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RURAL EMPLOYMENT IN TROPICAL AFRICA:
SUMMARY OF FINDINGS

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FOREWORD

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

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

Carl K. Eicher
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PREFACE

This report summarizes the results of the research project, "Rural Employment in Tropical Africa: A Network Approach," financed through USAID Contract AID/csd 3625. This research was initiated in 1972 by a network of scholars from Africa and Michigan State University to further research on rural labor utilization and to evaluate and formulate policies for promoting rural employment in tropical Africa. The research has utilized a network which has enabled scholars to undertake comparative studies in African countries at different stages of development and factor endowments and hence provide more general policy conclusions.

The network operated through annual meetings of principle researchers to jointly design research methodology and discuss results. The network also maintained a collection of documents on employment at Michigan State University which were sent to researchers on request. Finally, results of individual studies were reported in African Rural Employment/Economy Papers disseminated to researchers and policy makers interested in the employment question. Much of the information contained in this report was extracted from more detailed discussion of these topics reported in the African Rural Employment/Economy Papers. A list of these papers is provided at the end of this report.

Sierra Leone has been the focus for this study. An integrated set of nationwide surveys was conducted in Sierra Leone under the leadership of Dunstan S.C. Spencer of Njala University College. In addition, studies of specific aspects of employment have been carried out in Nigeria under the leadership of Professor S.O. Olayide and his University of Ibadan colleagues, Drs. F.S. Idachaba, S.Essang and O. Ogunfowora. Micro-level research has also been conducted in Ghana by Fred Winch and in the

Ada district of Ethiopia through the Institute of Development Research at Addis Ababa University under the leadership of Dr. Assefa Mehretu. For purposes of comparative analysis we have drawn upon research reported elsewhere in Africa, particularly the extensive studies of employment in Kenya.

1. INTRODUCTION

1.1 Problem Setting

The economic development performance as measured by growth rates has been disappointing in many African countries during the past decade and at the same time unemployment has emerged as a major national problem in nearly all African countries. During the late 1960s, it was becoming increasingly apparent that urban unemployment rates were as high as 20 percent in most urban areas, and recent evidence indicates that for the 15 to 24 age group, rates of unemployment are over 30 percent.

Both supply and demand factors have contributed to the emergence of the urban unemployment problem. On the one hand, demand for labor in the "modern" urban sector has stagnated or increased very slowly, primarily due to adoption of capital intensive technologies. Meanwhile, the supply of labor in urban areas has increased rapidly, partly because of high rates of natural population growth and largely because of migration from rural areas.

There is now a consensus that effective policies to deal with the urban unemployment problem must center on rural areas to reduce rural-urban migration and hence urban labor supply. This conclusion is underscored by considerable doubts that increasing the demand for labor in urban areas will, in fact, reduce urban unemployment [Harris and Todaro, 1970].

Although the unemployment problem was originally narrowly perceived as an urban problem of open unemployment, the scope of the problem has been considerably broadened in recent years to include at least three dimensions of the problem. First, there is an efficiency dimension associated with the belief that in many countries capital intensive development strategies

are inefficient because they underutilize labor -- the abundant and cheap resource. If labor is underutilized in urban and/or rural areas, there is potential for promoting growth at relatively low cost through fuller employment of this resource. The second dimension of the employment problem is the relationship between employment and equity. Since low income groups lack access to physical capital, education, etc., and depend largely on labor resources, any policy which promotes employment will improve income distribution, particularly among low income workers. Finally, employment has a socio-political dimension associated with high rates of open urban unemployment in tropical Africa which is widely perceived by policy makers as a major social and political problem.

Although employment has emerged as an important objective of development strategies, it cannot be separated from other objectives for analytical purposes. In particular, the design and evaluation of development strategies must consider the relationship between growth and employment. A major hypothesis of this study is that there need not be trade-offs between the growth and employment objectives, and development strategies can be designed which promote both rapid growth and increased employment. To date, neither the analytical framework nor empirical base has been adequate for a comprehensive testing of this hypothesis in tropical Africa. The present study is designed to provide an improved analytical and empirical foundation for evaluating output and employment effects of alternative policies in order to develop effective policies to promote rural output and employment in selected African countries.

1.2 Objectives of the Research

The general objectives of this research are to provide empirical information on employment and unemployment in rural Africa and how to use this

information to analyze the impact of alternative policies and development strategies on output and employment in rural Africa.

The specific objectives of the research are to:[1]

1. Provide detailed information on labor utilization, labor allocation, and labor productivity of rural households in selected African countries.

2. Analyze the consumer demand patterns of rural households in order to identify labor intensive commodities with favorable demand outlooks.

3. Analyze the demand for labor under different production technologies and systems and, in particular, assess the potential for labor-capital substitution in the following sectors of selected African countries:
   a. Agriculture
   b. Agriculture processing
   c. Small scale industry (both rural and urban)

4. Provide a detailed description of rural-urban migrants and the migration process and analyze the causes and implications of rural-urban migration.

5. On the basis of objectives 3 and 4, identify specific policies and programs which will lead to increased output and employment in agriculture, small scale industries, and agricultural processing and which will slow the rate of migration to urban areas.

6. Conduct an aggregate analysis in one African country (Sierra Leone) of the rural economy to evaluate macro-economic implications of selected policies on output and employment.

7. On the basis of objectives 5 and 6, provide general policy guidelines to selected African countries for dealing with the employment problem.

1.3 Conceptual Framework for the Study

The rural labor market broadly defined to include both self-employed labor in rural household firms and hired labor was taken as the basic unit of study. Conventionally, we can attribute changes in the rural labor market, reflected by changes in total employment and/or labor remuneration to changes on either the demand side or supply side of the market. The analysis of rural employment

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[1] Adapted from pages S-2 and S-3 of Contract AID/csd 3625. A further objective of the Contract discussed in the preface was to foster the development of a network of African and American researchers to jointly design and carry out the research in selected African countries.

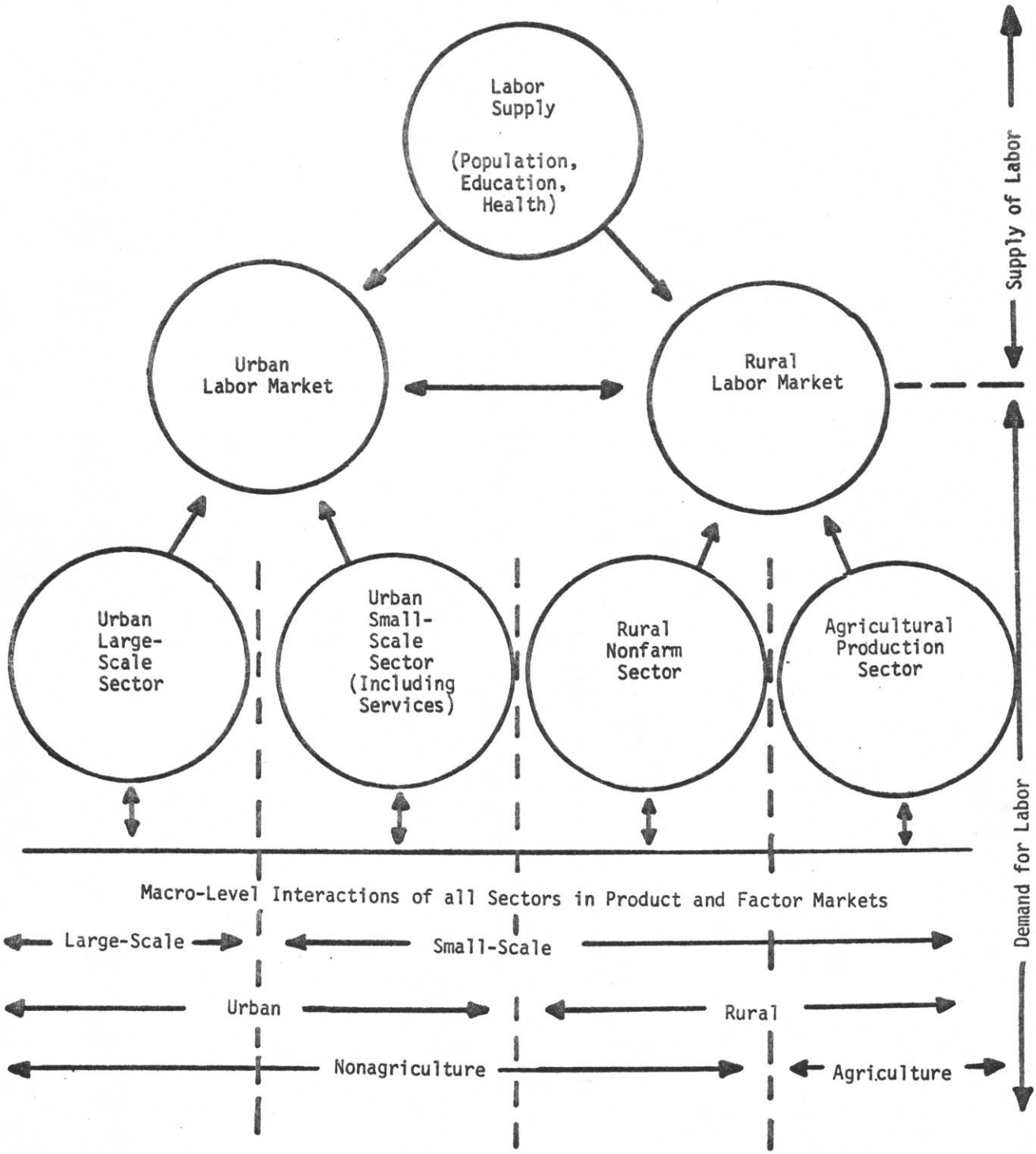
is therefore divided into factors affecting the demand for labor and factors affecting the supply of labor (Figure 1.1).

1.3.1. The Demand for Labor

The bulk of this study focuses on the demand for labor in rural areas. In analyzing the demand for labor we have made an important sectoral disaggregation of the economy on the basis of (a) commodity, (b) firm size, and (c) location [Byerlee and Eicher, 1974]. With respect to commodity, we distinguish broadly between agricultural and nonagricultural sectors where an important factor is the dependence of agriculture on ecological and biological factors which determine seasonal demands for labor. Firm size is used to delineate small-scale firms using largely family labor as opposed to large-scale firms using hired labor. This latter group of firms is sometimes referred to as the formal or modern sector. Finally, rural-urban location is clearly important when rural-urban migration and urban unemployment are of interest.

Using these three criteria we distinguish at least four sectors of the economy: (a) small-scale agriculture, (b) small-scale rural nonfarm, (c) small-scale urban, and (d) large-scale urban (see Figure 1.1). In some cases, it may be necessary to add other sectors, such as large-scale plantation agriculture, which are important in some countries such as Kenya. Furthermore, in this study, we further subdivide the small-scale nonfarm sectors into: (a) agricultural processing, (b) small-scale manufacturing, and (c) small-scale trading. Agricultural processing is distinguished on the demand side by the fact that it is directly dependent on agricultural output while demand for the outputs of small-scale manufacturing and trading is primarily income induced [Gibb, 1971]. Finally, choice of technique questions are relatively less important in small-scale trading and consequently the analysis in this study gives more attention

FIGURE 1.1



SOURCE: Byerlee and Eicher [1974].

to agricultural processing and small-scale manufacturing.

Within the above framework, the demand for labor is determined by (a) the type of commodity produced since some products particularly in agriculture are produced by more labor intensive methods, and (b) the production technique, whether labor intensive or capital intensive, used to produce a given commodity. A major factor determining the relative growth of commodities with differing labor intensity are consumer demand patterns. For example, an important issue in promoting rural small-scale industries which are labor intensive is whether there exists a long run demand for products of these industries. Some important theoretical models have been proposed which assert that products of these industries have a negative income elasticity [Hymer and Resnick, 1969].

The choice of technique in producing a given commodity is clearly an important consideration. In analysis of employment, labor intensive, as opposed to capital intensive, techniques of production by definition use more labor and less capital per unit of output. However, two important qualifications are necessary in defining labor intensity in rural areas. First, labor demand is seasonally determined. Thus, technology may be labor-saving with respect to peak season labor demands and labor-using for slack season labor. Second, much investment in agriculture, such as land improvement, is a product of labor and hence may be quite labor intensive. Thus, in measuring capital-labor ratios it is important to distinguish "imported" capital from capital generated by labor in rural areas.

In summary, analysis of the demand for labor in rural areas requires at least two types of micro-level studies. First, the possibility of substitution between different industries requires a knowledge of consumer expenditure patterns to identify those relatively labor intensive industries that have a favorable demand pattern. Second, an examination of the range of technologies

in agriculture, agricultural processing, and small-scale industry is necessary to determine the demand for labor under each technology and the effects of policies, particularly those affecting factor prices, on the choice of technology in those industries.

1.3.2. The Supply of Labor

On the supply side of the labor market, total labor supply is determined by (a) population growth rate, (b) population distribution as determined by migration, and (c) the labor inputs of rural people, particularly as it is affected by wage rates, sex, health, etc. Because this study assumes a medium term planning horizon of five to ten years, we have not dealt with population growth, although it is recognized that in the long term, policies to reduce population growth rates are important in an employment oriented development strategy. On the other hand, migration may have considerable short run impacts on labor supply which are amenable to policy manipulation and hence the analysis of the extent and determinants of both rural-rural and rural-urban migration is an integral part of this study. Finally, we examine how factors such as age and sex affect the total labor inputs of rural people, although we do not formally derive a labor supply curve relating work effort to wage rates.

1.3.3. Macro-Level Analysis

The foregoing discussion suggests the need for several types of micro-level studies in rural consumption, specific rural industries and migration to better evaluate the effects of alternative policies on rural employment. However, the importance of linkages between rural sectors and between rural and urban sectors in product and factor markets requires macro-level evaluation of agricultural and rural development policies for

all sectors of the economy.

Several types of intersectoral linkages are important. Linkages in the labor market are clearly important to the analysis of rural employment. These include labor allocation between the farm and the rural nonfarm sector and labor allocation between the rural regions and rural and urban sectors through migration. In the product market, the backward and forward linkages of agriculture have potentially important employment effects. For example, a capital intensive agricultural strategy emphasizing mechanization may have few backward employment linkages since mechanical equipment is often imported or produced in large-scale manufacturing. Finally, consumer expenditure patterns of rural people have potentially large employment implications. It is widely hypothesized that high income rural households have a higher propensity to consume urban products and imported goods which are capital and foreign exchange intensive. The effect of policies on rural incomes may, through consumer expenditures, be an important determinant of rural employment.

1.4. Analytical and Policy Issues

Within the above conceptual framework, we can distinguish several key analytical issues which must be addressed by the research. The dominant issue underlying much of the research is the potential trade-offs between increased growth and employment. In our research, this broad issue is broken down into several components.

First, focusing on the product market, it is necessary to analyze the demand for commodities to determine if commodities with rapid increases in demand can be produced by labor intensive technologies. If these technologies are also more efficient users of scarce resources, such as capital and foreign exchange, then consumer demand patterns will be consistent

with both increased output and employment. A related issue noted above is the extent to which a more equitable income distribution may increase the demand for more labor intensive commodities.

