive or negative, while the marginal propensity to consume of the RSLI increases or decreases monotonically as b_{1i} in equation 4.2 is positive or negative. The second partial with respect to $\bar{y}$ of the log-log inverse (i.e., the partial of the marginal propensity to consume) and the partial of the elasticity of the RSLI function with respect to $\bar{y}$ are of indeterminant sign.

Of these two functional relationships only the RSLI satisfies in a strict sense the additivity criterion, though as Prais and Houthakker [1971] note, any fitted curve should satisfy this condition approximately at the mean expenditure level. Even small deviations from unity in the sum of marginal propensities to consume at a given level of income may, as stated above, make comparisons between consumption patterns for different income classes invalid, however. In light of the objectives of this study, then, this is an important advantage to be gained by using the RSLI function.

4.3.2. The Introduction of Household Size Effects into the Models

Both the log-log inverse and the RSLI functions given above can be transformed from a per capita form to one which represents consumption for the entire household rather easily. By expressing equation 4.1 in its product form and multiplying both sides by household size, N_j, the following functional relationship, expressed in logarithmic form, is obtained:

$$\ln C_{ij} = a_i + b_{1i} \ln \bar{y}_j + b_{2i}/\bar{y}_j + b_{3i} \ln N_j + u_{ij} \qquad (4.5)$$

where C_{ij} is total household consumption expenditure on the i^{th} commodity; a_i, b_{1i}, b_{2i}, and b_{3i} are parameters to be estimated for commodity i; and u_{ij} is a disturbance term. This new relationship is not exactly equivalent to that

given by equation 4.1, but it should have greater explanatory power since the effects of household size have been explicitly incorporated. In effect, household consumption expenditure is now considered to be a function of per capita total consumption expenditure and household size.

The RSLI model given in equation 4.2 reduces to a set of household Engel curves by multiplying and dividing the dependent variable, $\bar{c}_{ij}/\bar{y}_j$, by N_j. Household size can then be introduced as an independent variable by multiplying both sides of the relation by Y_j, total household consumption expenditure for household j. The result is equation 4.6:

$$C_{ij} = a_i Y_j + b_{1i} Y_j \ln \bar{y}_j + b_{2i} N + u_{ij} \qquad (4.6)$$

where a_i, b_{1i} and b_{2i} are again parameters to be estimated, u_{ij} is a disturbance term, and other variables are defined as above.

Expressions for the expenditure elasticity of household expenditure on a good with respect to total household consumption expenditure are given in equations 4.7 and 4.8 for the log-log inverse and modified RSLI (MRSLI) functions, respectively.

$$\frac{\partial C_{ij}}{\partial Y_j} \cdot \frac{Y_j}{C_{ij}} = \left[b_{1i} \left(\frac{C_{ij}}{Y_j} \right) - b_{2i} \left(\frac{N_j C_{ij}}{Y_j^2} \right) \right] \frac{Y_j}{C_{ij}}$$

$$= b_{1i} - b_{2i} \left(\frac{1}{Y_j} \right) \cdot \qquad (4.7)$$

$$\frac{\partial C_{ij}}{\partial Y_j} \cdot \frac{Y_j}{C_{ij}} = \left[a_i + b_{1i} + b_{1i} \ln \bar{y}_j \right] \frac{Y_j}{C_{ij}} . \quad (4.8)$$

Comparison with equations 4.3 and 4.4 indicates that the form of the expenditure elasticity and marginal propensity to consume for both equations is essentially unchanged.

The nature of the relationship between consumption of a particular commodity and household size is indicated by the presence of economies or diseconomies of scale. Prais and Houthakker [1971, p. 148] define economies of scale in the following manner:

> At a given level of income per person, if there are economies of scale in the consumption of a particular commodity larger households will tend to have a smaller expenditure per person on that commodity due to those economies.

This is equivalent to saying that the elasticity of household consumption of a good with respect to household size is less than unity when economies of scale are experienced and greater than one when there are diseconomies of scale. This elasticity, derived by holding per capita total expenditure constant, is equal to b_{3i}, the coefficient of ln N, for the log-log inverse model given in equation 4.5. The household size elasticity for the MRSLI model in equation 4.6, on the other hand, is quite complex. As expressed in equation 4.9,

$$\frac{\partial C_{ij}}{\partial N_j} \cdot \frac{N_j}{C_{ij}} = a_i \left[\frac{Y_j}{C_{ij}} \right] + b_{1i} \left[\frac{Y_j}{C_{ij}} \right] \left[\ln \bar{y}_j \right]$$

$$+ b_{2i} \left(\frac{N_j}{C_{ij}}\right) , \qquad (4.9)$$

it is a function of per capita total expenditure, the budget share for the relevant commodity, and per capita expenditure on that community. While it is possible to make arguments for the relevance of these variables in determining economies and diseconomies of scale, this treatment of household size lacks the simplicity and intuitive appeal of that associated with the log-log inverse function.

4.3.3. The Incorporation of Other Independent Variables

As stated earlier, the percentage of the members of a household who are children, a household's ratio of subsistence consumption to total consumption expenditure, and regional location may affect consumption expenditure on a particular good. Ceteris paribus a household with a high percentage of members being children is expected to spend less on tobacco, for example, than a household composed mostly of adults. Similarly, households with high subsistence ratios are expected to spend less on manufactured goods than do households producing cash crops. Regional location may be associated with differences in consumption not only because tastes and preferences vary from region to region, but also because of interregional price differences.

The percentage of a household's members who are children and the subsistence ratio were added to both

models in their logarithmic form. Regional effects were incorporated by adding sets of binary variables to each model.[3]

The complete models to be tested in Chapter 5, then, are as follows:

$$\ln C_{ij} = a_i + b_{1i} \ln \bar{y}_j + \frac{b_{2i}}{\bar{y}_j} + b_{3i} \ln N_j + b_{4i} \ln D_j + b_{5i} \ln S_j + \sum_{h=1}^{7} g_{hi} R_{hj} + u_{ij} \qquad (4.10)$$

$$C_{ij} = a_i Y_j + b_{1i} Y_j \ln \bar{y}_j + b_{2i} N_j + b_{3i} \ln D_j + b_{4i} \ln S_j + \sum_{h=1}^{8} g_{hi} R_{hj} + u_{ij} , \qquad (4.11)$$

where D_j is the percentage of the members of household j younger than sixteen years of age; S_j is the subsistence ratio for household j; R_{hj} is the regional binary variable for the h^{th} region associated with the j^{th} household; a_i, b_{1i}, b_{2i}, b_{3i}, b_{4i}, b_{5i}, and the g_{hi}'s are parameters to be estimated for commodity i; u_{ij} is a disturbance term; and other variables are defined as before.

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[3]In the log-log inverse model the variable associated with one of the regions must be dropped to avoid perfect multicollinearity. This is not necessary with the MRSLI model since, as specified in equation 4.7, it passes through the origin.

4.4. Total Versus Cash Expenditure Elasticities

The total expenditure data used in this study include the value of goods produced and consumed within the household, as well as the value of consumption goods which are purchased. Data on subsistence consumption, however, are often not available or are difficult to collect. Therefore, it is of practical interest to determine how expenditure elasticities and marginal propensities to consume based on cash expenditure data alone differ from those estimated from total expenditure data.

It can be shown[4] that the total expenditure elasticity for the i^{th} commodity, E_i^t, can be equated to the expression on the right-hand side of equation 4.12,

$$E_i^t = E_m \frac{M_i}{C_i} E_i^m + E_s \frac{S_i}{C_i} E_i^s , \qquad (4.12)$$

where E_m is the elasticity of total cash consumption expenditure with respect to total consumption expenditure, E_i^m is the elasticity of cash expenditure on commodity i with respect to total cash consumption expenditure, E_s is the elasticity of the value of total subsistence consumption with respect to total consumption expenditure, E_i^s is the elasticity of the value of subsistence consumption in the i^{th} commodity with respect to the total value of subsistence consumption, M_i is total cash expenditure on commodity i, S_i is the value of subsistence consumption of commodity i,

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[4]See Mukhijee and Rao [1972].

and C_i is total consumption expenditure on commodity i, being the sum of M_i and S_i. It follows from equation 4.12 that cash expenditure and total expenditure elasticities should be quite similar for commodities or groups of commodities which are not produced and consumed by the households under study if E_m is close to unity.[5] In the case of commodities for which a significant portion of total consumption comes from households' own production, on the other hand, equation 4.12 indicates that cash expenditure elasticities cannot be expected to provide a good approximation of total expenditure elasticities.

The relationship between marginal propensities to consume based on cash and on total expenditure data is given in equation 4.13:

$$\frac{\partial C_i}{\partial Y} = \frac{\partial M_i}{\partial M} \cdot \frac{\partial M}{\partial Y} + \frac{\partial S_i}{\partial S} \cdot \frac{\partial S}{\partial Y} \qquad (4.13)$$

where M is total cash expenditure, S is the total value of subsistence consumption, and Y is total consumption expenditure. Equation 4.13 indicates that even for goods for which there is no subsistence consumption, so that $\partial S_i/\partial S = 0$, marginal propensities to consume based on cash expenditure data will tend to overestimate the actual value. This holds whenever $\partial M/\partial Y$ is less than one, i.e., whenever

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[5]Note that this condition can be met even when subsistence consumption is an important component of total consumption expenditure, since $E_m = 1$ requires only that the ratio of total cash expenditure to total consumption expenditure be constant at all levels of total consumption expenditure.

increases in the total value of subsistence consumption are associated with increases in total consumption expenditure.

In Chapter 5 estimated cash expenditure elasticities and marginal propensities to consume will be compared to estimates based on total expenditure data. Similarities and differences between the two sets of estimates will be examined in light of the relationships stated in equations 4.12 and 4.13.

4.5. Statistical Problems with Estimation

In this section difficulties associated with the fitting of the models specified in equations 4.10 and 4.11 are discussed and the extent to which both models may violate the assumptions upon which least squares regression analyses is based is examined.

4.5.1. Zero observations

Because of the interest in this study in the factor intensity of rural demand, commodity groupings have been kept disaggregated. As a result of this and also due to the fact that some households have very low incomes, it was expected that cases in which the members of a household did not purchase any items in a particular commodity group during the year would occur. Inspection of the data indicates that there are, in fact, large numbers of zero observations for certain commodities. Zero observations lead to problems with all functional forms, but they are

particularly troublesome when the dependent variable is in logarithmic form, as in the log-log inverse model, since the logarithm of zero is undefined.