The second set of issues relates to the operation of the factor markets and to what extent changes in factor prices may lead to capital-labor substitution in specific sectors. In particular, it is necessary to isolate where and why factor price distortions occur. Although factor price distortions have been widely cited as contributing to the employment problem, it is usually assumed that these factor prices apply across the whole economy. In practice, African economies are not well integrated and factor markets are fragmented. For example, minimum wages and subsidized interest rates which prevail in the modern urban industrial sector are usually not effective in the rural sectors.

Factor price distortions are only relevant to the choice of technique question so long as it can be demonstrated that various technologies of different capital-labor ratios are available and that the choice among these technologies is sensitive to changes in factor prices. Again, if these conditions hold and labor intensive technologies are also more efficient users of capital, there should be little trade-off between the growth and employment objectives.

Finally, we need to examine the labor market in terms of its efficiency in allocating labor between sectors. One important question relates to farm-nonfarm allocation of labor within the rural sectors. For example, are nonfarm activities available to use surplus labor in the agricultural slack season? Furthermore, to what extent is migration leading to efficient allocation of labor between rural and urban sectors? An important theoretical contribution by Harris and Todaro [1970] would

suggest that high urban wages are inducing high rates of migration and thereby reducing total national output. However, there are few empirical tests of this migration model.

The policy issues addressed by this study follow from the above analytical issues. Demand for labor intensive commodities may be influenced by policies which change income distribution. Likewise, correction of factor price distortions may lead to adoption of labor intensive technologies if choice of technique is shown to be sensitive to factor prices. On the other hand, if choice of technique is not sensitive to factor prices, there are important policy implications for further research to develop such technologies. Finally, more efficient allocation of labor may be fostered by policies to reduce migration, such as urban wage policy.

The emphasis in this study is on the short and medium term planning horizon of five to ten years. This leads to a focus on the demand side of the labor market where policies such as changing factor prices, investment priorities, etc., are feasible within this time horizon. It is recognized that policies to influence the supply side of the labor market, such as population control and changed educational priorities, are important in a longer run planning horizon.

1.5. Integrated Methodology for Data Collection

Since reliable survey and census data on farm and rural nonfarm production, rural consumption, and migration are not available in most tropical African countries, a substantial investment was made in the collection of primary data for this study. Sample surveys were undertaken in Nigeria, Ethiopia, and Sierra Leone.

The methodology employed in each component of the research is discussed in more detail in the respective chapters of this report. However,

three common threads underlie the methodology. First, the research is based on micro-level surveys specifically designed to obtain the necessary information on labor supply and demand. Furthermore, because labor is a continuous input and labor inputs are seasonally determined in rural areas, most of the surveys are based on multiple visits to selected households or firms to obtain a continuous record of labor inputs over a twelve month period. This methodology was most extensively applied in Sierra Leone where a nationwide sample of rural households and urban small industrial firms were visited twice weekly for a twelve month period. A second unique aspect of the methodology is the integration of data collection using the household as the basic unit of study for different components of the study. For example, data on farm production, small-scale industries, agricultural processing, and migration were all collected from the same sample of rural households. Finally, the comparative approach was used in the research. Because factors, such as resource endowments, ecological regions, institutions, and macro-economic policies vary from country to country and often within a country, more general conclusions can be reached by assembling data from research in a number of countries.

Nationwide sample surveys were conducted in Sierra Leone to obtain data for all components of the research. Some 500 rural households, 120 fishing households, and 200 urban small-scale industries were interviewed twice weekly over a 12 month period during the 1974/1975 cropping season. The research in Nigeria was restricted to a sample of 200 households in one state--Kwara State--again interviewed over one cropping season. In Ethiopia, the research was undertaken in the Ada district where an integrated rural development program was launched by the Government of Ethiopia. A total of 110 households in 5 villages were continuously interviewed over

the 1975/1976 cropping year. Data from the Ethiopian study are now being analyzed and will be reported in a later publication.

1.6. Outline of the Report

The structure of this report closely follows the conceptual framework discussed above. First, we present a descriptive analysis of rural labor utilization to identify the extent and nature of employment and underemployment in rural areas, the distribution of labor between farm and nonfarm work, the effects of sex and age on labor use, and finally the extent of hired labor use. We then turn to an examination of the implications of consumption patterns for employment in rural areas and provide estimates of the income elasticities of demand for several categories of labor intensive goods.

The next three chapters analyze the demand for labor in three sectors: (a) the agricultural production sector, (b) the agricultural processing sector, and (c) the small-scale industrial sector. In each case, a central focus of the analysis is the choice of production technique, the availability and profitability of labor intensive techniques, and the effect of changing factor prices on choice of technique.

In Chapter 7 the rural and urban labor market and the interactions through migration are examined. Particular attention is given to rural-urban migration and its relationship to rural employment and urban unemployment. The linkages between rural sectors and rural and urban sectors are analyzed in a macro-economic framework in Chapter 8 in order to evaluate the effects of various strategies on rural output, employment, and migration. Finally, Chapter 9 summarizes the results of the research and discusses the policy recommendations.

2. DESCRIPTIVE PROFILE OF RURAL EMPLOYMENT IN AFRICA

2.1. The Rural Population

The vast majority of the people of tropical Africa reside in rural areas. The definition of rural areas, of course, varies from country to country, with official definitions being as low as villages and towns with less than 2,000 persons in Kenya and Sierra Leone up to villages and towns with less than 20,000 persons in Nigeria. In addition to town size, the occupational structure is also useful in defining rural areas. As a working definition, rural areas should have at least half of the population primarily engaged in agriculture. By this definition some quite large towns in Western Nigeria could also be classified as rural. We shall primarily be concerned here with villages with less than 2,000 persons as a definition of the rural population. However, it is recognized that there is a continuum between rural and urban areas and any such demarcation is arbitrary. In fact in several chapters dealing with small scale industry and migration, data are presented for different size localities from small villages to large metropolitan areas in order to examine the influence of town size.

Using this definition of rural areas, 75 to over 90 percent of the population of African countries lives in rural areas [Hance, 1970]. This large rural population is estimated to have a natural growth rate of about 2.6 percent annually as a result of high fertility rates [Richer et al., 1970]. Although there is no evidence yet of a decline in fertility, factors such as urbanization, education, etc., point to the possibility of the beginning of such a decline in the coming decade [Caldwell, 1975]. However the growth in the total labor force will continue for many years even after any decline in population growth rates. At least until the end of this century the total labor force in most African countries will continue to increase by 2.5 to 3.0

percent per annum.

Despite the high proportion of the population in rural areas and the rapid growth of population, land/labor ratios are relatively high compared to other developing regions of the world. This does not necessarily imply a land surplus situation[1] in which additional population simply expands the land cultivated although this is clearly the case in some countries such as Zaire where the population density in high rainfall areas is only about 15 per square mile. However, most agricultural production systems are land extensive. For example the average farm cultivated in Sierra Leone is about seven acres, most of which is upland rice cultivated under a bush fallow system with a rotation cycle of about ten years. As population growth continues in these land extensive farming systems, declining soil fertility and adoption of more land intensive systems have important implications for labor use and productivity.

2.2 Aggregate Rural Labor Utilization

Conventional measures of labor utilization, such as labor force participation and unemployment rates, are not applicable to rural Africa where most of the population is self-employed in producing largely for home consumption. Almost all the adult rural population participates in the labor force at some time of the year. Likewise, a negligible proportion of the labor force is unemployed and seeking work. A more useful measure of rural employment is the actual hours worked by rural people. This measure is used in this report because it can be analyzed for different seasons, sexes, and regions and it can provide a measure of aggregate rural labor utilization or underutilization.

There are definitional problems in comparing estimates of labor use per person in Africa because of the use of different survey techniques. For example,

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1 Helleinger points out the pitfalls in generalizing about land and labor surplus conditions because of the variation in factor endowments within and between African countries [Helleiner, 1975].

some surveys may exclude time spent in nonfarm work or time spent walking to fields. Most surveys exclude domestic duties such as cooking, house cleaning, and child rearing which are usually performed by the women. In addition, labor use depends on a host of other factors relating to the individual, such as age and sex, and factors relating to the region or village, such as climate, location, economic returns, and cultural factors.

Within these limitations surveys do show that farmers in tropical Africa have a low labor input by international standards. Cleave [1974] in a review of 30 studies in tropical Africa notes that about 1,000 hours per year are spent by adults on agricultural field operations. In Sierra Leone our nationwide rural survey in 1973/1974 revealed that the average labor input for adults is about 1,200 hours per year; but this includes agricultural processing and nonfarm work in addition to agricultural field operations. In contrast, Hansen [1969] reports that in Egypt male adults work 2,280 hours per year and Cleave [1974] suggests that in parts of Asia this figure is as high as 3,000 hours per year. Moreover, in Sierra Leone, where more land intensive farming systems using improved biological technologies and water control have been introduced, labor inputs are as high as 2,000 hours per year.

Labor input depends on the age and sex of individuals. Most studies, including our Sierra Leone survey, show that children under 10 years of age are relatively unimportant as a source of labor. Children from 10 to 15 years of age in Sierra Leone were an important source of labor but still worked less hours than adults.

The relative contribution of females to total labor inputs is less clear. In Sierra Leone women worked about 900 hours per year compared to men who worked an average of 1,450 hours per year. However, the Sierra Leone survey excluded the domestic duties of women such as cooking. Since studies in other areas

indicate that these duties may account for up to two hours per day [Cleave, 1974], the total labor inputs of women are probably slightly higher than for men.

Part of the reason for these differences in labor inputs is the sex and age specific nature of many tasks. In Sierra Leone, bird scaring activities are typically performed by children. Likewise, Spencer [1976] shows that women are important sources of labor for traditional crops, particularly upland rice and groundnuts; but men are more important for export crops. Moreover, for any given crop, certain tasks may be sex specific. For example, clearing bush is usually the work of men while women are more important for weeding upland rice in Sierra Leone.

The most important single factor determining labor use is climate which regulates the seasonal nature of agricultural operations. One measure of seasonal variation is the coefficient of variation of monthly labor inputs around the mean monthly labor input for the year. As expected, this variation reflects to a large extent rainfall variability. Figures for Sierra Leone (Tables 2.1 and 2.2) show that in the wetter southern and eastern regions (regions 2, 4, 6, and 8) the coefficient of variation for male labor inputs is usually less than 0.25 while in the dryer northern region (regions 1, 3, 5, and 7) the coefficient is usually above 0.50. However, within regions, there are important differences depending on the type of cropping system. For example, for fishing households and vegetable farms using hand watering in the Scarcies region of the north, the coefficient of variation is low, but upland rice farmers in the same regions have a high variation. In general, households with tree crops such as oil palm, coffee, and cocoa, and improved farming systems have a lower variation in labor input. In northern Nigeria the coefficient of variation computed from Norman's [1973] data is 0.56, reflecting the fact that in this region there is a pro-

TABLE 2.1
HOURS WORKED PER MALE ADULT PER MONTH BY SEASON
AND FARM TYPE IN SIERRA LEONE, 1974/75

Region and Farming System	Average Labor Input[a] Hours/Month	Peak Month			Slack Season			Coefficient of Variation[b]
		Labor Input Hours/Month	Percent Change	Month	Labor Input Hours/Month	Percent Change	Month	
11. Upl. Rice	97	183	89	Oct.	24	-75	Dec.	60.4
12. Vegs./Rice	134	168	26	Jan.	86	-36	May	18.6
13. Vegs./Fishing	96	130	35	Feb.	62	-36	May	21.7
Scarcies region	108	170	61		49	-56		41.1
21. Upl. Rice	120	151	26	Sept.	91	-24	May	16.6
22. Rice/Oil Palm	120	135	25	June	97	-20	Feb.	11.6
23. Upl./Mang Rice	134	171	28	Aug.	79	-41	May	24.9
Southern Coast	123	149	21		91	-26		16.3
31. Upl./Inl. Rice	105	200	90	May	23	-78	April	66.1
32. Oil Palm	157	291	85	Aug.	96	-39	June	42.7
33. Inp. Inl. Rice	126	210	67	July	39	-69	Feb.	51.6
34. Upl. Rice	150	241	61	Sept.	60	-60	Dec.	48.2
Northern Plains	137	231	70		51	-64		52.0
41. Mech. Riv. Rice	74	110	49	June	56	-24	Feb.	22.8
42. Upl. Rice	93	128	38	July	66	-29	Jan.	18.8
43. Hand Riv.	122	189	55	March	44	-64	July	39.2
44. Oil Palm	154	204	32	Nov.	85	-45	Feb.	24.0
Riverain Grass.	94	133	41		63	-32		21.6
51. Upl. Rice/Grs.	101	154	52	Oct.	49	-59	Feb.	29.6
52. Mixed Boli	115	218	108	Aug.	22	-78	April	54.1
53. Mech. Boli	124	203	78	Sept.	23	-81	March	54.9
54. Hand Boli	140	224	65	Aug.	51	-61	April	
55. Inl. Rice/Grs.	95	137	43	July	23	-66	Oct.	45.2
Bolilands	108	187	66		37	-67		44.9
61. Up. Rice/Coffee-Cocoa	83	103	24	July	63	-24	Dec.	
62. Rice/Others	115	162	41	Sept.	78	-32	Dec.	23.9
Moa Basin	92	119	28		69	-26		23.9
71. Upl. Rice/Others	94	139	48	June	55	-41	Jan.	31.3
72. Upl./Inl. Rice	200	271	36	Aug.	107	-45	Feb.	26.3
73. Rice/Oil Palm	164	239	46	Sept.	87	-46	Feb.	29.7
74. Upl. Rice	n.a.							
North. Plateau	152	216	44		83	-44		29.2
81. Upl./Inl. Rice	118	156	32	Aug.	85	-28	Dec.	17.1
82. Upl. Rice/Coffee	114	218	91	May	62	-46	Dec.	36.3
Southern Plains	117	179	49		77	-33		24.1
Sierra Leone	121	188	55		70	-42		31.7

SOURCE: Spencer and Byerlee [1976].

[a]Average for twelve months from May 1974 to April 1975.

[b]Coefficient of variation computed as standard deviation of monthly labor inputs divided by mean monthly labor input.