A number of ways of dealing with zero observations have been proposed. Massell [1969], among others, suggests that households be grouped by income level to reduce zero observations. In his study of rural consumption patterns in Kenya, he found that by grouping the sample of 816 households into 136 groups of 6 households each, zero observations could be eliminated without decreasing degrees of freedom to a critical level. Grouping of this sort was considered for this study, but it was observed that the zero observation problem persists for some commodities, even when the number of groups becomes relatively small.

Another technique, sometimes used in the analysis of consumer demand for durables, involves the use of a binary dependent variable in a simple linear model or in a logit or probit model to determine the probability of purchase for a particular commodity at a given level of income. Snyder [1969] uses this approach in his study of consumption in Sierra Leone. Once probability of purchase has been determined households with zero observations for the commodity under analysis are dropped and the Engel curve is then fitted to the remaining observations. Probability of purchase and the estimated expenditure elasticity are then used jointly to determine the final estimate. This

method was not employed in this study, primarily because of its unwieldiness.

A third technique used for dealing with zero observations of a dependent variable to be expressed in logarithmic form is simply to replace zero observations with some arbitrarily small number. Prais and Houthakker [1971] note that this is equivalent to assuming zero observations are the result of errors in measurement. Despite its drawbacks, especially for major durable items, this method is used in the testing of the log-log inverse function in Chapter 5 because it is the only reasonable alternative. The alteration of zero observations leads to some bias in the estimated parameters, the size of which depends on the magnitude of the substituted value. The effects of different replacement values in the log-log inverse model are examined in Chapter 5.

4.5.2. Correlation Between the Independent Variables and the Disturbance Term

A basic assumption underlying ordinary least squares estimation techniques is that there is no correlation between any of the independent variables and the disturbance term. When this assumption is violated parameter estimates are biased and inconsistent. In the analysis of household consumption patterns it is usually assumed that, while the level of income has an effect on a household's expenditure for a particular commodity, the latter has no effect on income. When total expenditure is used as a measure of

income, however, this assumption of no feedback between dependent and independent variables is no longer tenable [Summers, 1959].

As a solution to this problem, Liviatan [1961] suggests estimation by instrumental variables, using some measure of income as an instrument. Massell [1969] in his analysis of rural consumption data from Kenya employs the method of two-stage least squares. Because of the similarities between Massell's problems and those encountered in this study, his approach is discussed here.

Massell specifies a double log model having the log of total household expenditure on a particular good (defined as in this study) as the dependent variable. Total consumption expenditure, household size, and subsistence ratios in their logarithmic form and a set of regional dummy variables are the independent variables. This model, then, is quite similar to the log-log inverse model specified above. He refers to the arguments of Summers and Liviatan regarding difficulties with the use of total expenditure as an independent variable. Massell [1969, pp. 137-138] goes on to point out that the independence of the subsistence ratio is also questionable, stating:

> The nonindependence of the subsistence ratio is attributable to errors in measuring subsistence production. The valuation of subsistence is necessarily arbitrary. In the sample used here subsistence was valued at the wholesale price. An item consumed from own production is valued less than an identical item purchased for cash. Both expenditure on food items and the subsistence

ratio may thus be understated, resulting in nonindependence of $\underline{R}_j$ (subsistence ratio) and $\underline{u}_{ij}$.

To obtain consistent parameter estimates, Massell suggests the use of a two-stage least squares model using cash income[6] and farm size as instrumental variables--both being correlated with total expenditure and the subsistence ratio and uncorrelated with the error term.

Massell's model leads to two difficulties--one practical and one theoretical. The first of these is that data on crop sales and wages earned are often not available to consumption researchers. Were this the only problem, it could be remedied by redesigning data collection procedures to include these variables. The second problem, however, is more serious. In order to make cash income acceptable as an instrument, Massell is forced to assume that consumption and production decisions are not made jointly[7]--a tenuous assumption where subsistence consumption represents a major portion of a household's total consumption expenditure. If this important assumption does not hold--and it does not seem valid for households in Sierra Leone--parameter estimates remain inconsistent, even if a two-stage least square model is used. Therefore, the simple ordinary least squares model was considered adequate in this study.

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[6]Income from the sale of crops and from wage labor.

[7]See footnote 6, page 138 of Massell [1969].

4.5.3. Other Statistical Problems

Heteroscedasticity is the property, exhibited by some estimated relationships, of non-constant variance of the disturbance term over the range of the data. It is a direct violation of one of the basic assumptions of least squares estimation. Heteroscedasticity is a common problem associated with the analysis of cross section consumption data. Its occurrence can often by explained by the fact that low income households exhibit less variance in consumption expenditure than do higher income households. When heteroscedasticity is present parameter estimates are unbiased and consistent, all other assumptions being met, but they are not efficient or asymptotically efficient. Estimates of their variances are biased in an indeterminant direction, which invalidates confidence intervals and hypothesis tests based on them.

The presence of heteroscedasticity is determined by analyzing the residuals of estimated equations. In cases where heteroscedasticity is believed to be present and where the size of the variance of the estimated equation can be assumed to be a function of a particular variable, the rather simple technique of weighted regression, a special case of generalized least squares, can be used to correct for it.[8] This approach, while relatively easy to implement, should not be used without careful examination

[8]See Johnston [1963, Chapter 8] for a complete discussion of this technique.

and analysis of the residuals of ordinary least squares estimates of the relationships under study. This was not feasible for this study. Rather than use a weighted regression model based on an assumed interdependence between total expenditure and the variance of the error term, therefore, it was decided, again, to test the models in the form specified in Section 4.3.3.

Errors in measuring both the dependent and independent variables are another source of difficulty when functional relationships are being estimated statistically. Little can be done to correct measurement errors, but their effect should be noted here. Errors in the dependent variables are absorbed in the disturbance term, thereby increasing its variance and lowering R^2. As such, they introduce no bias. Errors in the explanatory variables, however, bias the estimates of their coefficients toward zero, leading to the too frequent acceptance of hypotheses equating the parameter with zero.

CHAPTER 5

THE ESTIMATION OF TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME: EMPIRICAL RESULTS

5.1. Introduction

In this chapter, the performances of the log-log inverse model and the MRSLI model, as specified in equations 4.10 and 4.11 in Chapter 4, are examined and compared; and estimates of expenditure elasticities and marginal propensities to consume are presented. In addition, two questions of empirical and practical importance are examined. The effects of different values substituted for zero observations in the dependent variable are evaluated for their impact on parameters estimated with the log-log inverse model. Since the magnitude of these effects may influence the final choice of a functional form, this question is addressed prior to the evaluation of the two models. Also of interest is the extent to which estimated cash expenditure and total expenditure elasticities differ for a sample in which subsistence consumption is an important component of total consumption expenditure. This comparison is made in the final section of this chapter.

5.2. The Effects of Zero Observations

The presence of households for which no expenditures are reported for goods in a particular commodity group leads to difficulties in the use of the log-log inverse function. Under the commodity grouping used in this study, substantial

numbers of zero observations occur. In this section, the effect of substituting different small, arbitrary values for zero observations is examined.

Test regressions were run using the log-log inverse model specified in equation 4.10. The commodities used in these tests were chosen so that a wide range of frequencies of zero observations would be represented. To determine the effect of different substituted values on the additivity of marginal propensities to consume,[1] test regressions were run for all commodity groups in the aggregate food category. Four different values were substituted for zero expenditure levels in the experiments: .000025, .0025, .01, and .25. In most cases, the magnitude of even the largest of these values represents only a very small percentage of the average annual expenditure on a commodity; though, in the case of small-scale metal work items, average annual expenditure is only Le 1.27.

Estimated parameters from the four sets of regression are given in Table 5.1. These estimates demonstrate that the size of the substituted parameter can have a substantial effect on parameter estimates. The effects are greatest for commodities having a high frequency of zero observations, such as small-scale metal work items and institutional saving; but they are also quite pronounced for commodities with only a few zero observations, such as

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[1]The mathematical form of the log-log inverse function does not insure additivity.

TABLE 5.1
PARAMETER ESTIMATES FOR TEST COMMODITIES IN ZERO OBSERVATION EXPERIMENTS

Commodity Group	Number of Zero Observations	Average Total Expenditure (Leones Per Year)	Coefficient Of								R^2			
			$\ln \bar{y}$				$1/\bar{y}$							
			Substituted Value				Substituted Value				Substituted Value			
			.000025	.0025	.01	.25	.000025	.0025	.01	.25	.000025	.0025	.01	.25
Rice	0	263.13	.907[a] (.19)[b]				-9.821 (13.35)				.635			
Cereals and root crops	9	54.75	.934 (.91)	.983 (.66)	.984 (.60)	.881 (.48)	-99.547 (64.00)	-54.547 (47.20)	-41.332 (42.81)	-16.556 (33.95)	.470	.535	.552	.566
Fruits and vegetables	2	19.20	1.102 (.59)	1.151 (.51)	1.166 (.49)	1.200 (.46)	-17.439 (42.31)	-5.029 (36.06)	-1.293 (34.74)	7.381 (32.94)	.449	.487	.494	.494
Palm oil	7	50.17	2.306 (.92)	1.904 (.67)	1.783 (.59)	1.502 (.45)	-9.683 (65.70)	-10.250 (47.39)	-10.421 (42.34)	-10.818 (32.31)	.295	.333	.348	.386
Rural salt and other oil	67	1.73	-3.226 (1.80)	-1.758 (1.07)	-1.316 (.86)	-.290 (.44)	-256.187 (128.54)	-140.129 (76.08)	-105.192 (60.97)	-24.071 (31.31)	.197	.210	.218	.248
Imported salt and condiments	2	9.37	1.401 (.56)	1.337 (.45)	1.317 (.42)	1.272 (.38)	32.276 (39.58)	31.299 (31.71)	31.005 (29.88)	30.322 (27.02)	.274	.313	.322	.328
Meat and livestock products	33	10.86	1.637 (1.64)	1.384 (1.07)	1.308 (.91)	1.131 (.59)	-61.243 (117.14)	-35.278 (76.44)	-27.463 (64.95)	-9.314 (42.12)	.197	.220	.230	.248
Fish	0	56.16	.892 (.21)				4.723 (15.10)				.577			
Processed food	63	2.08	.236 (1.57)	.411 (.93)	.464 (.75)	.586 (.44)	-100.566 (112.16)	-47.637 (66.23)	-31.704 (53.44)	5.292 (31.16)	.371	.402	.417	.419
All food	0	467.46	.873 (.07)				-12.084 (4.90)				.925			

TABLE 5.1 - CONTINUED
PARAMETER ESTIMATES FOR TEST COMMODITIES IN ZERO OBSERVATION EXPERIMENTS

Commodity Group	Number of Zero Observations	Average Total Expenditure (Leones Per Year)	Coefficient of $\ln \bar{y}$ Substituted Value .000025	.0025	.01	.25	Coefficient of $1/\bar{y}$ Substituted Value .000025	.0025	.01	.25	R^2 Substituted Value .000025	.0025	.01	.25
Metal work (SSI)[c]	137	1.27	2.206 (1.69)	1.189 (1.02)	.883 (.833)	.172 (.54)	113.399 (120.24)	61.781 (72.34)	46.242 (59.35)	10.162 (38.20)	.164	.109	.082	.103
Clothing	9	20.25	1.920 (1.00)	1.345 (.70)	1.172 (.62)	.771 (.46)	21.468 (71.15)	.981 (49.67)	-5.186 (43.83)	-19.507 (32.70)	.191	.220	.232	.263
Institutional saving	95	6.69	-1.710 (1.91)	-.882 (1.23)	-.632 (1.04)	-.053 (.64)	-197.391 (135.94)	-108.379 (87.67)	-81.583 (73.89)	-19.366 (45.94)	.306	.269	.249	.173

SOURCE: Survey data.