TABLE 2.2
HOURS WORKED PER FEMALE ADULT PER MONTH
BY SEASON AND FARM TYPE IN SIERRA LEONE, 1974/75

Region and Farming System	Average Labor Input[a] Hours/Month	Peak Month			Slack Season			Coefficient of Variation[b]
		Labor Input Hours/Month	Percent Change	Month	Labor Input Hours/Month	Percent Change	Month	
11. Upl. Rice	62	139	124	Aug.	20	-68	April	68.2
12. Vegs./Rice	65	80	23	Feb.	45	-31	June	16.8
13. Vegs./Fishing	48	63	31	March	36	-25	Oct.	18.2
Scarcies Region	60	108	77		31	-49		44.0
21. Upl. Rice	80	119	49	Sept.	41	-49	Feb.	32.4
22. Rice/Oil Palm	81	109	34	Nov.	62	-23	Jan.	15.6
23. Upl./Mang Rice	117	163	36	Aug.	38	-68	April	33.6
Southern Coast	88	124	40		49	-42		25.9
31. Upl./Inl. Rice	48	95	98	June	9	-82	April	68.7
32. Oil Palm	147	312	112	May	33	-79	Jan.	62.5
33. Imp. Inl. Rice	36	70	94	May	12	-76	March	54.3
34. Upl. Rice	103	170	65	Sept.	12	-82	March	56.5
Northern Plains	83	147	80		13	-80		60.0
41. Mech. Riv. Rice	46	57	24	June	15	-67	March	37.4
42. Upl. Rice	63	110	74	July	19	-60	Feb.	48.3
43. Hand Riv.	84	149	79	April	41	-50	Feb.	38.5
44. Oil Palm	69	140	101	May	35	-50	Sept.	52.5
Riverain Grass.	61	103	65		21	-60		45.4
51. Upl. Rice/Grs.	68	104	53	Oct.	27	-60	Feb.	36.6
52. Mixed Boli	86	120	124	Aug.	14	-72	May	53.9
53. Mech. Boli	97	163	121	Aug.	22	-74	April	
54. Hand Boli	64	115	150	Aug.	18	-69	April	
55. Inl. Rice/Grs.	53	84	58	July	18	-66	Oct.	42.0
Bolilands	72	119	84		19	-66		46.0
61. Up. Rice/Coffee-Cocoa	70	123	76	Aug.	27	-62	March	
62. Rice/Others	68	106	56	Sept.	38	-44	March	38.5
Moa Basin	69	118	71		30	-57		38.5
71. Upl. Rice/Others	53	93	75	July	24	-54	Jan.	50.2
72. Upl./Inl. Rice	112	152	36	Sept.	63	-44	April	31.0
73. Rice/Oil Palm	95	143	51	Oct.	33	-65	May	39.2
74. Upl. Rice	n.a.							
North. Plateau	86	126	54		38	-55		39.3
81. Upl. Rice	77	109	41	Aug.	39	-49	Feb.	32.4
82. Upl. Rice/Coffee	65	105	61	May	35	-46	March	35.8
Southern Plains	74	108	47		38	-48		33.7
Sierra Leone	76	122	60		40	-53		36.2

SOURCE: Spencer and Byerlee [1976].

[a]Average for twelve months from May 1974 to April 1975.

[b]Coefficient of variation computed as standard deviation of monthly labor inputs divided by mean monthly labor input.

longed dry season. Finally, in Kenya, similar wide variation exists between regions largely as a result of climatic factors with the dryest regions having coefficients of variation above 1.0.

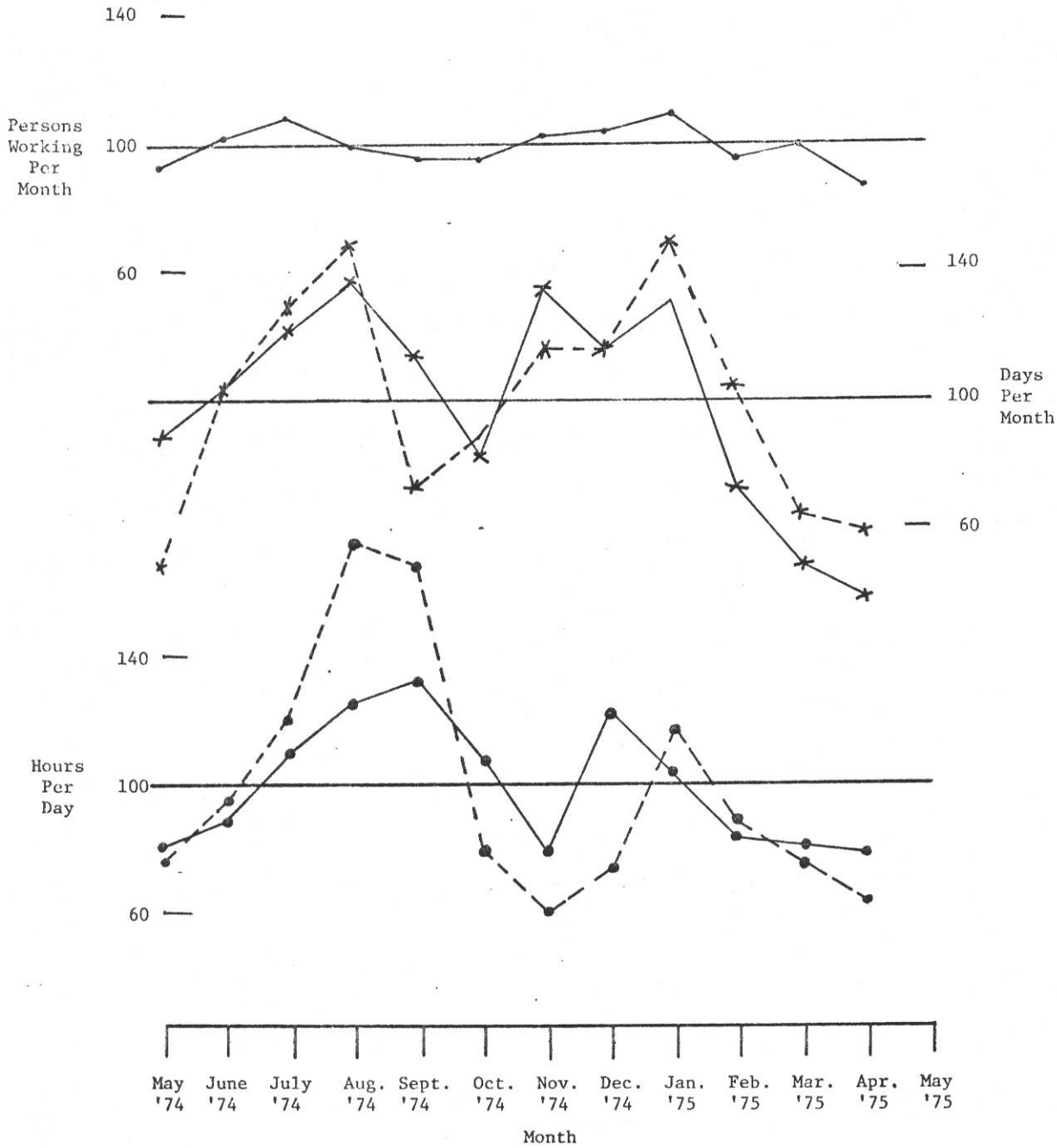
A further observation from our Sierra Leone survey is that female labor use in nearly all cases has a higher coefficient of variation than male labor (Table 2.2). At peak seasons females increase their labor supply relatively more than males to overcome peak season labor constraints.

There is now overwhelming evidence that labor is a binding constraint at the peak agricultural seasons. In Sierra Leone, labor inputs of men in the peak season average more than 180 hours, i.e. 40 hours per week on three-fourths of all farm types and rose above 200 hours per month for about half of all farming types (Table 2.1). For females, labor inputs exceed 120 hours per month (Table 2.2) at the peak season on about half of all farms - - a substantial input considering women perform other duties, such as cooking, which cannot be easily reduced even at the peak season. These figures are somewhat higher than Cleave [1974] reports for other African surveys indicating that farmers work harder at the peak season in Sierra Leone.

Further evidence of the peak season labor constraint is obtained for a survey in one area of Sierra Leone where mechanical cultivation is practiced. Figure 2.1 shows that both the number of hours worked per day and the numbers of days worked per month increased during the peak months. In the peak month of August when planting takes place, male adults worked an average 8.4 hours per day for 28 days of the month. Female labor inputs are lower but their relative increase at the peak season is greater. Moreover, the number of people working increased in the peak season through the participation of older people and short-term visitors who were presumably in response to seasonal labor constraints - - concentrated at the peak season. In the peak month of August,

Figure 2.1

SEASONAL INDICES OF HOURS WORKED PER DAY, DAYS WORKED PER MONTH AND PERSONS WORKING PER MONTH IN BOLILAND AREA OF SIERRA LEONE



INDEX: Persons Working Per Month: 100 = 4.6
Hours Per Day: Male - 100 = 6.7; Female - 100 = 3.3
Days Per Month: Male - 100 = 20.8; Female - 100 = 14.4

Figure 2.1 shows that the number of persons working increased by 8 percent compared to the average number working over the year.

There is also a well defined slack season in labor use in tropical Africa. This slack season coincides with the dry season after the harvest of annual crops. As a result, the slack season is usually longer in the drier Savannah areas. Although labor inputs are low in the slack season, they are by no means zero. In Sierra Leone, labor inputs in the slackest month averaged 70 hours per month for males and 40 hours per month for females (Tables 2.1 and 2.2).

2.3 Hired Labor

Farmers in tropical Africa, with the exception of large farmers and plantations, generally use less hired labor than in other areas of the world. In large part, this reflects the existence of a generally high land/labor ratio and the lack of a class of landless laborers or even of substantial differences in farm size among farmers except in countries such as Kenya and Ethiopia. At peak seasons, therefore, when labor could be hired to release seasonal bottlenecks, most farmers in a region will be experiencing similar labor bottlenecks.

Surveys do show that the percentage of labor hired is below 20 percent [Norman, 1973; Spencer and Byerlee, 1976] although it is sometimes higher for larger or cash crop oriented farmers [Cleave, 1974]. Furthermore, a major proportion of this labor is probably reciprocal labor or communal labor whereby farmers exchange labor or work in groups to perform certain tasks. In northern Nigeria, Norman [1973] notes that the proportion of nonfamily labor does not vary significantly over the year, again reflecting the fact that hired labor is not generally an important factor in releasing seasonal labor bottlenecks.

2.4 Rural Non-Farm Employment

Nonfarm activities provide an important source of employment in rural areas of tropical Africa. The available data indicates that a significant percentage of the rural labor force undertakes nonfarm activities as a primary activity. In Sierra Leone, approximately 19 percent of the males in the rural villages stated that their primary occupations were in the rural nonfarm sector (see Table 2.3).[1] Similar results have been reported in the I.L.O. [1970, p. 117] survey of three rural districts in Western Nigeria, where 18.6 percent of the males in these rural villages were primarily engaged in nonfarm activities. Finally, a study undertaken in four villages in rural Uganda revealed that 20 percent of the employed males were primarily engaged in nonfarm activities [Brand, Schubert, and Gerken, 1976, p. 2].

If one includes farmers who engaged in nonfarm activities on a part-time basis, however, the magnitude of these activities becomes even more striking. In Western Nigeria approximately 20 percent of the male members of farm households undertook nonfarm work as a secondary occupation. Approximately 39 percent of the employed males in the rural villages of Western Nigeria were engaged either primarily or part-time in nonfarm activities. The secondary nonfarm employment in the rural villages in Sierra Leone, on the other hand, was somewhat smaller as only 11 percent of the farmers were engaged in nonfarm activities as a secondary occupation. Consequently, in Sierra Leone, 30 percent of the male rural population worked part-time in rural nonfarm activities. Finally, Luning [1967], in a survey of rural villages in Northern Nigeria, reports that 48 percent of the employed males had either primary or secondary occupations in the rural nonfarm sector. These data thus indicate that nonfarm activity in the rural areas provides a source of primary or secondary employment for

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1 Occupational distributions reported here are as stated in response to questions as, "What is your most important work.....?.

TABLE 2.3
SIERRA LEONE: DISTRIBUTION OF PRIMARY EMPLOYMENT[a] OF MALES BY INDUSTRY GROUP IN RURAL VILLAGES,[b] 1974/1975

Industry Group	Percentage Employed
Agriculture, livestock, fishing	80.8
Manufacturing	7.6
Construction	0.3
Commerce	6.8
Government services	2.9
Other services	1.6
Total	100.0

SOURCE: Sierra Leone migration survey.

[a]Employment is defined to include those who are ten years of age and over and who were not in school and who were not primarily engaged in domestic activities.

[b]Rural villages are defined to include those localities with fewer than 2,000 inhabitants.

30 to 50 percent of the rural male labor force in tropical Africa.

The occupational distribution of the population reveals the uniformity of nonfarm activities in West African countries. However, another measure of the contribution of nonfarm activities -- the proportion of labor time devoted to nonfarm activities -- suggests considerable variability in the region. Norman [1973] reports that in the north of Nigeria, 47 percent of male labor time is devoted to nonfarm activities. In contrast, our 1974/1975 survey in Sierra Leone indicates that only about 11 percent of male labor time in rural households is devoted to nonfarm activities.[1] Part of the reason for the regional difference may be the longer dry season in Northern Nigeria which restricts farming activities and also a high labor/land ratio which lowers farm labor productivity. Furthermore, in Sierra Leone, during 1974/1975, there was a sharp increase in rice prices which encouraged a shift from nonfarm to farm activities.

There are a wide range of economic activities that fall within the rural nonfarm sector. The most important activities in tropical Africa, however, are trading and manufacturing; indeed, together they generally account for over 70 percent of the employment in the rural nonfarm sector. Government, transportation, construction, and service activities are generally of lesser importance.[2]

The data from our survey of Sierra Leone villages, for example, supports these generalizations. As Table 2.3 reveals, 40 percent of the males in the rural nonfarm sector of Sierra Leone engaged in manufacturing or repair, while 35 percent were in trading and 15 percent were in government activities. Similarly, in rural Western Nigeria [I.L.O., 1970], 48 percent of the rural nonfarm males were engaged in manufacturing and repair while 25 were in trading. Thus,

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1 Includes both farm and nonfarm households.

2 Based on stated primary and secondary occupations and not actual hours worked.

although the balance of employment between nonfarm activities varies from country to country, it would appear that trading and manufacturing predominate.

This static description of the rural occupational structure, however, masks the seasonal variations in the amount of rural nonfarm and farm activity. For example, nonfarm activity may be reduced during the peak farming season to provide a source of farm labor at this critical period. At the same time, nonfarm activity may provide an alternative source of income and rural employment for farmers during the slack season of farming.

The available evidence indicates that there are significant monthly variations in the amount of rural farm and nonfarm employment over the agricultural cycle in tropical Africa. Our Sierra Leone survey, indicates that 19 percent of the male labor hours of farming households are devoted to nonfarm activity during the slack agricultural month, while only 2.0 percent is devoted to such activities during the peak agricultural month. Correspondingly, 66.7 percent of the hours of the males in rural nonfarm households are devoted to nonfarm activities during the slack agricultural month and 15.5 percent during the peak agricultural month. The seasonal variations do differ, however, by region and activity type. Similar monthly variations are reported by Norman [1973] for Northern Nigeria, where a greater than three to one variation is reported between peak and slack labor use for both farm and nonfarm activities. The fluidity of labor between a number of activities on a seasonal basis is thus a striking feature of rural Africa.

2.5 Summary

The bulk of the population in tropical Africa resides in rural areas. This rural population is growing at a rate of about 2.5 percent annually; and, as a result, the rural labor force will expand rapidly for the remainder of

this century. Surveys of labor use in rural areas reveal considerable differences in total labor inputs by age and sex and between regions and farming systems. There is substantial evidence that there are seasonal labor shortages at planting, weeding, and harvesting periods and low labor inputs by farm families during the dry season. The annual male labor inputs in farming average between 1,000 to 1,500 hours per year in tropical Africa. Nonfarm employment is one means of using slack season labor and in fact accounts for 10 to 50 percent of rural labor inputs.

The following chapters present a more detailed examination of labor inputs in rural production sectors -- agriculture, small scale industry, and agricultural processing.