[a]When no zero observations are present, parameter estimates remain the same and will not be repeated.

[b]Numbers in parentheses are standard errors of the estimated coefficients. These can be used in computing the t statistic, used in testing hypotheses concerning the magnitude of estimated parameters.

[c]SSI indicates small-scale industry.

palm oil, fruits and vegetables and clothing. In general, the substitution of larger values leads to parameter estimates which are closer to zero and to higher values of R^2, the coefficient of determination, though this is not always the case. Specific effects for a given commodity also depend on the average level of expenditure on that commodity and on the relative income level of households with zero observations.

Expenditure elasticities and marginal propensities to consume derived from the parameters estimated in the test regressions are given in Table 5.2. Again, quite substantial differences are associated with variation in the value substituted for zero observations. For example, the expenditure elasticity and marginal propensity to consume of palm oil, a major commodity with only seven zero observations, are reduced approximately one-third over the range of substituted values. Because of variations of this magnitude in marginal propensities to consume, additivity properties are also affected. The test regression for the aggregate food category indicates that, at the mean expenditure level, .684 of each additional leone of total expenditure is allocated to food. The sum of marginal propensities to consume for the individual food commodity groups, however, ranges from .872 to .730, depending on the size of the value substituted for zero observations. Substitution of larger values yields sums of marginal propensities to consume closer to that derived from the

TABLE 5.2
ESTIMATED EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME FOR COMMODITIES IN ZERO OBSERVATION EXPERIMENT

Commodity Group	Elasticity[a]				MPC			
	Substituted Value				Substituted Value			
	.000025	.0025	.01	.25	.000025	.0025	.01	.25
Rice	.992	.992	.992	.992	.385	.385	.385	.385
Cereals and root crops	1.820	1.452	1.339	1.023	.149	.119	.110	.084
Fruits and vegetables	1.252	1.194	1.177	1.137	.036	.034	.034	.033
Palm oil	2.389	1.992	1.873	1.595	.179	.150	.141	.120
Rural salt and other oil	-1.023	-.553	-.411	-.083	-.003	-.001	-.001	.000
Imported salt and condiments	1.123	1.068	1.050	1.011	.016	.015	.015	.014
Meat and livestock products	2.164	1.687	1.544	1.211	.035	.027	.025	.020
Fish	.851	.851	.851	.851	.072	.072	.072	.072
Processed food	1.101	.821	.737	.541	.003	.003	.002	.002
All food	.977	.977	.977	.977	.684	.684	.684	.684
Sum of disaggregated MPC's for food					.872	.804	.783	.730
Metal work (SSI)[b]	1.231	.658	.485	.085	.002	.001	.001	.000
Clothing	1.735	1.337	1.217	.939	.033	.025	.023	.018
Institutional saving	-.012	.050	.070	.114	.000	.001	.001	.001

SOURCE: Survey data.

[a]All elasticities and MPC's are calculated for the mean levels of expenditure in the sample.

[b]SSI indicates small-scale industry.

aggregate relationship. In all cases, however, there is an upward bias in marginal propensities to consume for disaggregated commodities and in no case is their sum close enough to the aggregate marginal propensity to consume to allow it to be said that the additivity problem is eliminated.

The results of these test regressions indicate that the zero observation problem is a serious one and that parameter estimates based on the log-log inverse model must be interpreted with caution when zero observations are present in the data. These results do not point to a "best" value which, when substituted for zero observations, will both minimize the bias introduced by such a substitution and reduce the additivity problem. In further evaluation of the log-log inverse model the value of Le .01 is used as a substitute for zero observation. This choice is an arbitrary one. Le .01 is the largest value that can be considered a reasonable substitute.

5.3. The Performance of the Two Models

The data for each commodity were fitted using both the log-log inverse model and the MRSLI models for comparative purposes. The resulting parameter estimates are given in Tables 5.3 and 5.4.[2] Preliminary tests on both models

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[2]Estimated coefficients for regional binary variables are not included in these tables. In nearly all cases, an F test showed this set of variables to be highly significant.

TABLE 5.3
PARAMETERS ESTIMATED WITH LOG-LOG INVERSE MODEL

Commodity Group	Constant	Coefficient Of				R^2
		ln $\bar{y}$	$1/\bar{y}$	ln N	ln S	
Rice	-.457 (1.05)[a]	.907 (.19)	-9.821 (13.35)	1.016 (.07)	.231 (.05)	.635
Cereals and root crops	-3.360 (3.37)	.984 (.60)	-41.332 (42.81)	1.728 (.24)	.423 (.17)	.552
Fruits and vegetables	-4.856 (2.73)	1.166 (.49)	-1.293 (34.74)	1.095 (.19)	.446 (.13)	.494
Palm oil	-8.041 (3.33)	1.783 (.59)	-10.421 (42.34)	1.739 (.24)	-.597 (.163)	.348
Rural salt and other oil	4.827 (4.80)	-1.316 (.86)	-105.192 (60.97)	.433 (.34)	.379 (.24)	.218
Imported salt and condiments	-6.584 (2.35)	1.317 (.42)	31.005 (29.88)	.969 (.17)	-.255 (.12)	.322
Meat and livestock products	-7.246 (5.11)	1.308 (.91)	-27.463 (64.95)	1.465 (.36)	-.127 (.25)	.230
Fish	-1.707 (1.19)	.892 (.21)	4.723 (15.10)	.890 (.08)	-.072 (.06)	.577
Processed food	-5.329 (4.21)	.464 (.75)	-31.704 (53.43)	1.112 (.30)	-.244 (.21)	.417
All food	.382 (.39)	.873 (.07)	-12.089 (4.9)	1.030 (.03)	.158 (.02)	.925
Rural beverages and tobacco	-7.256 (4.13)	1.614 (.74)	75.580 (52.52)	.247 (.29)	.449 (.20)	.242
Urban and imported beverages and tobacco	-3.068 (2.51)	.926 (.45)	39.490 (31.89)	.473 (.18)	-.155 (.12)	.187
All beverages and tobacco	-2.351 (2.10)	.975 (.27)	53.787 (26.66)	.196 (.15)	.126 (.10)	.168
Bread	-4.499 (4.19)	.208 (.75)	-60.152 (53.25)	1.069 (.30)	-.409 (.21)	.281
Metal work (SSI)[b]	-7.018 (4.67)	.883 (.833)	46.242 (59.35)	.122 (.33)	.026 (.23)	.082
Wood work	-17.764 (5.24)	2.490 (.93)	90.984 (66.52)	1.625 (.37)	-.860 (.26)	.210
Gara cloth	-10.564 (4.90)	1.837 (.87)	41.182 (62.21)	1.373 (.35)	-.663 (.24)	.320
Tailoring	-2.468 (4.54)	.313 (.81)	-62.430 (57.74)	.924 (.32)	-.138 (.22)	.153
Other household and personal goods (SSI)[b]	-7.798 (3.90)	1.391 (.70)	17.722 (49.61)	.932 (.28)	-.174 (.19)	.285
All small-scale industry products	-7.935 (2.80)	1.626 (.50)	16.637 (35.63)	1.391 (.20)	-.468 (.14)	.436

TABLE 5.3 - CONTINUED
PARAMETERS ESTIMATED WITH LOG-LOG INVERSE MODEL

Commodity Group	Constant	Coefficient of				R^2
		ln $\bar{y}$	$1/\bar{y}$	ln N	ln S	
Fuel and light	-.505 (.96)	.517 (.17)	5.033 (12.24)	.519 (.07)	-.212 (.05)	.376
Metal work (LSI)[c]	-14.182 (4.04)	2.469 (.72)	19.490 (51.38)	2.051 (.29)	-.562 (.20)	.389
Clothing	-6.358 (3.45)	1.172 (.62)	-5.186 (43.83)	1.435 (.24)	-.698 (.17)	.232
Cloth	-11.541 (4.08)	2.141 (.73)	42.029 (51.88)	1.649 (.29)	-.544 (.20)	.266
Shoes	-3.885 (4.58)	.289 (.82)	-96.380 (58.19)	1.701 (.32)	-1.098 (.22)	.323
Other household and personal goods (LSI)[c]	-4.363 (1.59)	1.076 (.28)	-1.275 (20.26)	1.126 (.11)	-.363 (.08)	.534
All large-scale industry products	-2.008 (.98)	.960 (.17)	-.171 (12.47)	1.017 (.07)	-.355 (.05)	.651
Transport	-13.242 (3.54)	2.550 (.63)	95.830 (45.02)	1.167 (.25)	-.824 (.17)	.568
Ceremonail and entertainment	-12.921 (4.41)	2.325 (.79)	35.764 (56.00)	1.678 (.31)	-.373 (.22)	.450
Other services	-12.098 (5.55)	1.558 (.99)	37.994 (70.51)	.649 (.39)	-.843 (.27)	.319
All services	-12.183 (4.48)	2.215 (.80)	28.738 (56.96)	1.759 (.32)	-.457 (.22)	.440
Education	-4.761 (5.32)	.767 (.95)	.971 (67.57)	1.009 (.38)	-.815 (.26)	.348
Institutional saving	1.237 (5.82)	-.632 (1.04)	-81.583 (73.89)	.766 (.41)	-.484 (.28)	.249
Miscellaneous	-9.216 (5.03)	1.557 (.90)	41.142 (63.91)	.769 (.36)	.436 (.25)	.206

SOURCE: Survey data.

[a]Values in parentheses are standard errors.

[b]SSI indicates small-scale industry.

[c]LSI indicates large-scale industry.

TABLE 5.4
PARAMETERS ESTIMATED WITH MODIFIED RATIO
SEMI-LOG INVERSE MODEL

Commodity Group	Coefficient of				R^2
	Y	Y ln $\bar{y}$	N	ln S	
Rice	.7475 (.333)[a]	-.0636 (.058)	-4.1226 (6.170)	45.5279 (12.231)	.678
Cereals and root crops	.4407 (.183)	-.0636 (.032)	-4.7824 (3.402	10.2637 (6.743)	.387
Fruits and vegetables	.0753 (.062)	.0090 (.011)	-.5978 (1.143)	5.6147 (2.265)	.359
Palm oil	.1187 (.130)	-.0060 (.022)	-.5799 (2.401)	-11.9078 (4.760)	.399
Rural salt and other oil	.0026 (.009)	-.0003 (.002)	.0101 (.160)	.1017 (.318)	.284
Imported salt and condiments	-.0399 (.025)	.0081 (.004)	.7828 (.456)	-.3952 (.904)	.227
Meat and livestock products	-.1836 (.053)	.0357 (.009)	3.1608 (.979)	1.3258 (1.942)	.247
Fish	.2863 (.127)	-.0373 (.022)	-1.7032 (2.346)	-1.3201 (4.649)	.480
Processed food	.0027 (.009)	-.0001 (.002)	.1031 (.174)	-.0659 (.345)	.425
All food	1.4502 (.264)	-.1361 (.046)	-7.7493 (4.892)	49.1449 (9.696)	.908
Rural beverages and tobacco	-.0988 (.068)	.0185 (.012)	1.2376 (1.250)	6.1287 (2.477)	.164
Urban and imported beverages and tobacco	-.0182 (.028)	.0039 (.005)	.1512 (.516)	-.7515 (1.023)	.194
All beverages and tobacco	-.1170 (.072)	.0224 (.013)	1.3889 (1.340)	5.3771 (2.656)	.152
Bread	.0055 (.006)	-.0008 (.001)	-.0594 (.117)	-.4245 (.232)	.147
Metal work (SSI)[b]	.0069 (.014)	-.0010 (.002)	-.1844 (.263)	-.2628 (.521)	.051
Wood work	-.0217 (.019)	.0047 (.003)	.4750 (.353)	-1.2331 (.699)	.201
Gara cloth	.0148 (.022)	-.0016 (.004)	-.1650 (.412)	-1.3666 (.817)	.266
Tailoring	.0175 (.010)	-.0024 (.001)	-.1821 (.192)	-.0427 (.380)	.224
Other household and personal goods (SSI)[b]	.0036 (.024)	-.0001 (.004)	.0098 (.451)	-.7642 (.895)	.044
All small-scale industry products	.0265 (.044)	-.0011 (.008)	-.1060 (.818)	-4.0938 (1.621)	.288

TABLE 5.4 - CONTINUED
PARAMETERS ESTIMATED WITH MODIFIED RATIO
SEMI-LOG INVERSE MODEL

Commodity Group	Coefficient of				R^2
	Y	Y ln $\bar{y}$	N	ln S	
Fuel and light	.0469 (.026)	-.0062 (.005)	-.5541 (.485)	-3.4921 (.962)	.293
Metal work (LSI)[c]	.0390 (.032)	.0045 (.006)	-.2834 (.600)	-2.8389 (1.190)	.265
Clothing	.0001 (.038)	.0016 (.007)	.5730 (.700)	-4.8570 (1.387)	.233
Cloth	-.0016 (.066)	.0085 (.012)	.1427 (1.230)	-5.4737 (2.438)	.425
Shoes	.0634 (.023)	-.0096 (.004)	-.9831 (.425)	-3.2815 (.842)	.245
Other household and personal goods (LSI)[c]	.1142 (.095)	-.0108 (.017)	-1.2747 (1.766)	-5.0091 (3.500)	.299
All large-scale industry products	.2619 (.149)	-.0211 (.026)	-2.3797 (2.767)	24.9523 (5.485)	.558
Transport	-.0626 (.060)	.0162 (.010)	.5274 (1.111)	-6.3032 (2.201)	.279
Ceremonial and entertainment	-.4771 (.107)	.0960 (.019)	6.8729 (1.982)	-3.5499 (3.930)	.438
Other services	-.0214 (.036)	.0047 (.006)	.5520 (.664)	-2.6637 (1.316)	.153
All services	-.4985 (.112)	.1006 (.019)	7.4250 (2.081)	-6.2136 (4.124)	.455
Education	-.0398 (.052)	.0083 (.009)	1.0678 (.969)	-5.5387 (1.921)	.149
Institutional saving	.1123 (.090)	-.0180 (.016)	-1.9689 (1.671)	-1.8247 (3.313)	.072
Miscellaneous	-.1331 (.094)	.0288 (.016)	1.7947 (1.740)	-5.5957 (3.4492)	.157

SOURCE: Survey data.

[a]Values in parentheses are standard errors. Due to the small magnitude of coefficients in this model, parameter estimates and standard errors have been carried to an additional decimal place.

[b]SSI indicates small-scale industry.

[c]LSI indicates large-scale industry.

showed the variable representing the percentage of members of a household who are children to be consistently insignificant at even the .30 level, and it was dropped as an explanatory variable.

Because the two functional forms are so different, little can be said in comparing the levels of their respective income parameters. Even the values of R^2, the coefficient of determination, are not directly comparable because the disturbance term, u_{ij}, is specified differently in each model. It can be noted, however, that the parameters of the log-log inverse model tend to be different from zero at a given level of significance more often than those of the MRSLI model. In both models, the frequently low significance level of the income parameters may be attributable to the comparatively low variance of per capita total expenditure as indicated by the Gini ratio of .31.

The subsistence ratio is a highly significant explanatory variable in both models, and the direction of its effect differs between them for only a few commodities. In general, households with higher subsistence ratios tend to consume more food items and fewer manufactured goods than do households having the same income level but a lower subsistence ratio. This is as expected, since only food items are included in the subsistence component of consumption.

Household size effects are more difficult to compare due to the complexity of the expression for the elasticity of expenditure on a good with respect to household size in the MRSLI model. In Table 5.5, household size elasticities for aggregate commodity groups derived from the two models are given. Elasticities for the MRSLI model are computed at the mean income level, while those for the log-log inverse model are constant across the range of incomes. For most commodities the two values are remarkably similar, and the performances of the two models can be said to be roughly equal. Economies of scale are clearly indicated only for beverages and tobacco, while only services show strong diseconomies of scale. In both cases compositional, as well as household size, effects appear to be reflected in the household size elasticities. Large households are expected to expend less per person on beverages and tobacco because they tend to have a proportion of children, who do not generally use tobacco, among their members. Similarly, they may be expected to spend more per person on services, mostly ceremonial and entertainment, because they are more likely to be involved in baptism, adulthood, and marriage ceremonies.

A more meaningful comparison of the two models can be made by examining total expenditure elasticities and marginal propensities to consume derived from their parameters. These are given in Table 5.6. While elasticities and marginal propensities to consume generated by the two models

TABLE 5.5
HOUSEHOLD SIZE ELASTICITIES DERIVED FROM
THE TWO MODELS

Aggregate Commodity Group	Log-Log Inverse Model	MRSLI Model
Food	1.030	1.033
Beverages and tobacco	.196	.111
Small-scale industry products	1.391	1.045
Large-scale industry products	1.017	1.022
Transport	1.167	.906
Services	1.759	1.697
Education	1.009	.805
Institutional saving	.766	.624
Miscellaneous	.769	1.288

SOURCE: Survey data.

TABLE 5.6
ESTIMATED MEAN EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME FOR THE TWO MODELS

Commodity Group	Elasticity		MPC	
	Log-Log Inverse	MRSLI	Log-Log Inverse	MRSLI
Rice	.992	.968	.385	.381
Cereals and root crops	1.339	.904	.110	.074
Fruits and vegetables	1.177	.824	.034	.024
Palm oil	1.873	1.123	.141	.084
Rural salt and other oil	-.411	.348	-.001	.001
Imported salt and condiments	1.050	.470	.015	.007
Meat and livestock products	1.544	1.366	.025	.022
Fish	.851	.850	.072	.071
Processed food	.737	.673	.002	.002
All food	.977	.953	.684	.666
Rural beverages and tobacco	.964	.421	.018	.008
Urban and imported beverages and tobacco	.586	.250	.010	.004
All beverages and tobacco	.512	.338	.018	.012
Bread	.725	.579	.001	.001
Metal work (SSI)[a]	.485	.526	.001	.001
Wood work	1.708	1.492	.005	.005
Gara cloth	1.483	.712	.012	.006
Tailoring	.850	.954	.003	.003
Other household and personal goods (SSI)[a]	1.239	.830	.006	.004
All small-scale industry products	1.483	.873	.034	.020
Fuel and light	.473	.360	.015	.011
Metal work (LSI)[b]	2.301	.928	.032	.013
Clothing	1.217	.503	.023	.010
Cloth	1.780	1.578	.053	.047
Shoes	1.118	.887	.010	.008
Other household and personal goods (LSI)[b]	1.087	1.654	.034	.052
All large-scale industry and marginal products	.961	1.050	.129	.141
Transport	1.726	1.382	.038	.030
Ceremonial and entertainment	2.017	2.099	.073	.075
Other services	1.231	.736	.009	.006
All services	1.968	1.864	.085	.081

TABLE 5.6 - CONTINUED
ESTIMATED MEAN EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME FOR THE TWO MODELS

Commodity Group	Elasticity		MPC	
	Log-Log Inverse	MRSLI	Log-Log Inverse	MRSLI
Education	.759	.559	.011	.008
Institutional saving	.070	.849	.001	.009
Miscellaneous	1.203	1.860	.022	.033
Total of aggregate MPC's			1.022	1.000
Total of disaggregated MPC's			1.160	1.000

SOURCE: Survey data.

[a]SSI indicates small-scale industry.

[b]LSI indicates large-scale industry.

are similar in a number of cases, there are some rather important differences. Of relevance to policy decisions, for example, are the relative magnitudes of the expenditure elasticities for large and small-scale industry products. Results from the log-log inverse model indicate the elasticity for small-scale industry products is the higher, while the MRSLI model points to the opposite conclusion.

Differences in estimated expenditure elasticities, while important, cannot be the basis for a choice between the two models, since it is not known a priori which, if either set of estimates is "correct". One basis for such a choice, however, is conformity to the criterion of additivity of the marginal propensities to consume. The MRSLI model conforms exactly with this criterion. The log-log inverse model conforms rather well for aggregate commodity groupings at the mean expenditure level; but, largely due to the zero observation problem, it performs rather poorly when marginal propensities to consume for disaggregated commodity groups are summed. The figures given in Table 5.7 indicate that the additivity problem becomes more serious at income levels other than the mean, even for aggregate commodity groups which have few zero observations. Because it does not conform to the additivity criterion and because systematic biases are known to have been introduced by substituting small positive values for zero observations, the log-log inverse model is rejected in the remainder of this study. Further analysis is based on the MRSLI model.