3. EMPLOYMENT IMPACTS OF RURAL CONSUMPTION PATTERNS

3.1. Introduction

Consumption patterns have important implications for employment and economic growth. In rural areas of LDCs, where purchased inputs in agricultural production are minimal, the most important intersectoral linkages occur through consumer demands. The pattern in which rural households allocate an additional unit of income to consumption purchases may have significant implications for the design of rural development strategies.

Three aspects of rural consumption patterns are basic to assessing impacts of policies on rural employment: (a) the income elasticities of basic food commodities, (b) the demand for products of rural nonfarm industries and (c) the effect of income distribution on the demand for labor intensive goods.

The projection of food demand is an integral part of development planning and policy evaluation; but in most African countries, demand projections for even staple foods are based on unreliable estimates of income elasticity such as "general" elasticities provided by international organizations. Where income elasticities are available for a particular country, they are often based on limited urban consumer surveys.[1]

The extent to which rural households purchase goods produced in rural sectors, urban sectors or abroad is an important factor in designing development strategies and in assessing the role of the rural nonfarm sectors

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[1]For example, in Sierra Leone, the income elasticity of demand for rice, the staple food, derived from urban consumer surveys by Levi [1976] and Snyder [1971] is near zero--a dubious result and certainly not representative of Sierra Leone as a whole which until recently has had to import an increasing amount of rice to meet domestic demand. For an excellent discussion of the pitfalls in estimating the demand for food in Africa, see Farnsworth [1961].

as a source of employment and development in rural areas. If, as Hymer and Resnick [1967] hypothesize, the income elasticity of demand for rural nonfarm goods (i.e., Z goods) is low or negative the role of this sector will diminish and the role of urban and imported goods will increase as rural income increases (see Chapter 6). However, there have been almost no analyses of the demand for rural nonfarm goods in LDCs.

Recently there has been increasing interest in the labor and capital intensity of goods consumed by different income groups. This interest is generated out of a widely accepted but largely untested hypothesis, first explicitly stated in the Colombia ILO study [ILO, 1970] that lower income groups consume relatively more labor intensive goods while high income groups consume more capital intensive and imported goods. In fact, this hypothesis is central to the new emphasis on labor intensive rural development (e.g., Mellor [1975], Johnson and Kilby [1973]). For example, a development strategy that generates additional employment reduces income disparities, and if the above hypothesis holds, results in added demand for labor-intensive goods. One implication of this hypothesis is that both growth and employment objectives can be achieved by income redistribution toward low income groups.

To date there are only limited analyses of the factor intensity of consumption patterns in developing countries and none in Africa. Soligo's [1973] and Sunman's [1974] analysis of consumption patterns in Pakistan and Turkey respectively provide the only available evidence. Both studies tend to confirm the hypothesis.

This chapter reports a detailed analysis of rural consumption patterns in Sierra Leone emphasizing the demand for certain basic commodites and factor intensities by income group. Because there are no other

comparable studies in Africa, there is some difficulty in generalizing these results. However, we believe the main findings are broadly representative of West African rural areas.

3.2. Methodology of the Sierra Leone Consumption Survey

The Sierra Leone rural consumption survey was closely integrated with a nationwide farm management survey. The households comprising the sample for the consumption study were also interviewed in connection with a farm management study of labor use, production practices, output and sales. This unified sample approach was particularly advantageous because it provided data on the amount of production used for household consumption (i.e., subsistence production).

One-half of the households in each enumeration area were selected randomly from the original farm survey sample of five hundred households and interviewed over the entire cropping year. Four-day reference periods were established for which all purchases on each of the four days were recorded.[1] This was particularly helpful in recording frequently consumed commodities such as food which are subject to considerable recall lapse. In addition a second questionnaire was administered at the end of each month so that all purchases excluding food, drinks, and tobacco could be recorded. This longer reference period increased the number of observations on infrequently consumed commodities.[2] Subsistence consumption was computed from the farm management data by subtracting sales from total farm output.

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[1] The short reference period questionnaire was administered twice for consecutive four-day periods each month so that actual consumption expenditures for each household were recorded for one week per month over the entire year.

[2] See King [1977] for more details.

3.3. Descriptive Analysis of Income Distribution and Consumption Expenditures

Since an important part of the analysis is to examine the impact of income distribution on consumption patterns, the sample of two hundred households was post-stratified into six income classes. Lower, upper, and mean per capita expenditure levels for each income group are given in Table 3.1. The Gini coefficient computed from these figures is 0.31. By international standards this is low, indicating a high degree of uniformity of income distribution. This, of course, is expected where land is not a binding constraint and nearly all households use traditional farming techniques.

Average propensities to consume for fourteen major commodity groups comprising total household consumption appear in Table 3.2. Groups of commodities were established in such a way that differences in factor intensity could be preserved while still presenting a descriptive breakdown comparable to conventional industrial sector definitions. In particular, manufactured goods are disaggregated by small and large-scale sectors. As expected, expenditures on food items are a major part of total expenditures, accounting for 70 percent of the value of consumption.[1] The products of large-scale industry and services are other major components of total expenditure. Overall subsistence consumption is about 48 percent of total consumption expenditure.

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[1]Total expenditure is the sum of cash expenditures and subsistence consumption.

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

Income Class	Number of Households	Lower Expenditure Bound (Leone)[a]	Upper Expenditure Bound (Leone)	Mean Annual Per Capita Expenditure (Leone)	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	13.00	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	132.31	264.88	3.2	.11	.38
Entire sample	203	20.46	432.31	116.28	6.9	.34	.48

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

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

TABLE 3.2
AVERAGE TOTAL EXPENDITURE AND AVERAGE PROPENSITY TO CONSUME
FOR MAJOR COMMODITY GROUPS[a]

Commodity Group	Average Household Expenditures (Leones per Year)	Average Propensity to Consume	Proportion Subsistence Consumption
1. Food	473.16	.701	.670
1.1. Rice	266.55	.395	.791
1.2. Palm oil	49.97	.074	.378
1.3. Fish	58.19	.086	.289
1.4. Other food	98.45	.146	.721
2. Beverages and tobacco	23.99	.036	0.000
3. Small-scale industry products	15.57	.023	0.000
4. Large-scale industry and imported products	89.80	.134	0.000
4.1. Fuel and light	20.71	.031	0.000
4.2. Cloth	20.10	.030	0.000
4.3. Other large-scale industry products	48.99	.073	0.000
5. Transport	14.46	.021	0.000
6. Services	28.94	.043	0.000
7. Education	10.21	.015	0.000
8. Institutional saving	6.68	.010	0.000
9. Miscellaneous	11.70	.017	0.000
Total	674.51	1.000	.471[b]

[a]Calculated at the mean level of total expenditure.

[b]Mean for all commodities.

3.4. Expenditure Elasticities and Income Distribution

Expenditure elasticities and marginal propensities to consume are the analytical tools used in determining the effects of change in income on consumption patterns. The definition of commodity groupings and the techniques used to estimate these relationships for individual commodities follow from our interest in the growth and employment effects of rural consumption patterns. Commodity groups were kept as disaggregated as possible so that a maximum amount of information could be preserved. In choosing an appropriate functional form for the fitting of Engel curves for individual commodities, the extent to which estimated elasticities were reasonable over the range of total expenditures represented in the sample, the flexibility of the form with respect to changes in elasticities over income levels and consistency with the additivity criterion were important factors.[1] A modified semi-log ratio was chosen as the basic consumption-income relationship to be used in the estimation procedure.[2] This function can be expressed in its linear form as:

$$C_i = ay + b_1 Y \log (Y/N) + b_2 N + u$$

where C_i is expenditure on the i^{th} commodity; Y, total household consumption expenditure; N, household size; u, a disturbance term; and a, b_1 and b_2, parameters to be estimated. Expressions for expenditure elasticity, e_i, and marginal propensity to consume, $\partial C_i/\partial Y_1$ are respectively:

$$e_i = [a + b_1 + b_1 \log (Y/N)]\ [Y/C]$$

$$\partial C_i/\partial Y = a + b_1 + b_1 \log (Y/N)\ .$$

---

[1]The additivity criterion is important because the sum of the marginal propensities to consume should equal unity since we are dealing with complete household budgets.

[2]See King [1977] for further details of the choice of functional form.

The semi-log ratio function provided a good statistical fit for most commodities, and is quite flexible with respect to variations in marginal propensity to consume and expenditure elasticities over a broad range of total expenditure levels. It also allows the testing of the hypothesis that marginal propensities to consume remain constant at all expenditure levels, since it reduces the constant marginal propensity to consume when b_1 is not significantly different from zero.

The estimated total expenditure elasticities and marginal propensities to consume for the six income classes appear in Table 3.3. Variation across income classes is not pronounced for most commodities. As expected with increases in income, basic consumer items, such as rice, cereals, fish, fuel and light, have a significantly declining marginal propensity to consume while "luxury" items, such as meat, imported condiments, transport, wood work and services, have a significant increase in this marginal propensity to consume.[1]

Food products, in general, have expenditure elasticities close to unity. In particular, the elasticity for the staple food rice which accounts for 40 percent of all consumption has an elasticity of .97 at the mean income level and is above unity for the lowest income group. The uniformly positive expenditure elasticities for small-scale industry products is especially significant. Small-scale products have an average elasticity of .87. Only metal work, which does not include expenditures on inputs to agriculture, such as farm tools, has an elasticity close to zero. These results contradict the Hymer and Resnick [1969] hypothesis that the products of rural small-scale industry are inferior goods.

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[1] As computed at a 0.32 (one standard deviation) level of significance (see King [1977]).

TABLE 3.3
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES TO CONSUME BY INCOME CLASS

Commodity Group	Income Class											
	Elasticity						MPC					
	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	.036	.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

(Continued)

[a]SSI indicates small-scale industry.

TABLE 3.3 - CONTINUED
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES
TO CONSUME BY INCOME CLASS

Commodity Group	Income Class											
	Elasticity						MPC					
	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)	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	1.46	.140	.132	.123

(Continued)

[a]SSI indicates small-scale industry.

[b]LSI indicates large-scale industry.

TABLE 3.3 - CONTINUED
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES
TO CONSUME BY INCOME CLASS

Commodity Group	Income Class											
	Elasticity						MPC					
	Lowest Decile	Second and Third Decile	Fourth and Fifth Decile	Sixth and Seventh Decile	Eighth and Ninth Decile	Highest Decile	Lowest Decile	Second and Third Decile	Fourth and Fifth Decile	Sixth and Seventh Decile	Eighth and Ninth Decile	Highest Decile
Transport	.380	1.166	1.617	2.321	1.445	.996	.010	.018	.026	.031	.037	.044
Ceremonies 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
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

It is difficult to compare our results from Sierra Leone to results from other African countries because few studies have examined changes in consumption patterns across income groups or identified rural nonfarm goods as a distinct commodity group. Snyder [1971] analyzed household consumption in Freetown, Sierra Leone, and obtained comparable elasticities for food, meat, clothing and fish. However, his estimated elasticity of .03 for rice seems irreconcilable with our findings. Elasticities for services, processed food and transportation are quite similar to those reported by Hay [1966] in his study of rural consumption in Nigeria. Finally, reported elasticities for cereals and root tubers from East African studies by Massell [1969] and Massell and Parnes [1969] as well as Snyder's [1971] estimates indicate that the elasticity reported here for cereals and root crops is high.[1]

Elasticities and marginal propensities to consume for goods grouped by origin appear in Table 3.4. As expected, marginal expenditures on goods and services from rural areas predominate. Imported items are the next largest category while marginal propensities to consume for goods from small and large urban areas are quite small together accounting for only 4 percent of marginal expenditures. Somewhat counter to our initial expectations the expenditure elasticities for goods from rural and small urban areas are higher than goods from large urban areas. However, goods from rural areas have a declining elasticity since food is the major proportion of expenditures on rurally produced items. The high elasticity for goods produced in small urban areas (elasticity of 1.58 in Table 3.5) is a reflection of the dominance of small-scale industrial products such

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[1]However, because root crops such as cassava are harvested over an extended period and measured in ill defined local units, this is probably the most unreliable of our estimates.

TABLE 3.4
ESTIMATED TOTAL EXPENDITURE ELASTICITIES AND MARGINAL PROPENSITIES
TO CONSUME FOR COMMODITIES GROUPED BY ORIGIN

Origin	Income Class											
	Elasticity						MPC					
	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

TABLE 3.5
AVERAGE LABOR CAPITAL AND FOREIGN EXCHANGE
REQUIREMENTS PER LEONE OF EXPENDITURE
BY INCOME CLASS

Income Class	Labor (Person-Hours)	Capital (Leones)	Foreign Exchange (Leones)
Lowest decile	8.57	.055	.12
Second and third deciles	8.87	.049	.15
Fourth and Fifth deciles	8.64	.058	.12
Sixth and Seventh deciles	8.95	.051	.12
Eighth and ninth deciles	8.37	.059	.14
Highest decile	7.56	.064	.14

as tie-dyed cloth in this group of commodities. Although large urban goods have a very low elasticity this is in large part due to expenditures on fuel and light which is the major urban produced good consumed in rural areas. In other countries with a larger urban industrial base we would expect a higher elasticity for goods produced in large urban areas and consumed in rural areas. Finally imports have an elasticity slightly above unity.

3.5. The Factor Intensity of Rural Consumption Patterns

The factor intensity of consumption is defined as the number of units of labor or capital employed per unit of consumption expenditure. Factor intensities may be average factor intensities when the present consumption patterns are used in the computation or they may be marginal factor intensities if the consumption pattern of an additional unit of expenditure is used. Algebraically factor intensities can be expressed as:

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

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

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

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

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 .

Specifically, we wish to test the hypothesis stated earlier that lower income households consume a more labor intensive bundle of goods and services while households with higher incomes purchase goods and services which are relatively more capital intensive and less labor intensive. Average factor intensities are relevant for examining the effect of changes in the number of people in an income class through population growth while marginal factor intensities are most useful for examining the impact of changes in income distribution.

Labor output and capital output ratios were derived from various sources. Estimates for agricultural commodities and for small-scale industrial products were derived from surveys by Spencer and Byerlee [1976] and Liedholm and Chuta [1976] respectively. Secondary sources were used to estimate ratios for large-scale sectors (e.g., Government of Sierra Leone [1974]).

Average factor intensities are shown in Table 3.5. Neither average capital nor average labor intensities show a consistent trend as income increases, although the highest income group does consume a more capital intensive and less labor intensive bundle of goods than the lowest income group. Marginal factor intensities shown in Table 3.6 exhibit consistent trends. Marginal labor intensities decrease and marginal capital intensities are increased as incomes increase, but the effects of income changes are not large.

The relatively small changes in both average and marginal factor usage among rural consumers of increasing income levels in Sierra Leone is striking when compared to the findings of Soligo [1973] in Pakistan and Sunman [1974] in Turkey. Both found rather strong support for the hypothesis of decreasing labor intensity (and a corresponding increase in capital

TABLE 3.6
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)
Lowest decile	9.35	.050	.13
Second and third deciles	9.02	.051	.14
Fourth and fifth deciles	8.71	.053	.14
Sixth and seventh deciles	8.46	.053	.14
Eighth and ninth deciles	8.15	.055	.14
Highest decile	7.75	.056	.15

intensity) of goods and services as income increases. In Pakistan, for example, there was an increase of 82 percent in capital intensity and a decrease in labor intensity of 56 percent [Soligo, 1974] over the range of incomes. For comparison our results indicate differences between the highest and lowest income groups of only 10 and 17 percent in marginal capital and labor intensities.