TABLE 5.7
SUMS OF MARGINAL PROPENSITIES TO CONSUME
DERIVED FROM THE LOG-LOG
INVERSE MODEL

Income Class	Sum of Marginal Propensities to Consume	
	Aggregated Commodity Groups	Disaggregated Commodity Groups
Lowest decile	1.018	1.104
Second and third deciles	1.036	1.145
Fourth and fifth deciles	1.019	1.149
Sixth and seventh deciles	.985	1.128
Eighth and ninth deciles	1.047	1.213
Highest decile	1.078	1.252

5.4. Estimates of Marginal Propensities to Consume and Expenditure Elasticities

Estimated marginal propensities to consume and expenditure elasticities for each income class are given in Table 5.8. As expected, estimated marginal propensities to consume confirm the importance of expenditures on food in all income classes; although as incomes rise, a significant decline is seen in this measure of food's importance as a component of consumption expenditures. Within this aggregate grouping the substitution of meat for fish as incomes rise is of interest from a policy and planning point of view. Other changes in the marginal propensity to consume, significant at the .30 level,[3] include increases for imported salt, wood work, transport, all services, ceremonial and entertainment, and miscellaneous goods as incomes rise. The marginal propensities to consume for rice, cereals and root crops, tailoring, fuel and light, shoes, and institutional saving decline at this level of significance as incomes rise. With respect to the estimated total expenditure elasticities, it can be said that in general they conform with expectations concerning their level and behavior.

Hymer and Resnick [1969] have hypothesized that the income elasticity of demand for small-scale industry products is near zero, if not negative. Estimated total

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[3] As stated in Chapter 4, if the coefficient of $Y \ln \bar{y}$ is different from zero at the specified level of significance, the marginal propensity changes in the direction of the sign of this parameter as income rises.

TABLE 5.8
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME BY INCOME CLASS

Commodity Group	Elasticity						MPC					
	Income Class						Income Class					
	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Rice	1.162	.932	.995	.887	1.001	1.012	.460	.428	.398	.378	.356	.329
Cereals and root crops	1.813	1.552	1.356	.718	.509	.431	.153	.121	.091	.071	.049	.022
Fruits and vegetables	.838	1.370	.803	.720	.779	1.043	.035	.030	.026	.023	.020	.016
Palm oil	2.070	1.422	1.201	.990	1.109	.799	.092	.089	.086	.084	.082	.079
Rural salt and other oil	.509	.395	.324	.311	.465	.239	.001	.001	.001	.001	.001	.001
Imported salt and condiments	-.189	.040	.353	.563	.846	.767	-.003	.001	.005	.007	.010	.013
Meat and livestock products	-1.166	-.329	1.112	1.557	1.747	2.550	-.022	-.004	.013	.024	.-36	.051
Fish	1.671	1.340	.750	.900	.678	.545	.118	.099	.081	.070	.057	.041
Processed food	.354	.542	.992	.454	1.035	.826	.002	.002	.002	.002	.002	.002
All food	1.224	1.046	.991	.874	.912	.897	.836	.767	.703	.660	.613	.554
Rural beverages and tobacco	-.383	-.299	.085	.962	1.566	1.220	-.015	-.006	.003	.009	.015	.023
Urban and imported beverages and tobacco	-.023	.072	.194	.236	.440	.426	-.001	.002	.003	.004	.006	.008
All beverages and tobacco	-.254	-.113	.122	.469	.909	.834	-.016	-.004	.006	.013	.021	.031
Bread	1.265	.814	1.228	.378	.258	.000	.002	.001	.001	.001	.000	.000
Metal work (SSI)[a]	.787	1.054	.000	.288	.247	.196	.002	.002	.002	.001	.001	.000
Wood work	-.776	.454	1.286	2.643	1.655	1.624	-.001	.002	.004	.005	.007	.009
Gara cloth	1.867	.916	.854	.930	.478	.499	.008	.007	.006	.006	.005	.004
Tailoring	1.908	1.284	1.179	1.100	.666	.402	.007	.005	.004	.003	.003	.002

TABLE 5.8 - CONTINUED
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME BY INCOME CLASS

Commodity Group	Elasticity						MPC					
	Income Class						Income Class					
	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Other household and personal goods (SSI)[a]	.698	.908	.559	.976	1.211	.746	.004	.004	.004	.004	.004	.004
All small-scale industry products	1.180	.879	.928	.993	.771	.760	.022	.021	.021	.020	.020	.019
Fuel and light	.429	.425	.421	.362	.320	.223	.019	.016	.013	.011	.009	.006
Metal work (LSI)[b]	1.992	1.285	1.175	1.158	.567	.749	.019	.016	.014	.013	.011	.009
Clothing	.426	.283	.504	.524	.658	.679	.007	.008	.009	.010	.010	.011
Cloth	2.746	1.810	1.472	2.151	1.262	1.510	.037	.041	.045	.048	.051	.054
Shoes	1.771	1.293	1.366	1.135	.388	.000	.020	.015	.010	.007	.004	.000
Other household and personal goods (LSI)[b]	2.378	2.077	2.623	1.475	1.306	1.131	.065	.060	.055	.051	.047	.043
All large-scale industry and imported products	1.361	1.099	1.225	1.140	.887	.910	.167	.156	.146	.140	.132	.123
Transport	.380	1.166	1.617	2.321	1.445	.996	.010	.018	.026	.031	.037	.044
Ceremonail and entertainment	-2.599	.341	1.197	4.280	2.325	2.385	-.044	.005	.050	.080	.113	.155
Other services	-.052	.308	1.429	.858	.703	.815	.000	.002	.004	.006	.007	.009
All services	-1.946	.325	1.212	3.382	2.039	2.138	-.044	.007	.054	.086	.120	.164

TABLE 5.8 - CONTINUED
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME BY INCOME CLASS

Commodity Group	Elasticity						MPC					
	Income Class						Income Class					
	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Education	-.052	.229	.438	1.216	.693	.783	-.002	.002	.006	.008	.011	.015
Institutional saving	3.159	4.004	1.607	.364	.296	-.494	.030	.022	.013	.008	.002	-.006
Miscellaneous	-.259	.952	1.463	4.928	1.866	1.752	-.003	.011	.025	.034	.044	.056

SOURCE: Survey data.

[a]**SSI indicates small-scale industry.**

[b]**LSI indicates large-scale industry.**

expenditure elasticities for rural consumers in Sierra Leone are uniformly well above zero and are, in fact, above unity for the lowest income class. This is strong evidence against validity of the Hymer-Resnick hypothesis, though it should be noted that rejection of the hypothesis on strict statistical grounds is not possible due to the large standard error of the estimated income parameters.[4]

Comparison of estimated expenditure elasticities with those reported in other African consumption studies is difficult because commodity groupings differ and because the elasticities in this study are specific to a given level of income. It can be noted, however, that the elasticity of demand for rice of .03 reported by Snyder [1971] for urban consumers in Sierra Leone differs substantially from the estimated elasticity close to unity for rural households in this study.

The marginal propensities to consume given in Table 5.8 will be used in analyzing the factor intensity of marginal expenditures. A more complete evaluation of the effects they have on employment and capital requirements is presented in the following chapter.

Parameters estimated for consumption expenditures on commodities grouped by origin are given in Table 5.9, while

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[4]The relevant test here involves constructing a confidence interval around the marginal propensity to consume. If it can be shown to be positive, the elasticity is positive as well.

TABLE 5.9
ESTIMATED PARAMETERS FOR COMMODITIES
GROUPED BY ORIGIN

	Coefficient Of				R^2
	Y	Y ln $\bar{y}$	N	ln S	
Rural	.9355 (.241)[a]	-.0280 (.042)	-.8655 (4.465)	45.9454 (8.851)	.981
Small urban	.0208 (.079)	.0007 (.014)	-.1059 (1.466)	-6.5103 (2.905)	.262
Large urban	.0142 (.043)	.0010 (.007)	-.3960 (.793)	-5.4285 (1.571)	.853
Imported	.1040 (.162)	.0065 (.028)	.2180 (2.995)	-21.7191 (5.937)	.784
No location	-.0746 (.124)	.0198 (.021)	1.1494 (2.289)	-12.2875 (4.537)	.393

SOURCE: Survey data.

[a]Values in parentheses are standard errors.

derived expenditure elasticities and marginal propensities to consume for each income class are presented in Table 5.10. Examination of the parameters and their standard errors indicates that in all equations except that for goods of rural origin the log of the subsistence ratio is the only variable which is significant at even a .30 level of significance. Income, then, does not appear to be a significant factor in the breakdown by origin of rural consumption patterns. The results given in Table 5.10 are discussed in detail in Chapter 6. It should be noted here, however, that because of the large standard error associated with the coefficients in which they are based, the extent to which they can be interpreted is somewhat limited.

5.5. Total Versus Cash Expenditure Elasticities

As stated in Chapter 4, data on subsistence consumption are difficult and expensive to obtain. Therefore, it is of practical interest to examine the differences between estimated marginal propensities to consume and expenditure elasticities based on cash and on total expenditure data. To allow such a comparison, cash expenditure elasticities were estimated using the following model:

$$M_{ij} = a_i Y_{cj} + b_{1i} Y_{cj} \ln \bar{y}_{cj} + b_{2i} N_j + \sum_{h=1}^{8} g_{hi} R_{hj} + u_{ij} . \qquad (5.1)$$

TABLE 5.10
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME FOR COMMODITIES GROUPED BY ORIGIN

Origin	Elasticity						MPC					
	Income Class						Income Class					
	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile	Lowest Decile	Second and Third Deciles	Fourth and Fifth Deciles	Sixth and Seventh Deciles	Eighth and Ninth Deciles	Highest Decile
Rural	1.100	1.056	.998	.981	1.018	1.029	.809	.795	.782	.773	.763	.751
Small urban	1.783	1.653	1.948	3.204	.965	1.379	.024	.024	.025	.025	.025	.025
Large urban	.267	.327	.419	.371	.464	.427	.019	.019	.020	.020	.021	.021
Imported	1.128	.916	1.181	1.227	1.284	1.028	.133	.137	.140	.142	.144	.147
No location	.238	1.017	.897	1.162	1.336	.879	.015	.025	.035	.040	.047	.056

SOURCE: Survey data.

M_{ij} represents cash expenditure on the i^{th} commodity by the j^{th} household; Y_{cj}, total cash expenditure on consumption goods by household j; $\bar{y}_{cj}$, cash expenditure per person by household j; N_j, the number of members in household j; and R_{hj}, a binary variable which is equal to one if household j is in region h and zero otherwise. Again, a_i, b_{1i}, b_{2i}, and the g_{hi}'s are parameters to be estimated; and u_{ij} is a disturbance term. Marginal propensities to consume and expenditure elasticities based on the two sets of data are given in Table 5.11.

Elasticities of total cash expenditure and of the total value of subsistence consumption with respect to total consumption expenditure, E_m and E_s,[5] were also estimated. Their values at the mean expenditure level are 1.044 and .953, respectively. Using the same parameter estimates, partial derivatives of total expenditure and of the total value of subsistence consumption with respect to total consumption expenditure, $\partial M/\partial Y$ and $\partial S/\partial Y$, were also derived. At the mean level of expenditure, they equal .544 and .456, respectively. These estimated relationships are used in equations 4.12 and 4.13 to analyze the differences between expenditure elasticities and marginal propensities to consume based on cash and total expenditure data.

As expected, little similarity is seen between the two rates of marginal propensity to consume. This follows

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[5] $E_m = (\partial M/\partial Y)\ (Y/M)$ and $E_s = (\partial S/\partial Y)\ (Y/S)$.

TABLE 5.11
CASH EXPENDITURE VERSUS TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME[a]

Commodity Group	$\frac{M_i}{C_i}$[b]	Elasticity		MPC	
		Cash Expenditure	Total Expenditure	Cash Expenditure	Total Expenditure
Rice	.212	.916	.968	.147	.381
Cereals and root crops	.080	1.205	.904	.015	.074
Fruits and vegetables	.265	.807	.824	.012	.024
Palm oil	.625	1.351	1.123	.122	.084
Rural salt and other oil	.858	.235	.348	.001	.001
Imported salt and condiments	1.000	.650	.471	.018	.007
Meat and livestock products	.465	1.061	1.365	.015	.022
Fish	.726	.618	.849	.072	.071
Processed food	1.000	.702	.673	.004	.002
All food	.333	.909	.953	.406	.666
Rural beverages and tobacco	.362	.520	.421	.007	.008
Urban and imported beverages and tobacco	1.000	.312	.250	.010	.004
All beverages and tobacco	.669	.370	.338	.017	.012
Bread	1.000	1.121	.579	.003	.001
Metal work (SSI)[c]	1.000	.741	.526	.003	.001
Wood work	1.000	1.878	1.492	.013	.005
Gara cloth	1.000	.536	.711	.008	.006
Tailoring	1.000	.752	.953	.005	.003
Other household and personal goods (SSI)[c]	1.000	.742	.830	.007	.004
All small-scale industry products	1.000	.869	.873	.039	.020
Fuel and light	1.000	.426	.360	.025	.011
Metal work (LSI)[d]	1.000	1.020	.928	.027	.013
Clothing	1.000	.756	.503	.027	.010
Cloth	1.000	1.298	1.578	.075	.047
Shoes	1.000	1.236	.887	.021	.008
Other household and personal goods (LSI)[d]	1.000	1.656	1.654	.100	.052
All large-scale industry and imported products	1.000	1.072	1.050	.275	.141
Transport	1.000	1.334	1.382	.056	.030

TABLE 5.11 - CONTINUED
CASH EXPENDITURE VERSUS TOTAL EXPENDITURE ELASTICITIES
AND MARGINAL PROPENSITIES TO CONSUME[a]

Commodity Group	M_i/C_i[b]	Elasticity		MPC	
		Cash Expenditure	Total Expenditure	Cash Expenditure	Total Expenditure
Ceremonial and entertainment	1.000	1.319	2.099	.091	.075
Other services	1.000	1.263	.736	.018	.006
All services	1.000	1.309	1.864	.109	.081
Education	1.000	.810	.559	.023	.008
Institutional saving	1.000	1.249	.849	.024	.009
Miscellaneous	1.000	1.515	1.860	.051	.033

SOURCE: Survey data.

[a]Both marginal propensities to consume and expenditure elasticities are computed at mean expenditure levels. Comparison at different levels is difficult because ranking of households is not the same in the two data sets.

[b]M_i/C_i indicates the percentage of total expenditure on commodity i which comes from cash expenditure. S_i/C_i, the percentage of total expenditure on commodity i attributable to subsistence consumption, is equal to $1 - M_i/C_i$.

[c]SSI indicates small-scale industry.

[d]LSI indicates small-scale industry.

from the relationship stated in Chapter 4,[6]

$$\frac{\partial C_i}{\partial Y} = \frac{\partial M_i}{\partial M} \cdot \frac{\partial M}{\partial Y} + \frac{\partial S_i}{\partial S} \cdot \frac{\partial S}{\partial Y} \cdot \qquad (5.2)$$

In the case of food items for which there is subsistence consumption, it is difficult to analyze the relationship between the cash and total expenditure marginal propensities to consume without information on the corresponding marginal propensity to consume subsistence goods. For other commodities where subsistence consumption is very low (i.e., $dS_i/dS = 0$), because $\partial M/\partial Y = .544$, the cash marginal propensity to consume is expected to be approximately twice the size of that for total consumption expenditure. The figures in Table 5.11 confirm this.

Estimated expenditure elasticities, on the other hand, are remarkably similar for nearly all of the aggregate categories and for a number of disaggregated commodity groups. In the case of nonfood items, this similarity follows from the relationship:[7]

$$E_i^t = E_m \frac{M_i}{C_i} E_i^m + E_s \frac{S_i}{C_i} E_i^s \cdot \qquad (5.3)$$

Since $S_i/C_i = 0$, $M_i/C_i = 1$, and $E_m = 1.044$, the cash expenditure elasticity should be approximately equal to the total expenditure elasticity. Where the two are dissimilar, this

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[6]Equation 4.13, page 55.

[7]Originally given in equation 4.12, page 54.

may be attributable to the fact that they are based on parameter estimates which have large standard errors.[8]

These results indicate, then, that the use of cash expenditure elasticities for the projection of consumer demand for major commodities when total expenditure data are not available may be quite accurate, especially when goods which are not produced by the households and when the elasticity of total cash expenditure with respect to total consumption expenditure is believed to be close to unity. Marginal propensities to consume based on cash expenditure data, on the other hand, cannot be expected to be reliable estimates of actual marginal propensities to consume.

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[8]The similarity between cash and total expenditure elasticities for food items is more difficult to explain. It can only be said that cash expenditure and subsistence consumption elasticities are apparently quite similar for these items among rural consumers in Sierra Leone.

CHAPTER 6

EMPLOYMENT AND GROWTH EFFECTS OF RURAL CONSUMPTION PATTERNS

6.1. The Factor Intensity of Rural Consumption Patterns

The marginal propensities to consume given in Chapter 5 provide a basis for the systematic analysis of the employment and capital intensity of rural consumption patterns. When combined with information on the relative labor and capital requirements of the production process in each sector of the economy, they can be used to determine the number of units of capital and labor required per unit of consumption expenditure--the factor intensity of consumption--at a given income level. Because both average and marginal propensities to consume have been estimated in this study, both average and marginal factor intensities of consumer demand can be derived. The former are of use in describing capital and labor requirements as they exist currently, while the latter can be used to analyze the effect of a change in income on labor and capital requirements. Symbolically these measures of factor intensity can be expressed as:

$$\text{average capital intensity} = \Sigma_i \, APC_i \, (K/O)_i$$

$$\text{average labor intensity} = \Sigma_i \, APC_i \, (L/O)_i$$

$$\text{marginal capital intensity} = \Sigma_i \, MPC_i \, (K/O)_i$$

$$\text{marginal labor intensity} = \Sigma_i \, MPC_i \, (L/O)_i$$

where

APC_i = average propensity to consume commodity i

MPC_i = marginal propensity to consume commodity i

$(K/O)_i$ = capital-output ratio for the industry producing commodity i

$(L/O)_i$ = labor-output ratio for the industry producing commodity i.

In this section factor intensities for each income group are presented. These are used to test the hypothesis that lower income households consume a more labor intensive and less capital intensive bundle of goods than that consumed by households with higher incomes. The implication of this hypothesis is that increases in income realized by low income households have a greater employment generating potential than similar increases in high income households. Because of multiplier effects associated with a higher level of employment and because of the relatively low requirement for additional capital (the scarce factor of production in most developing economies) associated with such increases, they can be expected to foster rather than retard growth in the economy as a whole. Clearly, if the hypothesis is a valid one, broad based development strategies aimed at increasing the incomes of the poorer segments of the population will lead to both increased growth and employment generation.

The economic ratios used to determine the factor intensity of consumer demand were derived from a number of

sources. Labor and capital requirements for the production of one leone of output of various agricultural commodities were calculated from survey data and from information given in Spencer and Byerlee's [1977] analysis of incomes and productivity in rural areas of Sierra Leone. Figures cited by Liedholm and Chuta [1976] were used to calculate labor-output and capital-output ratios for the large and small-scale industry sectors. Finally, data given in The National Accounts of Sierra Leone, 1964/65 to 1970/71 [1972b] were the basis for the determination of economic ratios for the transport, education, and institutional saving sectors. The services and miscellaneous components of consumption expenditure, because they represent expenditures on goods from all sectors, were assumed within an income class to have labor-output and capital-output ratios equal to the average value of these ratios over all other sectors.

The economic ratios derived from these sources are given in Table 6.1. In all cases the labor-output ratio is expressed in terms of hours worked per leone of output, and the capital output ratio is given in terms of the annual cost of capital per leone of output. In cases where only data on the capital stock for a sector were available, the conversion to a flow of capital services was made using the following capital recovery formula:[1]

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[1]See Liedholm and Chuta [1976, pp. 27-29] for a discussion of this formula and its use.

TABLE 6.1
LABOR-OUTPUT AND CAPITAL-OUTPUT RATIOS FOR SECTORS OF THE SIERRA LEONIAN ECONOMY

Commodity Group	L/O[a]	K/O[b]
Rice	12.75	.017[c]
Cereals and root crops	16.56	.017
Fruits and vegetables	9.89	.017
Palm oil and other rural oil	5.16	.017
Meat and livestock products	4.80	.017
Fish	5.30	.227
Rural beverages and tobacco	10.79	.017
Small-scale industry products[d]	5.95	.178
Large-scale industry products	.28	.267
Transport	1.16	.310
Education and institutional saving[e]	1.71	.026

SOURCE: Survey data, Liedholm and Chuta [1976], Spencer and Byerlee [1977], Central Statistics Office [1972b].

[a]Person-hours per Leone of output.

[b]Annual cost of capital per Leone of output.

[c]Capital-output ratios are identical for agricultural products because it was not possible to disaggregate capital use by crop.

[d]Includes processed food, most of which originates in rural and small urban locations.