The differences between our findings in Sierra Leone and the limited evidence from other LDCs is in part due to the relatively uniform income distribution in our sample. In Sierra Leone and many other African countries where there are no landlords, tenants and landless laborers there is relatively less social and economic stratification. Furthermore, the greater majority of households in our sample are subsistence oriented so that even the highest income households derive almost half of their consumption from subsistence production.

3.6. Implications of the Results

An important result of the Sierra Leone consumption survey is that the income elasticities for small-scale industrial products are generally high and above zero. In fact, the income elasticity of demand for these products was often as high or higher than substitute products from large-scale industries or imported from abroad. There is every indication then that demand is not a constraint on the development of small-scale industries.

Moreover, income elasticities for most rural products such as rice, palm oil, fruit, etc., were high and only slightly below one. Since agricultural products, particularly annual crops, are produced by the most labor intensive methods the overall labor intensity of rural consumption is high indicating that programs to increase rural income will increase employment in rural areas through consumption linkages.

The Sierra Leone consumption survey lends moderate support to the hypothesis that higher income groups consume more capital intensive (and less labor intensive) goods. The effect of income on factor intensities is not, however, as strong as observed in other countries, probably in part because of a relatively equal income distribution. This implies that policies that widening existing income disparities are likely to have adverse effects on employment and growth due to a switch to more capital intensive consumer goods.

4. TECHNICAL CHANGE AND EMPLOYMENT IN THE AGRICULTURAL SECTOR

4.1. Introduction

In Chapter 2 a descriptive profile of labor utilization in rural areas of Africa under traditional production systems was presented. An important finding of this analysis was the contrast between labor bottleneck in the peak season and surplus labor in the slack season. Moreover it was observed that land/labor ratios in Africa are, in general, high compared to other developing regions. An important policy question is how the introduction of new cropping systems and technologies affects employment and output in agriculture in light of the observed land and labor use under traditional systems. In this chapter we examine empirical evidence on the effects of introducing new technologies.

Following Hayami and Ruttan [1971], technological change may be disaggregated into labor saving mechanical technologies and land saving biological technologies. Given the factor endowments of a seasonal labor bottleneck and high land/labor ratio the appropriate technical change is adoption of labor saving technology to raise labor productivity. Where the labor bottleneck occurs at planting time, as is common in tropical Africa, this translates into mechanization of planting operations, particularly cultivation, to enable expanded acreage. However, the Hayami/Ruttan framework must be extended in the situation where labor constraints are only seasonal since conventional land saving technologies, i.e., biological-chemical technologies which increase yields per acre and hence increase weeding and harvesting labor but leave planting labor unchanged, will, in fact, be labor saving with respect to labor at the peak season. Thus, it is not uncommon to observe both mechanical and biological-chemical technologies being adopted side by side in high

land/labor ratio areas in Africa.

In the next section we present a series of case studies from West Africa on the introduction of technological change. These case studies represent different biological and mechanical technologies under different factor pricing policies and are useful in drawing some general implications about technological change and labor use. We conclude with some specific policy recommendations for developing and promoting new technologies and cropping systems.

4.2. Case Studies of the Impact of New Technologies on Employment and Productivity in West African Agriculture

4.2.1. Mechanization of Rice Production in Ghana

Rice production in Ghana has increased dramatically in recent years, expanding from 28,000 acres in 1968 to 90,000 acres in 1974, largely as a result of subsidized tractor cultivation and combine harvesting which have expanded the planted acreage on previously idle land. Mechanization has been encouraged by various government policies such as over-valued exchange rate and subsidies on combine harvesting which reduce the private costs of mechanization (see Table 4.1).

Winch [1976] surveyed 161 farms through continuous interviews over the 1974 cropping season to determine costs and returns to alternative production systems. Six production systems were identified as shown in Table 4.2 on the basis of three technological alternatives. First, land preparation techniques included bullock ploughing (system VI), tractor hire services (systems I-III) and tractor ownership (systems IV-V). Second, various degrees of use of combine harvesters were employed ranging from almost zero (systems III-VI) to the 77 percent of acreage mechanically harvested in system V. Third, biological technology also varies with some farms using traditional seeds (systems I, IV, VI), others improved seed (systems II, V) and one system (system III) using a

TABLE 4.1
SUBSIDIZED AND UNSUBSIDIZED PRICES AND PERCENT OF SUBSIDY FOR SELECTED INPUTS USED IN RICE PRODUCTION IN NORTHERN GHANA, 1973/1974

Capital Input	Unit	Subsidized Prices Paid by Farmers[1]	Unsubsidized Price[2]	Percent of Subsidy
1. Fertilizer				
a. 15-15-15	112 lbs.	2.80	15.63	82
b. 20-0-0	112 lbs.	2.00	9.89	80
2. Improved Seed	160 lbs.	12.00	20.60	42
3. Land Preparation				
a. Tractor Owners[3]				
1) Plowing	acre	8.10	10.76	25
2) 1st Harrowing	acre	5.16	6.77	24
3) 2nd Harrowing	acre	3.13	4.08	24
b. Contract Charges[4]				
1) Plowing	acre	9.36		
2) 1st Harrowing	acre	4.48		
3) 2nd Harrowing	acre	4.07		
4. Mechanized Harvesting				
a. Combine	180 lbs.	1.00	4.20	76
b. Combine as Stationary Thresher	180 lbs.	0.80	2.55	69
c. Tractor Threshing	acre	3.78	4.84	22

[1]Actual prices paid by farmers during the 1973-74 production season.

[2]Computed. See the appendices for calculations of the economic costs of each factor.

[3]Based upon computed owning and operating cost for Northern Region tractor owners. See Appendix C.

[4]The actual financial cost-price of contract charges is the computed average charge per measured acre for 83 sample farms hiring tractor services. We did not have the required data to estimate the unsubsidized cost of private contract plowing. As a consequence, the estimated unsubsidized cost of land preparation for tractor owners is used in the economic analysis.

Table 4.2

FINANCIAL AND ECONOMIC COSTS OF PRODUCTION FOR SIX RICE PRODUCTION SYSTEMS IN NORTHERN GHANA

System	Method of Ploughing	Percent Mechanically Harvested	Type of Seed	Fertilizer Use (Bags per Acre)	Farm Size (Acres)	Labor Input per Acre (Man-Hours)	Capital-Labor Ratio	Yield (Bags per Acre)	Financial Costs[a] (¢ per Ton)	Economic Costs [a] (¢ per Ton)
I	Tractor Hire	20	Traditional	.51	12.8	116.0	1.9	5.2	133	165
II	Tractor Hire	14	Improved	1.52	21.2	103.6	3.8	6.2	112	173
III	Tractor Hire	3	Mixed	1.27	16.9	219.6	2.0	8.3	110	141
IV	Tractor Owned	12	Traditional	1.06	41.6	88.8	4.4	6.5	112	165
V	Tractor Owned	77	Improved	1.79	119.3	37.8	8.5	7.1	104	193
VI	Bullock	0	Traditional	.83	1.1	690.7	0.4	7.5	179	207

[a]Import parity price for rice estimated at ¢143 per ton. ¢1.00 = $ 1.15

SOURCE: Winch [1976].

seed mixture.[1] The resulting systems vary considerably in farm size, labor input per acre and capital intensity. At one extreme the most labor intensive system employed bullock power and cultivated only 1.1 acres using 691 man-hours per acre. The most capital intensive system on the other hand (system V) cultivated 119.3 acres with a labor input (largely hired) of only 37.8 man-hours per acre. Combine harvesting had a particularly dramatic effect on labor inputs, reducing harvesting labor from 142 man-hours per acre to 10 man-hours per acre. Using market prices to cost all inputs the most capital intensive system had the lowest cost and the bullock system the highest cost. However, Winch [1976] noted substantial factor price distortions in the Ghanian economy. Some distortions arise out of direct government subsidies for fertilizer, improved seed, fuel and services of government-owned combine harvesters. Furthermore, the official exchange rate in Ghana was estimated to be 35 percent overvalued, thus reducing the cost of imported equipment. Taking into account these factor price distortions, the subsidies were estimated to be 25 percent for tractor cultivation and 75 percent for combine harvesting services (Table 4.1). Using these corrected prices the economic costs of production were second highest for the most capital intensive system (system V) which had the lowest private costs. The lowest economic cost of production occurred for system III which used tractor cultivation but almost no mechanical harvesting. In fact, system III was the only system to demonstrate a positive "social" profit.

Winch concluded that policy to expand rice production should be reoriented toward the small farmer through several mechanisms. Because combine harvesting is expensive in real costs, expansion of combine harvesting should be discouraged and several measures taken to relieve the labor bottleneck at harvest time. These include (a) removing the subsidy on combine harvesting to increase labor

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1 In general, use of improved seed was also associated with higher inputs of fertilizer.

demands and wage rates in order to encourage seasonal migration from areas where there was a seasonal labor slack, (b) providing hand threshers, (c) introducing seed varieties with different dates of maturity to stagger harvests, and (d) reorienting credit away from loans for tractor purchases toward seasonal loans for labor hiring at harvest time. Finally he advocated measures to increase yields and reduce acreage expansion such as an increased tariff on tractor imports.

4.2.2. Comparison of Biological and Mechanical Technologies in Rice Production in Sierra Leone

Our second case study deals with two contrasting systems of rice production in Sierra Leone -- one employing mechanical cultivation and the other improved biological-chemical technology. We examine the impact of each technology on the demand for labor, returns to labor, and total household labor supply.

Data reported were obtained as part of the Sierra Leone nationwide farm management survey we conducted during 1974/1975. Data from only two survey areas are discussed here. The first area is situated in the center of the Boliland area where rice is grown in infertile swamp grasslands. Extensive mechanical cultivation is practiced in the area through a government hire tractor scheme which charges a subsidized price for tractor services.[1] The second study area is located in the Moa Basin region in an area served by an Integrated Agricultural Development Project (IADP) with major emphasis on improved biological-chemical technology for production of inland swamp rice. Each farmer participating in the project receives credit, improved seed, fertilizer and tools as well as extension advice on constructing water control measures. No mechanical cultivation is practiced in the area.[2]

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1 There is also some variation in biological technology in the area with respect to the planting procedures -- broadcasting or transplanting -- and use of fertilizer.

2 See Spencer and Byerlee [1976] for details of the data collection procedure.

Demand for Labor. Labor inputs for rice production using varying technologies are shown in Table 4.3. In the IADP area, farmers previously grew upland rice using traditional bush fallow cultivation. Some farmers also grew swamp rice under traditional methods. These two production systems are used as benchmarks for the "without" project situation to be compared with the improved seed, fertilizer and water control package to produce swamp rice used by farmers in the project. In the IADP area, labor inputs per acre have increased substantially as a result of participation in the project (significant at the 1 percent level). The increased labor per acre is due to improved land preparation and a larger harvest.

In the Bolilands, labor inputs per acre declined by 40 percent from 317 man-hours per acre under hand cultivation to 193 man-hours per acre using tractor cultivation as farmers substitute capital for labor in land preparation activities. To further understand these production relationships a constant elasticity of substitution production function was fitted to farm data for the Bolilands (see Spencer and Byerlee [1976]). This function indicated constant returns to scale on labor and capital providing evidence that land is not a limiting factor. In fact, because land is relatively abundant in this area farmers expand acreage with mechanical cultivation. The average size farm for those farmers with only hand cultivation was 8.4 acres compared to 12.7 acres for farmers using mostly mechanical cultivation. The results indicated that substantial flexibility exists to substitute capital for labor in the Bolilands. However, it is important to note that this substitution enables an expanded acreage to be cultivated and hence although labor saving technology is employed, it is not necessarily labor displacing.

Returns to Labor. Enterprise budgets for each farming system are constructed in Table 4.4. In the IADP area, returns per acre are increased on improved

TABLE 4.3
LABOR INPUTS AND YIELDS IN RICE PRODUCTION UNDER DIFFERING TECHNOLOGIES IN SIERRA LEONE, 1974/75

Technology	Labor Input Per Acre[a/]			Yield Per Acre
	Family	Hired	Total	
	(Person Hours Per Year)			(Pounds Per Acre)
IADP Area				
Traditional upland	884	60	953	798
Traditional swamp	697	39	736	1,260
Improved swamp[b/]	1,125	256	1,393	1,734
Bolilands				
Hand cultivation	270	47	317	858
Mechanical cultivation	153	40	193	1,008

Source: Survey data.

[a/] Person hour equivalents computed by applying weights of 1.0, .75, .5 to men, women and child labor respectively in the IADP area and weights of 1.0, 1.0 and 0.5 to men, women and child labor in the Boliland area. Weights reflect relative wage rates in those areas as discussed in Spencer and Byerlee [1976].

[b/] IADP package of fertilizer, seed and water control.

Table 4.4

Enterprise Budgets for Different Systems of Rice Production in Sierra Leone, 1974/75

	IADP Area			Bolilands	
	Traditional Upland	Traditional Swamp	Improved Swamp[f]	Hand Cultivation	Mechanical Cultivation
	Average Per Acre				
Output-value (Le.)[a]	67.0	105.0	144.0	61.4	72.1
Variable costs (Le.)					
Land payment[g]	0.0	0.0	.7	.3	2.1
Seed	5.3	4.4	5.1	4.5	3.8
Fertilizer	0.0	0.0	1.5	.8	1.2
Mechanical service	0.0	0.0	0.0	0.0	6.8
Hired labor[b]	6.5	4.7	23.9	3.1	3.1
Others	0.0	0.0	2.2	0.0	0.0
Total variable cost	11.8	9.1	33.4	8.6	16.9
Interest on total costs[c]	2.3	1.8	6.7	1.7	3.4
Enterprise gross margins[d]					
Per acre	52.6	94.1	103.3	51.1	51.9
Per hour of family labor	.06	.13	.10	.18	.34
Gross margins per hour family labor with unsubsidized costs[e]	.06	.13	.09	.18	.06

Source: Survey data.

[a] Le. 1.00 = $1.10 U.S. in 1974/75.

[b] Valued at wage rate specific to the area.

[c] Assumes 20 percent opportunity cost.

[d] Output value less variable costs less interest on variable cost.

[e] Assumes fertilizer subsidy of 67 percent and mechanical ploughing subsidy of 85 percent.

[f] IADP package of seed, fertilizer and water control.

[g] A nominal fee may be paid for the use of land. See Spencer and Byerlee [1977].

swamp rice farms compared to traditional systems. However, returns per man-hour of labor input are lower on improved swamp rice (Le 0.10) compared to traditional swamp rice production (Le 0.13) although 50 percent higher than on upland rice production (Le 0.06). Adoption of the IADP package to improve swamp rice has resulted in increased returns to land; but because of the added labor, returns per unit of family labor are lower than under traditional swamp cultivation systems. However, the IADP package enables more family labor to be employed during the slack months so that total returns to the household are higher than under either of the traditional systems.

In the Bolilands, returns per unit of land are virtually the same for both hand and mechanical cultivation. However, returns per unit of family labor are substantially higher under mechanical cultivation.

In Sierra Leone, mechanical cultivation services and fertilizer are both heavily subsidized. To assess the economic returns, returns to labor were recomputed using unsubsidized prices.[1] For the IADP area, returns are virtually unchanged; but in the Bolilands, hand cultivation is now considerably more profitable than mechanical cultivation. In fact, the previously high returns to labor under mechanical cultivation are reduced to a level below that of improved swamp cultivation in the IADP area. The results indicate that neither the biological-chemical technology of the IADP nor the mechanical technology of the Bolilands is particularly successful as measured by returns to labor. If returns are to be increased in the IADP area, either labor inputs must be reduced or yields increased. Since the project is new, both are likely to occur as farmers become more familiar with the new technology and labor for land preparation is reduced. In the Bolilands, the increase in cultivated area resulting from mechanization has occurred at substantial cost to society given the current

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1 It is estimated that current subsidy levels are 67 percent for fertilizer and 85 percent for tractor.

high cost of operating the government tractor hire scheme.

The relationships observed here are consistent with theoretical expectations. That is, the mechanical technology has increased labor productivity while the biological-chemical technology has increased land productivity. However, in each case, we have evaluated only one technology among a range of potential alternatives. Thus, biological-chemical technologies employing only improved seed and fertilizer but not water control measures may be more appropriate than the IADP package considered here. In fact, Spencer [1975] has shown that application of improved seed and fertilizer to upland rice (the dominant rice production system in Sierra Leone) will increase returns to labor by 50 to 100 percent. Moreover, addition of improved seed and fertilizer to upland crops only requires additional labor at harvest time (excluding a small amount for fertilizer application). As a result, this package of technologies is compatible with the existing seasonal labor profile where harvesting labor is not usually binding.

Total Family Labor Supply. In addition to analyzing factor combinations, we also examined the effect of technology on total family labor inputs of adults to assess the impact on work loads and seasonal labor distribution. In particular, it is important to analyze how the introduction of technological change affects the division of labor by sex. In fact, several writers (e.g., Boserup [1970], Skonsberg [1975], and Tinker [1975]) assert that new agricultural technologies have an adverse effect on women since they lead to an increase in women's work loads while the work loads of men are reduced.

The seasonal profile of total hours worked each month by family members in farm and nonfarm work (excluding domestic duties, such as cooking) for our two survey sites are shown in Table 4.5. In the IADP area, households were divided into three groups: (a) nonparticipants or households who had not

Table 4.5

Seasonality of Labor Inputs for Adult Family Members in Sierra Leone Rural Households Using Differing Agriculturai Technologies

Type of Household	Sample Size	Month[a/]												Total Hours for Year[b/]
		May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	
		Average Hours Worked Per Adult Per Month												
IADP Area														
Male														
Nonparticipant	14	67	147	114	141	93	68	67	68	70	81	60	51		1,027
First year participant	10	187	231	228	268	207	140	124	134	151	131	102	125		2,028
Second year participant	14	167	162	232	201	137	92	84	66	82	69	95	85		1,472
Female															
Nonparticipant	21	46	140	145	164	114	106	106	54	74	41	18	29		1,037
First year participant	14	96	145	153	144	116	80	97	80	87	52	19	36		1,105
Second year participant	15	139	156	143	211	143	89	83	60	60	34	22	28		1,168
Bolilands															
Male															
Hand cultivation	10		125	186	231	199	128	137	204	182	97	56	55	80	1,680
Hand and mechanical cultivation	12		95	184	239	179	93	78	157	160	85	38	25	46	1,379
Mechanical cultivation	14		95	181	215	221	158	120	178	145	57	24	42	52	1,488
Female															
Hand cultivation	7		55	108	160	81	53	39	57	88	54	32	20	22	769
Hand and mechanical cultivation	6		60	133	193	103	86	69	99	119	67	50	25	24	1,028
Mechanical cultivation	20		90	158	214	164	84	75	121	107	59	40	25	32	1,169

Source: Survey data.

[a/] Survey from May 1974 to April 1975 in IADP area and June 1974 to May 1975 in Bolilands.

[b/] Differences between groups significant at 5 percent level for males in IADP and for females in Bolilands.

joined the IADP, (b) households who were participating in the project for the first year and (c) households who were second year participants in the project. Boliland households are grouped into (a) households using primarily hand cultivation, (b) households using mixed hand and mechanical cultivation, and (c) households using primarily mechanical cultivation.[1]

The technologies examined here have had relatively little impact on the "spread" of labor inputs over the year. In every case the peak season occurs at planting (July through September) with a subsidiary peak at harvest (December and January). In the IADP area, first year participants in the project have less pronounced slack periods partly because they are still producing some traditional upland rice which has different seasonal labor demands than swamp rice [Spencer and Byerlee, 1976]. In the Bolilands, labor inputs of households with mechanical cultivation are slightly less in the slack period since this is the time of mechanized land preparation.

The introduction of improved technologies has a significant impact on the total supply of household labor by sex. In the IADP project, male adults increase their labor inputs by at least 50 percent when they join the project; and in the first year of participation in the project when most land development is undertaken, male adults worked over 2,000 hours per year. In contrast, female labor input is not significantly changed by participation in the IADP project.

In the Bolilands, the effect of mechanical technology on labor use by sex is quite different. The mean hours of work per adult male decreases as mechanical

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1 Of course, with cross-sectional data, we cannot always be sure that the difference among groups is the result of the technological adoption or the cause of the adoption. In the following comparison among groups, we assume that observed differences are the result of the technological change. Boliland households with and without mechanical cultivation exhibit similar characteristics with respect to age and sex composition of family members. However, in the IADP area heads of nonparticipant households are older than for participant groups so that a priori we expect their labor inputs to be somewhat lower.

cultivation is substituted for hand cultivation (but the difference is not statistically significant even at the 30 percent level). However, the hours worked increase significantly for female adults so that in households using primarily mechanical cultivation, females work 50 percent more than in households using primarily hand cultivation. Also, at the peak season, women in households using mechanical cultivation work the same number of hours in farm activities as men.

The key to these differential effects of varying technologies on male and female labor inputs lies in the sex-specific nature of many farm activities in Sierra Leone. In the Bolilands, mechanization almost completely eliminates the heavy land preparation usually undertaken by men but increases farm size so that there is a big increase in the demand for labor for planting and harvesting where women traditionally play an important role. In the IADP area, the substantial land development required in the early years of the project places the burden of the work primarily on men.

These findings indicate that it is unwise to generalize about the role of women in African agriculture in light of the variation in the sex division of labor by farming system, ethnic group, etc. Further work is now underway by Spencer [1976] to clarify some of these relationships.

4.2.3. Cotton Growing Recommendations in Nigeria

Our third case study is an analysis by Norman et al. [1974] of the applicability of biological technologies including use of fertilizer, spraying equipment, and insecticide in cotton production in the north of Nigeria. Fifty farmers in three villages were randomly selected and then stratified into those continuing traditional technologies and those who for the first time were encouraged to use recommended practices under supervision of extension staff. Total costs with

particular attention to labor inputs and returns were recorded. It was found that labor inputs increased by 94 percent under the recommended practices in large part due to higher yields which increased harvesting labor but also because of labor required for spraying insecticides which involved considerable effort in carrying water from streams and wells to the field. The most significant change in labor inputs was a seasonal shift in labor requirements resulting from the earlier planting date under the recommended practices which increased the conflict between cotton and food production. Figure 4.1 shows that unsprayed cotton required 60 man days per hectare during the peak farming month of July while sprayed cotton requires 90 man days per hectare during this month.

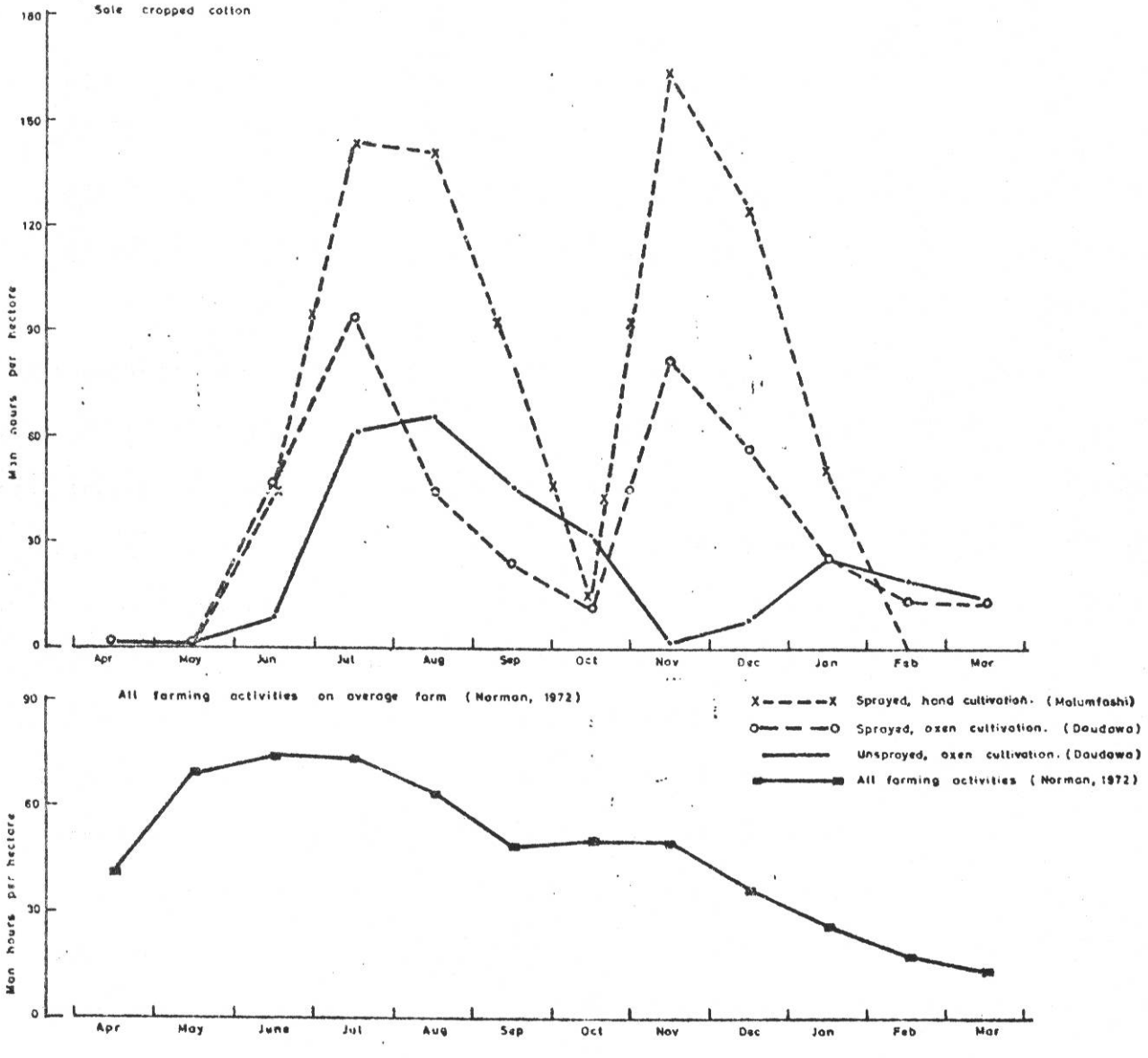
Norman et al. [1974] concluded that although returns were substantially higher using the improved practices the peak season competition for labor with food crops would be a serious limitation on widespread adoption of the practices since historically farms meet their security objective for food crops before planting cash crops such as cotton.

4.2.4. Mechanization in Sierra Leone Marine Fisheries

Mechanization in the marine fisheries in Sierra Leone provides an interesting contrast to mechanization of rice production in Ghana and Sierra Leone discussed previously. Unlike agriculture, mechanization in small-scale fishing through the use of outboard motors to replace sail and paddle has occurred without minimum encouragement from the government. In fact, the factor pricing ratios are such that capital goods are priced at a higher value than their opportunity cost. Out-board engines are imported at a 35 percent rate of duty. Moreover, commercial traders in the capital city, Freetown, provide loans to the fishermen to buy the outboard engines at a 40 percent rate of interest. Despite their high cost, about 12 percent of fishermen are now using out-board engines of varying sizes from 7 to 40 h.p. Linsenmeyer [1976] in a survey of small-

Figure 4.1

MONTHLY LABOUR REQUIREMENTS FOR NORMAL FARMING ACTIVITIES AND FOR GROWING SOLE CROP COTTON



SOURCE: Norman, et al. [1974].

scale fisheries identified nine different firm types based on boat, net, and propulsion equipment. The capital-labor ratios for these firms are shown in Table 4.6. However, the firms that use outboard engines (firms VI-IX) do not have significantly different capital-labor ratios than the nonmechanized firms. The mechanized firms are able to go much further to sea, and return faster with a larger catch and reduced spoilage. This larger catch and the ability of mechanized boats to operate in bad weather increase total employment so that there is very little substitution of capital for labor. As a result, when the cost of capital is reduced to the opportunity cost of 20 percent and import duties lowered to 10 percent, the relative profitability of the different firms does not change.

However, Linsenmeyer [1976] did note a basic dichotomy between small-scale and large-scale fishing firms. The latter use trawlers and have a higher capital-labor ratio. Moreover, large-scale fisheries operate in a different capital market obtaining institutional credit at a 10 percent interest rate and importing equipment duty free, which tends to bias factor prices in favor of capital. Expressed in terms of costs of production at market prices large-scale firms were higher cost than any of the small-scale firms. When economic costs are computed using a 20 percent opportunity cost of capital, costs of large-scale production further increase and become barely profitable. Moreover, in a linear programming framework, Linsenmeyer [1976] shows that if large-scale firms are charged the opportunity cost of capital imported fish becomes cheaper and large-scale firms are dropped from the solution which maximizes returns to the industry and are replaced by small-scale firms and imported fish.

4.3 Some Implications from the Case Studies

Because of relatively high land-labor ratios in Africa and the acuteness of the seasonal labor bottleneck, mechanization schemes have been implemented in

TABLE 4.6
CAPITAL INTENSITY AND COSTS OF PRODUCTION FOR TEN TYPES OF FISHING FIRMS IN SIERRA LEONE EMPLOYING DIFFERENT BOAT, NET AND MECHANICAL TECHNOLOGIES

System	Type of Boat	Length of Boat (Feet)	Net	Type of Propulsion	Labor Capital Ratio[a]	Cost per Leone of Fish	
						Market Prices[b] (Cents)	Adjusted Prices[c] (Cents)
I	Kroo	15-20	Cast	Paddle	18.5	.27	.25
II	Standard	20-24	Ring	Sail/Paddle	19.9	.50	.44
III	Standard	20-24	Set	Sail/Paddle	17.8	.51	.44
IV	Standard	20-24	Drift	Sail/Paddle	43.1	.54	.48
V	Salla	24-40	Beach Siene	Paddle	16.7	.57	.48
VI	Salla	24-40	Ring	<15 H.P. Eng.	7.0	.68	.57
VII	Salla	24-40	Ring	>15 H.P. Eng.	20.6	.77	.72
VIII	Fante	35-50	Ring	<26 H.P. Eng.	23.8	.69	.64
IX	Fante	35-50	Ring	>26 H.P. Eng.	18.2	.79	.73
X	Trawler	60-120	Siene Trawl	>50 H.P. Eng.	3.0	.83	.90

[a]Man hours of labor per Leone of annual capital cost.