[e]These economic ratios were derived from public administration and services data.

$$R = \frac{rV}{1 - (1 + r)^{-n}}$$

where R is the constant annual service flow, V is the original market value of the capital asset,[2] r is the interest rate, and n is the expected life of the asset. In all cases r was set at .20. A priori estimates of an aggregate value of n were made for each sector.

Estimates of average and marginal labor, capital and foreign exchange requirements per leone of expenditure in each income class are given in Tables 6.2 and 6.3. In the last two columns of each table capital and labor requirements that could possibly result from a policy of total import substitution are given. These figures were calculated under the assumption that imports compete most directly with or eliminate the need for domestically produced large-scale industry products and that the entire substitution is effected through a rapid expansion of domestic large-scale industry. While such an assumption is not wholly realistic, it is not unreasonable to believe that with high unemployment in large urban centers any policy of import substitution would focus on the development of an urban centered industrial base. Within this framework, then, each leone not spent on imported goods increases domestic capital and labor requirements by Le .267 and

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[2]For the agricultural sector the cost of tree plantations, livestock herds, etc., is not included in the determination of annual capital costs.

TABLE 6.2
AVERAGE LABOR, CAPITAL, AND FOREIGN EXCHANGE REQUIREMENTS PER LEONE OF EXPENDITURE BY INCOME CLASS

Income Class	Labor (Person-Hours)	Capital (Leones)	Foreign Exchange (Leones)	Corrected for Import Substitution	
				Labor (Person-Hours)	Capital (Leones)
Lowest decile	8.57	.050	.12	8.60	.087
Second and third deciles	8.87	.049	.15	8.91	.089
Fourth and fifth deciles	8.64	.058	.12	8.67	.090
Sixth and seventh deciles	8.95	.051	.12	8.98	.082
Eighth and ninth deciles	8.37	.059	.14	8.41	.097
Highest decile	7.56	.064	.14	7.60	.102

SOURCE: Survey data.

TABLE 6.3
MARGINAL LABOR, CAPITAL, AND FOREIGN EXCHANGE REQUIREMENTS PER ADDITIONAL LEONE OF EXPENDITURE BY INCOME CLASS

Income Class	Labor (Person-Hours)	Capital (Leones)	Foreign Exchange (Leones)	Corrected for Import Substitution	
				Labor (Person-Hours)	Capital (Leones)
Lowest decile	9.35	.050	.13	9.39	.086
Second and third deciles	9.02	.051	.14	9.06	.088
Fourth and fifth deciles	8.71	.053	.14	8.75	.090
Sixth and seventh deciles	8.46	.053	.14	8.50	.091
Eighth and ninth deciles	8.15	.055	.14	8.19	.093
Highest decile	7.75	.056	.15	7.79	.095

SOURCE: Survey data.

.28 person-hours--the capital and labor requirements for a leone of domestic large-scale industry output. Comparison of the corrected and uncorrected factor intensities indicates that an import substitution policy of this sort would have only a minor effect on labor requirements, while capital requirements would increase substantially.

The average factor intensity figures given in Table 6.2 do not follow a consistent pattern,[3] but the overall trend in both labor and capital intensities does conform with the hypothesized decrease in labor intensity and increase in capital intensity as incomes rise. The marginal factor intensity figures in Table 6.3 also conform to the hypothesized relationship between income and factor intensities, and the increase in capital intensity and decrease in labor intensity with rising incomes are monotonic.

The percentage decrease in labor intensity over the range of incomes is 11 percent with respect to average expenditures and 17 percent with respect to marginal expenditures. Capital requirements increase by 16 and 12 percent respectively for average and marginal expenditures, and foreign exchange requirements increase by 16 and 15 percent. While these changes do lend support to the hypothesis under consideration, their magnitude is not as great as that seen in the results of Asian and Latin American studies. In Pakistan, for example, Soligo [1974] found an increase of

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[3]Some of their irregularity may be attributable to regional effects included in average budget shares.

82 percent in capital intensity and a decrease in labor intensity of 56 percent over the range of incomes in rural areas. To a large extent the relative homogeneity of consumption patterns in the rural areas of Sierra Leone can be attributed to the comparative uniformity of the income distribution. Also, in Sierra Leone, as in many other African countries, there are few landlords, tenants, or landless laborers so the degree of social and economic stratification is less than that in Asia and Latin America.

6.2. Consumption-Based Growth Linkages

The results given in Table 5.10, where expenditure elasticities and marginal propensities to consume for commodities grouped by origin are presented, indicate relatively little consumption-based market interaction between the rural population and the large-scale industry sector of the economy, which is located chiefly in the large urban centers. Expenditure elasticities for goods produced in large urban areas range from .267 in the lowest income class to .464 in the eighth and ninth deciles and .427 in the highest class. Marginal propensities to consume increase only slightly from .019 to .021.[4] As noted in Chapter 5, the statistical significance of the coefficients in which these figures are based is quite low. Until further information becomes

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[4]Expenditures on fuel and light, mostly kerosene, represent the bulk of rural expenditures on goods produced in large urban areas and are largely responsible for the low elasticities and marginal propensities to consume.

available, however, it can be concluded that the demand for products produced in large urban centers changes little as incomes rise and is low for all income classes. Due to this demand pattern and to the low labor intensity of the large-scale industry in urban areas, there seems to be little likelihood of significant consumption-based growth linkages,[5] such as those discussed by Mellor [1976] in relation to India, developing in Sierra Leone. In part, this is attributable to the relative lack of development in Sierra Leonian large-scale industry, which necessitates the importation of the bulk of the manufactured goods consumed in rural areas. While imports represent a major leakage of growth producing potential, however, the results above indicate that a policy of import substitution which fosters the growth of large-scale industry will not have a large effect on employment.

Growth and employment linkages between rural consumers and urban large-scale industries are not strong. There are, however, strong linkages between sectors of the economy concentrated in rural areas. Marginal propensities to consume and expenditure elasticities for rural goods are high in all income classes. Food items represent the bulk of rural goods, but small-scale industry products and rural services, especially ceremonial and entertainment services,

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[5]It should be noted that there are other forms of intersectoral and interregional linkages--the delivery of government services being one such example.

are also important. All of these goods and services can be considered to be labor intensive, which means that an increase in expenditures on them should have a strong positive impact in employment. Expenditure elasticities are quite high for products produced in small urban areas, mostly labor intensive goods produced by small-scale industrial firms. Rising rural incomes may be expected to result in relatively stronger economic growth and increased employment in small urban areas than in large urban areas because of these consumption-based linkages.

6.3. Policy Implications

Several conclusions relevant to planning and policy decisions can be drawn from the results given in this chapter. First, the hypothesis that the labor intensity of consumption decreases and the capital intensity increases as incomes rise is supported, but the effects are not as strong as Latin American and Asian studies have indicated. While development programs directed at lower income classes are preferable in terms of employment generating potential, actual differences are not great. Similarly, no important differences are seen among income groups in their potential for fostering rural-urban growth and employment linkages.

Second, a strategy of import substitution based on the development of capital intensive domestic industry will not have a major impact on employment. Rather, a

policy of developing more labor intensive import substitution industries and of encouraging the growth of small-scale industry will lead to increased employment and economic growth, keep capital requirements at a more reasonable level, and free foreign exchange for other purposes.

Finally, the results confirm the growth and employment stimulating potential of rural development programs. They also indicate, however, that consumption-based linkages resulting from increased rural incomes alone may not contribute much to the solution of problems in large urban centers, especially the unemployment problem. Because the economy is not well integrated in this sense the multiplier effects of growth in rural and small urban areas do not extend to sectors centered outside of these areas to any great extent.

CHAPTER 7

SUMMARY AND CONCLUSIONS

The principal aims of this study were to describe and analyze statistically the relationships between income and consumer demand in rural areas of Sierra Leone, to analyze the growth and employment effects associated with consumption patterns at different income levels, and to formulate an appropriate methodology for consumption research in developing countries. Throughout, emphasis has been placed on the premise that consumption research should be directed toward the testing of hypotheses designed to further theoretical and empirical understanding of the development process, as well as toward the more conventional focus of describing consumer behavior and estimating expenditure elasticities for use in the projection of consumer demand.

Descriptive analysis of the survey data indicates that income distribution in rural areas is rather uniform, the estimated Gini coefficient for the sample being .31. This contrasts with the comparatively unequal distribution of incomes seen in Sierra Leone as a whole and with the high degree of income disparity in the rural areas of Asian and Latin American countries. Another important characteristic of rural households in Sierra Leone is the high percentage of total consumption expenditure which is attributable to subsistence consumption. The ratio of total subsistence consumption to total consumption expenditure

averages .48 over the entire sample. In light of these characteristics, it is not surprising that food expenditures account for over half of each leone spent, both on the average and at the margin, in even the highest income class. With respect to consumer demand as a whole, although important variations in consumption patterns associated with different income levels were shown to exist, they are not as pronounced as those seen in Latin American and Asian countries. The rural economy of Sierra Leone, then, is an economy based on subsistence consumption which, due to the relatively equal income distribution, cannot be characterized as having a sharply defined class structure.

Of particular interest among the total expenditure elasticities estimated in this study are those for small-scale industry products. Hymer and Resnick [1969] have hypothesized that the income elasticity for these goods is negative, or at most, near zero. The results of this study indicate, however, that the products of small-scale firms are not inferior goods[1] and that, while their elasticity is generally lower than that for similar goods produced by large-scale firms, there is potential on the demand side for growth in the small-scale industry sector.

The factor intensity of consumer demand at differing levels of income was calculated to determine the effect

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[1]The results, however, cannot be considered to be statistically significant.

consumption patterns have in labor, capital, and foreign exchange requirements. It has been widely hypothesized that foreign exchange requirements and the capital intensity of consumer demand increase as incomes rise, while the labor intensity declines with rising incomes. The results of this study support this hypothesis, though not as strongly as do results of studies in Pakistan [Soligo, 1973] and Turkey [Sunman, 1974]. Again, the uniformity of income distribution in rural Sierra Leone appears to be a factor which reduces variation in consumption behavior among income classes.

The factor intensity figures were corrected for the presence of imported goods in order to test the effects on capital and labor requirements of a policy of import substitution focusing on the development of urban-based large-scale industries. This experimental correction leads to the interesting result that such a policy can be expected to have little effect on employment but will greatly increase capital requirements. In light of the fact that capital tends to be the scarce factor of production in Sierra Leone, while unemployment is a serious problem, a policy of developing domestic industries which are more labor intensive and less dependent on the use of expensive capital (often imported) is clearly indicated.

Analysis of the consumption patterns for commodities grouped by origin indicates relatively small variations across the range of incomes for both average and marginal

expenditures. At all income levels, market interaction between rural consumers and the urban-based industrial sector of the economy is not great. This indicates that consumption-based linkages between rural and urban areas are not well developed and that an increase in rural incomes may have only minor growth and employment effects in large urban centers. In contrast to the situation Mellor [1976] describes in India, rural consumer demand is not at present a major integrative force in the Sierra Leonian economy.

The methodology developed in this study is based on the premise that data collection, data analysis, and the application of research results to theoretical and empirical problems are interrelated processes. The survey design and statistical estimation procedures were developed to facilitate the testing of particular hypotheses concerning consumer behavior. Specific features of this methodology include the use of an integrated sampling procedure, whereby the households comprising the consumption survey sample were drawn from the larger sample of an ongoing household production survey to permit the estimation of subsistence consumption, and the inclusion in the set of data collected of information on the origin of purchased commodities to facilitate the classification of commodities for the analysis of the factor intensity of consumption.

Both the particular objectives of this study and certain statistical problems common to any study of low

income households for which subsistence consumption is an important component of total consumption expenditure were factors in the choice of the statistical model used to estimate total expenditure elasticities and marginal propensities to consume. Two models, one based on the log-log inverse function and the other derived from the ratio semi-log inverse function, were specified and tested. Both functional forms are flexible in their mathematical characteristics, unlike the more commonly used double log model. Test results indicated that zero observations, which were present in the data due to the high degree of disaggregation of commodity groups and to low income level of many households, became a major problem when the log-log inverse model was used. The substitution of arbitrary, small values for zero observations to permit estimation was shown to introduce considerable bias. In addition, the log-log inverse model failed to meet the criterion that the sum of all marginal propensities to consume computed at a given income level equal unity, making comparisons of consumption patterns among income classes different. The MRSLI model, which was used in this study for the statistical analysis of consumption patterns, does meet the additivity criterion and is not as adversely affected by zero observations.

Of methodological and practical interest are the results concerning the differences between cash and total expenditure elasticities, since data on subsistence

consumption are difficult and expensive to collect. In nearly all cases cash expenditure elasticities were found to be quite similar to elasticities based on total expenditure data, though a mathematical formulation of the relationship between the two sets of elasticities indicates that this similarity cannot be expected to hold for commodities consumed largely out of subsistence consumption. These results indicate, then, that expenditure elasticities for commodities not produced and consumed within households estimated from cash expenditure data may well be adequate for use in projecting commodity demands.

Also of interest from a practical standpoint are the results on the seasonality of consumption patterns. They indicate that for Sierra Leone the pattern of allocation of cash expenditures among rice, other food, and nonfood items in October is representative of that for the entire year and that a number of representative pairs of months can be identified. This information can be of use to those designing short term consumption surveys, though it should be noted that it is only applicable to Sierra Leone.

Among possible research projects that could complement this study, a similar description and analysis of urban consumption patterns is the most important. Information on consumption could then be integrated into a broader analytical framework, such as the Land-Soligo [1971] model or the Mellor [1976] strategy for economic growth. Only in this way can the impact of both rural and urban

consumption patterns on the Sierra Leonian economy be fully analyzed so that policy decisions designed to take advantage of their growth and employment effects can be made.

A potential area for further research on a smaller scale is the more detailed analysis of the imported goods consumed in Sierra Leone combined with a study of possibilities for the development of more labor intensive import substitution industries. Also, further analysis of the demand for the products of large and small-scale industry might be undertaken, perhaps using a procedure involving a logit or probit model to obtain more reliable expenditure elasticity estimates for these goods.

Finally, while the research projects mentioned above are extensions of this particular study, consumption research directed at the testing of hypotheses relevant to the development process also needs to be undertaken in other developing countries. Only when tested in several different contexts can the validity and applicability of concepts upon which development strategies are based be fully assessed.

APPENDICES

APPENDIX 1

QUESTIONNAIRES USED FOR OBTAINING CASH EXPENDITURE DATA FOR THE SIERRA LEONE RURAL CONSUMPTION STUDY

E.A. Number: _____

Locality: _____

Name of Holder: _____

Holder Number: _____

DAILY CONSUMPTION PURCHASES
FORM RER/C-1

Interviewed by: _____

Date: _____

On: THURSDAY

	Item	Description of Item	Wednesday / / 74						Tuesday / / 74					
			Origin	Where Purchased	Quantity	Unit	Total Cost Le	Total Cost Cents	Origin	Where Purchased	Quantity	Unit	Total Cost Le	Total Cost Cents
Food and Drinks	1. Rice	Parboiled												
	2. Rice													
	3. Fish	Dried Bonga												
	4. Fish													
	5. Peppers	/ / / / / /												
	6. Maggi Cubes	/ / / / / /	I						I					
	7. Palm Oil													
	8. Salt													
	9.													
	10.													
	11.													
	12.													
Other Items	1. Kerosene		Freetown						Freetown					
	2. Matches													
	3. Tobacco													
	4. Cigarettes													
	5. Soap													
	6. *													
	7. *													
	8. *													
	9. *													
	10. *													
	11. *													
	12. *													
	13. *													
	14. *													

*Record any other purchases for that day for household items, personal items, services, ceremonial, entertainment, education, etc.

	Item	Description of Item	Monday / / 74						Sunday / / 74					
			Origin	Where Purchased	Quantity	Unit	Total Cost		Origin	Where Purchased	Quantity	Unit	Total Cost	
							Le	Cents					Le	Cents
Food and Drinks	1. Rice	Parboiled												
	2. Rice													
	3. Fish	Dried Bonga												
	4. Fish													
	5. Peppers	/ / / / / /												
	6. Maggi Cubes	/ / / / / /	I						I					
	7. Palm Oil													
	8. Salt													
	9.													
	10.													
	11.													
	12.													
Other Items	1. Kerosene	/ / / / / /	Freetown						Freetown					
	2. Matches													
	3. Tobacco													
	4. Cigarettes													
	5. Soap													
	6. *													
	7. *													
	8. *													
	9. *													
	10. *													
	11. *													
	12. *													
	13. *													
	14. *													

***Record any other purchases for that day for household items, personal items, services, ceremonial, entertainment, education, etc.**

NJALA UNIVERSITY COLLEGE

(University of Sierra Leone)

RURAL EMPLOYMENT RESEARCH PROJECT

Consumption Study

Form RER/C-2

SECTION I: I D E N T I F I C A T I O N

1. Enumeration Area Number _____

2. Chiefdom _____

3. District _____

4. Name of Holder _____

5. Locality _____

6. Holder Number _____

7. Interviewed By _____

8. Date _____ 197__

MONTH OF: _____

SECTION II - PURCHASES OF CONSUMPTION ITEMS FOR THE MONTH OF: _____

(Excluding Food, Drinks, and Tobacco)

Description of Item Purchased (Be Specific) (a)	Origin (b)	Where Purchased (c)	Quantity (Give Unit) (d)	Total Value (e)	
				Le	Cents
Household Items					
1.					
2.					
3.					
4.					
5.					
Personal Items					
1.					
2.					
3.					
4.					
5.					
Services					
1.					
2.					
3.					
4.					
5.					
Ceremonial and Entertainment					
1.					
2.					
3.					
Educational Expenses					
1.					
2.					
3.					
Savings					
1.					
2.					
Other Items Specify					
1.					
2.					

APPENDIX 2

INDEXING PROCEDURE USED TO FILL IN MISSING DATA

APPENDIX 2

INDEXING PROCEDURE USED TO FILL IN MISSING DATA

Where observations on a household's consumption expenditure patterns for a particular month were absent or insufficient,[1] the indexing procedure given below was used to estimate expenditure levels for various commodities. Households that failed to meet the minimum data requirements of three months' data from RER/C1 and three months' data from RER/C2 were dropped from the sample before indexing was performed. At the time of indexing, the data file contained observations on expenditures by each household on each of 112 commodity-origin categories and the number of days in each month for which data from the short reference period questionnaire (RER/C1) were present. Data from RER/C1 and RER/C2 were separate. To lessen computational expense, the 112 commodity-origin categories were grouped into three large categories: rice, other food, and nonfood; and within each of these, the seasonal pattern of expenditure was assumed to be the same for all commodities. Sets of monthly indices for the relevant year[2] were calculated for each large commodity category for each research region for both RER/C1 and RER/C2 data.

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[1]Data for a month were considered insufficient if data from RER/C1 covered less than three days.

[2]May 1974 - April 1975.

The first step in the indexing procedure was to "puff up" the data from RER/C1 so that it represented monthly expenditure levels. If, for example, seven days' expenditures were recorded in September for a household, the sum of observed expenditures for that month for each commodity was multipled by 30/7, while the quantity 30/5 would be used for a household with only five days of observation. By puffing up the data, expenditure totals were given in monthly terms and were comparable for all households. This process was not necessary for RER/C2 data since it was already in monthly form.

Next, the indices for each commodity group were calculated in the following manner. First, the average expenditure on a commodity group for the j^{th} month in the i^{th} region, $\bar{e}_{ij}$, was determined using the formula:

$$\bar{e}_{ij} = \left(\sum_{h=1}^{N_{ij}} e_{hij} \right) / N_{ij} \qquad \text{(A.2.1)}$$

where

e_{hij} = expenditure on the commodity group in question by the h^{th} household in the i^{th} region during the j^{th} month, household h being one for which valid data are present

N_{ij} = is the number of households in region i for which valid data is present for month j.

Monthly average expenditures were then summed over the year as in equation A.2.2,

$$E_i = \sum_{i=1}^{12} \bar{e}_{ij} \ , \qquad \text{(A.2.2)}$$

to obtain the average annual expenditure on the commodity group in region i, E_i. Monthly indices for the i^{th} region, I_{ij}, were then calculated using equation A.2.3.:

$$I_{ij} = \bar{e}_{ij}/E_i \qquad \text{(A.2.3)}$$

The procedure used constrains the sum of the monthly indices to equal unity.

The determination of the adjusted total expenditure on a particular commodity-origin category by the h^{th} household in region i, T^*_{hi}, for households with missing data was the next step in the process. T^*_{hi} was calculated using equation A.2.4.,

$$T^*_{hi} = \left[1/(1 - \sum_{j=1}^{k} I_{ij}) \right] T_{hi} \ , \qquad \text{(A.2.4)}$$

where

T_{hi} = unadjusted total expenditure on the commodity by household h in region i

$\sum_{j=1}^{k} I_{ij}$ = the sum of the indices for the appropriate large commodity group for months with missing or inadequate data.

Finally the estimated value cash expenditure on the commodity in question for missing month m by household h in region i, t^*_{him}, was calculated using equation A.2.5.:

$$t^*_{him} = T^*_{hi} I_{im} \ . \qquad \text{(A.2.5)}$$

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