[b]Cost of capital at 40 percent and import duties of 36 percent for small firms (I-IX) and 10 percent and zero respectively for large firms (X).

[c]Assumes 20 percent opportunity cost of capital for all firms.

most African countries. Case studies of two such schemes to promote rice production in Sierra Leone and Ghana reveal that substantial capital-labor substitution is possible. In Sierra Leone, a production function fitted to data from farmers in a tractor hire scheme showed that the elasticity of substitution between labor and capital is very high. In both Sierra Leone and Ghana, tractor cultivation has led to substantially increased acreages since in both areas use of mechanical cultivation has enabled previously idle land to be cultivated. For this reason, mechanization has not been labor displacing because the larger acreage required additional labor for planting, weeding, and harvest. In fact, in Sierra Leone, households in the tractor hire scheme actually work longer hours than households using hand cultivation because of a larger female labor input.

While tractor cultivation relieves peak season labor bottleneck to some extent, labor peaks are often transferred to other months such as harvest time. In Ghana, the government introduced combine harvestors in an effort to overcome a perceived harvesting constraint.

In both Ghana and Sierra Leone, the private profitability of mechanization was shown to be very high with returns to labor and management, often several times higher than the rural wage rate. However, in both cases, government policy has encouraged mechanization either intentionally through subsidies or unintentionally through cheap credit policies and overvalued exchange rates. When factor prices are adjusted to eliminate these distortions, social profitability is much lower and often negative. Nonetheless, the Ghana study showed at least one system using tractor cultivation and no mechanical harvesting as being socially profitable. In Sierra Leone, the cost of tractor hire services run by the government is about five times higher than in Ghana where tractor hire services are privately run. If costs of tractor cultivation in Sierra

Leone could be reduced to the level in Ghana, it would also be socially profitable in Sierra Leone.

It should also be noted that the benefits from mechanization in both the Sierra Leone and Ghanian study have largely resulted from an expanded acreage. In areas where land is in short supply, mechanization must be justified through increased timeliness of operations or better soil preparation which increase yields. In practice, it is extremely difficult to estimate these effects from survey data because of the large number of other factors which affect yields such as improved seeds and fertilizer which are often adopted simultaneously with tractor cultivation.

Evidence from other agricultural and rural industries also support the relative profitability of small-scale versus large-scale operations. The marine fisheries sector of Sierra Leone is an interesting example of small-scale producers with small-scale firms generally paying above the opportunity cost of capital and large-scale producers below the opportunity cost of capital. However, even under these adverse circumstances, small-scale firms were substantially more profitable.

Biological-chemical technologies pose an alternative means of increasing output and employment. The success of biological-chemical technologies, however, depends largely on seasonal labor requirements of the new technologies. Ideally, where the planting season is the peak season, an "extensive" strategy of introducing new seeds and fertilizer with minimal changes in such factors as water control, land preparation, and weeding has the greatest short-term payoffs. In this way, peak season (planting and weeding) labor is not binding, although development of varieties of different maturity has potential for staggering harvesting labor requirements. For example, a strategy in Sierra Leone of introducing fertilizer and/or improved seed on upland rice production is

likely to be more profitable and consistent with seasonal labor availability than a strategy requiring new seed, fertilizer, water control, and improved land preparation in swamp rice [Spencer, 1973]. The study of Norman et al. [1974] of introducing a biological-chemical technology of cotton spraying again demonstrates how important labor constraints can be in the successful adoption of a biological-chemical technology in West Africa.

It is evident from these case studies that government agricultural strategies have often encouraged extremes of technological innovations usually imported from abroad. Thus, the mechanization of rice farming has involved use of imported large tractors, and in Ghana, combine harvestors. Also, in Sierra Leone, biological packages for increasing rice production have imported "Asian" systems emphasizing water control to increase land productivity. What is striking is the absence of intermediate technologies developed specifically for the factor endowments of small farmers in West Africa. For example, an intermediate technology with considerable potential for success in Savannah areas is oxen cultivation. A few studies such as Renault [1965] in Ivory Coast and Laurent [1968] in Northern Nigeria indicate that oxen power may be more profitable than either hand or tractor cultivation. In part, the returns from oxen-power result from expanded acreage and it is not surprising that where land/labor ratios are low, such as in Malawi, oxen cultivation was not profitable [Gemmill, 1972]. Success of oxen cultivation also depends on appropriate equipment (e.g., for weeding) and a training program in which farmers have had little experience with animal power. Sargent's [1976] ongoing survey of an apparently successful oxen-power scheme in northern Benin should provide guidelines for the expansion of oxen-power in West Africa. In forest areas of Africa which are not suitable for oxen, small tractors such as rotary tillers have

potential for overcoming planting bottlenecks, but again have not been evaluated to date.

Small-scale marine fisheries offer another example of the introduction of technology intermediate between hand operated canoes and large trawlers. In this case the new technology was introduced without an active government policy and in spite of adverse factor prices. Moreover, it is significant that small mechanized boats are relatively labor intensive since they enable fishermen to use larger boats and hence to navigate further off shore and to operate in rough weather so that labor is more evenly distributed throughout the year.

There are many types of intermediate technologies which are available but have not been introduced on a large scale in tropical Africa and therefore have not been included in our case studies here. These include small rotary tillers which have potential in swamp farming to release labor bottlenecks in land preparation, peddle threshers where labor is constraining at harvest time, and chemical weedicides to reduce the weeding bottleneck. The technical and economic efficiency of such technologies need to be examined under former conditions in Africa. Furthermore, potential exists for development of improved hand tools to increase labor productivity in the peak seasons, although little research has been undertaken in this area.

Finally, in the area of biological-chemical technologies, plant breeding research has not adequately considered the seasonal labor requirements of existing systems in developing new varieties. By the use of varieties that change planting or harvesting dates, labor can be more effectively utilized and the likelihood increased that new varieties will be widely adopted.

4.4 Policy Issues

The foregoing evidence suggests that there are two major components of a strategy to increase output and employment in agriculture: (a) pricing

policy and (b) policies such as research, credit and extension to develop and diffuse appropriate technologies.

Factor price ratios are determined by the prices of labor and capital. While most African governments have enacted various minimum wage policies, they have had very little effect on the price of labor in agriculture. However, the price of capital has often been reduced by government policies. In particular, mechanization schemes operated by governments are nearly always heavily subsidized largely as a result of the high cost of operation of these schemes. From an economic viewpoint, most evidence indicates that these schemes are not profitable and there is a strong case for discouraging further expansion. However, both our Sierra Leonean and Ghanaian results suggest that tractor cultivation, but not combine harvestors, can be profitable in rice production in certain regions. In the Sierra Leone case, the extremely high costs of government tractor operation appear to be the problem. If tractor cultivation can be shown to be profitable, then the question of subsidizing tractor cultivation has to be weighed against subsidies on other inputs given the limited budget resources of governments.

Governments also reduce the price of capital by subsidized interest rates and overvalued exchange rates. However, only a relatively few large farmers benefit from these policies. At the same time, as demonstrated in the Sierra Leone fisheries industry, factor prices to small producers are biased against capital goods by import duties on small equipment such as hand tools and outboard engines and by interest rates in excess of 40 percent in the traditional money market. Governments should give serious attention to equalizing factor prices for small- and large-scale producers by revising import duties and raising institutional lending rates for credit. The higher interest rates would help to offset the higher cost of administering loans to small farmers. The

case studies have shown that changes in factor prices to more correctly reflect opportunity costs can affect the choice of technology. At the same time, however, we do not believe that policies should be implemented to artificially raise the costs of mechanization above the opportunity cost by, for example, placing a high import duty on tractors as is sometimes advocated.

Our research has shown that both biological and mechanical technologies have often emphasized extreme changes which may not be consistent with the factor endowments and seasonal labor profiles of small farmers. Given that planting and weeding are the labor bottleneck and that in many cases land is not particularly limiting, several types of technologies are suggested. First, even though fertilizer prices are currently high, most analyses indicate that it is highly profitable to apply fertilizer even for traditional crops, especially since the additional labor requirements at the peak season are minimal. However, although fertilizer is often heavily subsidized, the real price to farmers may be quite high because of its lack of availability in the villages. Second, improved seeds that do not necessarily require large inputs of complementary factors, such as water control, land preparation, and weeding labor, may also increase output through labor utilization at other than the peak season. Third, efforts to improve labor productivity at the peak season have a potentially high payoff, particularly in areas where labor limits the land area cultivated. The potential for tractor cultivation is limited to certain areas; and even there, often not profitable but improved hand tools, oxen power, small rotary tillers, weedicides, etc., are less expensive alternatives which all have potential.

It is clear that the above recommendations are contingent on the development of suitable technologies. This requires that the level of agricultural research be substantially increased and that this research be tailored to the

current cropping systems and production techniques of small farmers.[1] The micro-level research of this study provides a more comprehensive understanding of the small farmer to help in identifying potentially profitable technological developments consistent with current factor endowments of small farmers.

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1 For example, Norman [1973] notes that until recently research in Nigeria was based on sole cropping although most farmers grow crop mixtures.

5. CHOICE OF TECHNIQUE, EFFICIENCY AND EMPLOYMENT IN AGRICULTURAL PROCESSING[1]

In preceding chapters, we have described and analyzed the demand for labor in agricultural production. Agricultural processing activities also play an important role in rural employment and income generation in many African countries. Our research in Sierra Leone, for example, showed that about five percent of total rural employment is in rice processing [Spencer et al, 1976]. Moreover, a wide range of available technologies is used in agricultural processing. These range from labor intensive hand processing to large capital intensive mechanical processing technologies.

In this chapter, we analyze the choice of technology as it affects output and employment in agricultural processing industries. First, we present a theoretical framework for the analysis of the choice of technique in agricultural processing. We then describe the range of technologies in the agricultural processing industries; and finally, we analyze the potential efficiency, income, and employment effects of alternative policies for the agricultural processing industry under varying assumptions about factor and product prices.

5.1 Theoretical Framework

The wide range of technologies available and in use in agricultural processing have varying factor intensities and technical efficiences.[2]

The adoption of one technique, or a combination of techniques, in any

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[1] This is a condensed version of a seventy-six page report on rice processing by Spencer, May-Parker, and Rose, [1976]. For details, consult this report.

[2] Technical efficiency refers to the physical output per unit of input, e.g., units of clean rice per unit of husk rice and units of palm oil per unit of fruit.

country will have important effects on the level of aggregate employment and investment, as well as the level of output. The choice of technique must not be restricted to an examination of efficiency in engineering terms or financial costs of production. Policy makers also need information on the economic analysis of alternative techniques, as well as their employment implications. Timmer [1972] points out that economists have, until recently, given little attention to the employment aspects of interventions in processing and marketing. Studies in West Africa by Tempelman [1972], Oni and Olayemi [1975] and Rosenboom and Parker [1975] all analyze cost and returns in only one technique of rice processing (small rice mills) and make recommendations designed to help operators improve their financial rates of return. When researchers compare hand and mechanical processing techniques, they often condemn hand processing because of its assumed low technical efficiency. For example, the United States Department of Agriculture/Agency for International Development (USAID/AID) report on rice in West Africa [1968] stated:

> Most of the rice milled in West Africa is milled by producers by hand pounding with mortar and pestle. This is a slow process. It is inefficient because rice is lost in the pounding process and in winnowing or separating kernels from bran and chaff and the quality is poor.[1]

Timmer [1972] developed a methodology for analyzing the choice of technique in agricultural processing which gave explicit consideration to employment. He applied the technique to the Indonesia rice processing industry. Timmer constructed a unit isoquant in value added by each of five techniques including hand pounding. He then minimized the costs of production of one unit of value added in rice processing where costs include labor and capital costs of rice milling. In computing these milling costs, inputs as well as outputs were shadow priced at their economic opportunity costs. Such shadow pricing is

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[1] USAID/AID [1968, p. 21]

necessary because many developing countries have severe price distortions within their economies due to overvalued currency, government policies that regulate interest and wage rates, import quotas, and tariffs [Eicher et al., 1970]. These distortions result in misallocation of resources and, more particularly, lead to the choice of capital intensive techniques.

Timmer's [1972] framework, however, ignores the costs of assembling raw material from farmers prior to processing and costs of distribution of the final product to consumers. These assembly and distribution costs differ with the size and capacity utilization of the plant and the location of the plants relative to producing and consuming centers and could affect the optimal choice of technique. King and Logan [1964] have developed a linear programming transhipment model which solves for plant numbers and location by minimizing total costs, including costs of milling, assembly, and distribution. The King and Logan model can also be solved for cases in which there are economies of scale, and it is unrealistic to expect fractions of plants to be constructed.

This programming framework provides the basis for an analysis of rice processing in Sierra Leone. Total costs, including processing and assembly and distribution costs, are minimized. Corrections are made for factor and product price distortions by shadow pricing inputs and outputs. The effect of government policies, e.g., input sudsidy, output pricing, and tariff policies on aggregate employment, incomes, and output, are then explicitly measured.

5.2 Agricultural Processing Technologies in West Africa

Despite the wide range of agricultural processing techniques which are in use in Africa and the importance of this sector for employment and income generation, there are very few economic studies of the agricultural processing sector. Most existing empirical studies in West Africa have examined only one

processing technique. We are aware of only two comparative analyses of alternative agricultural processing technologies: Miller's [1965] analysis of oil palm processing in Eastern Nigeria and our study in Sierra Leone [Spencer et al., 1976].[1]

Miller presents data on five palm oil processing technologies: hand processing, the small screw press, the small hydraulic hand press, the large pioneer mill, and the major stork mill. Table 5.1 shows the size of operation, physical inputs, and relative efficiency of the five technologies. There was a great difference in labor and capital intensity of the five technologies. Labor use ranged from 9.2 person-day equivalents per cwt. of oil produced in hand processing to 0.7 for the major stork mill, while capital investment per firm in 1964 ranged from 1.4 pounds sterling in hand processing to 55,210 pounds sterling for the major stork mill. Table 5.1 also shows that the large mills were more technically efficient than the small labor intensive techniques. The quantity of oil per cwt. of fruit extracted ranged from .154 cwts. in hand pounding to .213 cwts. in the major stork mill.

In our study in Sierra Leone, we found a similar range of technologies in the rice processing industry [Spencer et al., 1976]. Four techniques are presently used to process rice: hand pounding, small steel cylinder mills, small rubber roller mills, and large disc sheller mills. A fifth technique, large rubber roller mills, is being considered for introduction into the country. Table 5.2 presents data on these five techniques. Again we see that

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[1] Goodwin's [1975] analysis of rice processing in Ghana considered only one technique of rice milling (multi-stage rice mills) -- various plant sizes being obtained by multiples of the basic unit. In Sierra Leone, Agrar-Und Hydrotechnik, a German consulting firm, recently completed a study of rice marketing in which alternative rice processing techniques were examined [Agrar-Und Hydrotechnik, 1973] but the input-output data used in their analysis are inaccurate. Consequently, the study is not discussed here.

TABLE 5.1
SIZE OF OPERATION, PHYSICAL INPUTS AND RELATIVE EFFICIENCY OF FIVE PALM OIL PROCESSING TECHNOLOGIES IN EASTERN NIGERIA, 1964

Technology	Capital Investment	Average Output Per Day	Technical Efficiency[b]	Labor Days[c] Per Cwt. of Oil	Efficiency Index[d]	
					Average Season for Each Tech.	150 Day Season for All Tech.
	(£)[a]	(Cwt. Oil)	(Cwt.)	(Days)	(%)	(%)
Average hand method	1.42	.2	.154	9.2	83	84
Average screw press	35.62	1.5	.154	3.8	92	93
Hydraulic hand press	556.10	2.8	.159	3.0	94	94
Pioneer oil mill	18,000.00	16.7	.172	1.1	95	90
Stork major mill	55,209.90	22.3	.213	0.7	87	71

SOURCE: Miller [1965, Tables 9.1 and 9.2].

[a] £ 1 = $2.80 in 1964.

[b] Cwt. of oil per cwt. of fruit.

[c] This includes all labor for an eight hour day including both unskilled and skilled labor at the average daily level of output. One man-day equals eight man-hours or one woman-day equivalent. One woman-day equivalent equals eight woman-hours of thirty-two child hours.

[d] Average revenue divided by average total cost (including assembly cost) multiplied by 100.

TABLE 5.2
SOME INPUT-OUTPUT RELATIONSHIPS FOR FIVE TECHNIQUES OF RICE PROCESSING IN SIERRA LEONE, 1974/1975

Technology	Capital Investment (Le.)[a]	Husk Rice Processed Per Hour (Cwt.)	Technical Efficiency[b]	Labor Days Per Ton of Rice Milled (Days)
Hand pounding	1.5	0.1	.684	33.9
Small steel cylinder mill	3,300.0	5.0	.675	1.3
Small rubber roller mill	5,000.0	5.0	.700	1.3
Large disc sheller mill	n.a.	40.0	.640	1.1
Large rubber roller mill	110,000.0	40.0	.720	.4

SOURCE: Spencer et al. [1976].

[a]Le 1.00 = $1.10 U.S. in 1974. Cost of equipment only, i.e., excludes building costs.

[b]Pounds clean rice per pound of husked rice.

hand processing is the most labor intensive technique and that the more capital intensive techniques have a large output per hour and are more technically efficent in terms of recovery of clean rice per unit of husk rice processed.

5.3 Effect of Alternative Policies on Employment and Incomes in Agricultural Processing

In his analysis of alternative technologies in the palm oil processing industry, Miller constructs an efficiency index defined as average revenue divided by average total costs (including assembly costs) multiplied by one hundred. Based on the similarity of this index for the screw press, hydraulic hand press, and pioneer mill, he recommended that investment continue in these three techniques. In what was an unusual analysis for the period, Miller also estimated the loss of rural employment in Eastern Nigeria that would result from a shift from exclusive use of one of the three optimum techniques to exclusive use of another. With reference to the framework of analysis we have presented, Miller's analysis suffered from two limitations: (1) no correction was made for distorted input and output prices, and (2) distribution costs of final products were not considered.

In a recent study in Ghana, Goodwin [1975] used a modification of the King and Logan linear programming model, as well as mixed integer programming models, to examine the effect of factor price distortions on the optimum size and location of rice milling plants in northern Ghana. Goodwin found that distortions in the factor markets (the low financial cost of capital and the overvalued exchange rates) encourage larger and fewer plants and therefore lower employment than is optimal for the economy considering the social welfare costs of national resources as measured by the shadow price of capital, the shadow foreign exchange rate, and the shadow wage rate. Within our framework of analysis, the major limitation of Goodwin's study is that he only considered

one technique of rice milling (multi-stage rice mills), various plant sizes being obtained by multiples of the basic unit at each of the thirty-nine locations considered.

In our study of the rice processing industry in Sierra Leone, we applied the theoretical framework developed earlier. We developed a continuous linear programming model and used it to determine the effects of alternative policies on the optimum technique, size, and location of rice processing facilities and their effect on efficiency, employment, and incomes in the rice processing industry. The model incorporates five techniques of rice milling (Table 5.2) at each of ten possible regional locations. Assembly and distribution costs are explicitly introduced. A full specification of the model is given in Spencer et al. [1976].

Table 5.3 shows the results of using the model to test the effect of (a) continuation of present policies, i.e., cheap capital in combination with high rice prices, and (b) a strategy that raises the cost of capital closer to its social opportunity costs in the face of reduced rice prices.

If Sierra Leone continues present policies of low interest rates (10 percent) and high rice prices, than all hand pounding would be eliminated and the small and large rubber mills would dominate because they would minimize total costs of milling, assembly, and distribution. However, this strategy would eliminate hand pounding and as a result over 40,000 man years of employment and incomes in rural areas. Moreover, although the higher technical efficiency of the rubber mills enables rice to be exported, the large foreign exchange costs of these mills produces a net loss in foreign exchange. If Sierra Leone shifts to new policies where capital is shadow priced at its estimated opportunity cost of 20 to 35 percent and rice prices are at 60

TABLE 5.3
PREDICTED NUMBER AND TYPE OF PROCESSING FACILITIES, EMPLOYMENT AND INCOMES IN RICE PROCESSING UNDER ALTERNATIVE POLICIES IN SIERRA LEONE

	Actual (1974) Situation	Present Policies Continued[a]	New Policy[b]
Number of firms			
Hand pounding[c]	40,807	0	35,757
Small steel mills	110	0	0
Large disc mills	0	0	0
Small rubber mills	30	498	236
Large rubber mills	0	36	0
Employment (000 man-days)			
Rural unskilled (hand pounding)	12,242	0	10,727
Urban unskilled (mills)	1	34	2
Urban skilled (mills)	35	163	59
Total	12,278	197	10,789
Incomes[d] (Le 000)			
Rural unskilled (hand pounding)	4,774	0	4,185
Urban unskilled (mills)	1	35	1
Urban skilled (mills)	35	182	57
Total	4,810	216	4,243
Net foreign exchange costs (Le million)	2.49	3.64	1.90
Rice imports (000 tons)	5.06	0.00	3.12
Rice exports (000 tons)	0.00	5.90	0.00

SOURCE: Spencer, May-Parker and Rose [1976, Table 18].

[a] 10 percent interest rate, high rice price.

[b] 35 percent interest rate, 20 percent increase in price of foreign exchange, low rice prices.

[c] Man-years.

[d] Wages of people employed.

percent of 1974 prices (the expected price in 1980), large mills drop out of the solution completely (Table 5.3). The number of small mills in the solution is reduced from 498 to 236 and the amount of hand pounding is only slightly reduced from the run simulating actual 1974 conditions. Shadow pricing foreign exchange further reduces the number of small mills in the solution and increases hand pounding.

Further runs of the model not shown in Table 5.3 lead to the following conclusions: [Spencer et al., 1976].

1. Rice prices have more effect on the number of large mills in the optimum solution than the rate of interest because with high rice prices the technical efficiency of the large mills, in terms of higher out-turn of rice, is accentuated. With lower rice prices and low interest rates, small rice mills predominate.

2. The number of large mills in the optimum solution is highly dependent on the technical efficiency of their operation. Even with high rice prices, low interest rates and 100 percent capacity utilization, a 2 percent drop in technical efficiency from 72 to 70 percent removes all large rubber roller mills from the solution.

3. The small steel cylinder mills and the large disc-sheller mills are not included in any of the unconstrained optimum solutions because they are not competitive with either small rubber roller mills, large rubber roller mills, or hand pounding. This indicates that they are less efficient under all circumstances investigated and are likely to decline in the future.

A major finding of this research is that employment and incomes in rural areas will be drastically reduced if the government of Sierra Leone pursues policies which make capital available at interest rates lower than the social opportunity costs of capital which is in the range of 20 to 35 percent. For example, our model shows that if private or quasi-government mill operators obtain capital at an interest rate of 10 percent, the equivalent of up to 40,000 full-time jobs will be lost because small and large rubber mills will replace hand pounding.

Since a stated objective of the Sierra Leone government is to increase the level of rural incomes and maintain rural employment, we recommend that govern-

ment policy should require investors to pay an interest rate on borrowed capital close to the opportunity cost of capital of 20 to 35 percent. Such discount rates should also be used in appraisal of large rice mill investment projects.

Development policy for the rice processing industry should concentrate on investment in hand processing and small rubber roller mills in order to reduce processing costs and maintain employment. Further investment in reactivation of the old disc-sheller mills is unjustified. Investment in new large rubber roller mills would only be justified if they would operate at full capacity (20 hours per day for 200 days per year) and achieve clean rice recovery rates of 72 percent and rice prices remain high. Since this level of capacity utilization and recovery rates would be difficult to achieve in practice and since rice prices are likely to fall from 1974 levels policy makers are urged to tread carefully on this issue.

We have presented evidence in this chapter that there are a range of techniques of varying labor intensities for processing oil palm and rice in West Africa. The choice of technology is sensitive to relative factor prices. However, there are two important factors in addition to capital-labor substitution in the choice of technique in agricultural processing. First, the technical efficiency of processing plants usually increases from hand pounding to larger mechanized processing technologies. Because of this variation product prices will also affect choice of technology. Second, assembly and distribution costs of products increase with the larger, more capital intensive firms. The importance of this effect is determined by the relative density of producers and consumers of a commodity.

The consideration of all these factors in the Sierra Leone rice processing study shows that no one technique, but rather a mix of technologies, may

be optimal to minimize processing costs. However, the results of the Sierra Leone study are quite sensitive to factor and product prices. Nonetheless, when factors and products are priced at their opportunity cost, there is little conflict between the objectives of increased employment and reducing costs.

6. THE ROLE OF SMALL-SCALE INDUSTRIES IN EMPLOYMENT AND RURAL DEVELOPMENT[1]

Small-scale industries play an important role in employment and rural development in African countries. African governments have recently become increasingly aware of and concerned with the importance of designing effective strategies and policies for developing their rural and urban small-scale industries. Unfortunately, both the analytical framework and the empirical data required for this task have been seriously deficient. The conventional two sector development models of Lewis [1954], Fei and Ranis [1964], Harris and Todaro [1970], and Mellor and Lele [1972], for example, do not explicitly consider the small-scale industrial sector. Indeed, only recently have researchers such as Oshima [1971], Hymer and Resnick [1969] and Byerlee and Eicher [1972] pointed out the importance of including small-scale industries as a separate and distinct sector for analytical purposes.[2] The analytical deficiencies with respect to the small-scale activity are reinforced by the general lack of empirical data on this sector. As Morawetz [1974] commented in his recent review of the industrialization literature, "...remarkably little is known about its [small-scale industry] composition and characteristics." This is particularly true of those industries located in rural areas of Africa.

In this chapter, the existing empirical and analytical evidence relating to the role of small-scale industry in employment and rural development will be examined. The empirical evidence with respect to the magnitude and composition of small-scale industry in tropical Africa will first be examined. There will then follow an analysis of the major determinants

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[1]This is a condensed version of a 129 page report on small-scale industry by Liedholm and Chuta [1976]. For details, consult this report.

[2]The recent development of the concept of "informal sector" (see I.L.O. [1972]) and the "intermediate sector" (see Steel [1977]) also reflect this concern.

of the demand for small-scale industry output. The production functions and alternative production techniques within each industry will be examined next to shed light on the corresponding demand for labor. The chapter will conclude with an examination of the policy recommendations with respect to small-scale industries.

In view of the general paucity of information, the chapter, of necessity, must draw heavily from the results of our Sierra Leone small-scale industry research [Liedholm and Chuta, 1976]. A two-phase survey was conducted in order to obtain data on these industries in Sierra Leone.[1] In Phase 1, which began in March 1974, a census of Sierra Leone's small-scale industry sector was undertaken to estimate the population or the total number of small-scale industrial establishments in the country. Phase 2 was designed to generate more detailed economic data from a selected sample of 366 industrial establishments over a one-year period--August 1974 to July 1975. Since these firms generally kept no accounts, it was necessary to collect data from them twice-weekly during this period.

6.1. Magnitude and Composition of Small-Scale Industries

Small-scale industrial[2] establishments provide an important source of employment in tropical Africa. The available evidence indicates that the small-scale establishments, defined in this study as

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[1] See Chuta and Liedholm [1975] for details of the survey procedure.

[2] The "industries" examined in this study include only those establishments that specifically engage in the production and repair of "manufactured goods" and thus excludes those establishments engaged in mining, construction, trading, transport, financial, social and personal services. Agricultural processing is also excluded since it is analyzed in a separate study. For a more extensive discussion of the industry definition, see Chuta and Liedholm [1975, p. 8].

those employing less than fifty persons,[1] account for the vast majority of the industrial sector employment. Typical examples are found in Sierra Leone where small-scale firms generated 95 percent of the employment in the industrial sector [Liedholm and Chuta, 1976, p. 9] and Nigeria where they generated over 70 percent of the industrial employment [Aluko, 1973].

An even more striking finding is the indication that the bulk of the small-scale employment occurs in rural areas. In Sierra Leone, for example, approximately 80 percent of the industrial employment is in localities with less than 2,000 persons [Liedholm and Chuta, p. 9]. The importance of small-scale industries in rural areas is reinforced by an examination of the composition of the labor force in these rural areas. In Sierra Leone, 7.6 percent of the males in localities with less than 2,000 inhabitants stated that their primary occupation was manufacturing (Table 2.3, Chapter 2). Moreover, in the rural villages of Western Nigeria, 12.6 percent of the males were primarily engaged in manufacturing activities [I.L.O., 1970, p. 117]. These results thus reflect the importance of rural industries and point to the need to ensure that rural industries are incorporated into both industrial and rural studies in tropical Africa.

The general composition of activities undertaken within the industrial sector is quite similar in tropical Africa. In terms of employment, tailoring is consistently the most important activity, usually constituting over 25 percent of the small-scale industry employment.[2] Carpentry,

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[1]For a more complete discussion of the small-scale industry definition, see Chuta and Liedholm [1975, p. 9].

[2]For a review of the relative importance of tailoring in other countries, see Liedholm [1973, p. 8]. Typical examples of the position of tailoring are found in the studies of rural Western Nigeria, 26 percent [I.L.O., 1970, pp. 187-188]; Eastern Nigeria, 32 percent [Kilby, 1962, p. 6] and Accra, 33 percent [Steel, 1977]. One of the highest percentages is urban Western Nigeria, where 51 percent of the firms engage in tailoring [Industrial Research Unit, 1972, p. 41].

blacksmithing, baking and repair activities are also large sources of employment in this sector, although they all tend to follow tailoring in importance by quite a wide margin.

The relative importance of these activities, however, varies importantly with location. The more traditional activities such as blacksmithing, weaving and mat-making, are relatively more important in rural areas, while the more modern activities such as tailoring, vehicle repair and metal repair are more important in the urban areas. In Sierra Leone, for example, tailoring accounts for 29 percent of the industrial employment in rural areas and 46 percent in urban areas [Chuta and Liedholm, 1975, p. 17]. These results thus reinforce the importance of distinguishing between rural and urban small-scale industries and point to the dangers of making predictions about rural industries on the basis of urban industrial surveys alone.

With this perspective on the relative importance and composition of small-scale industries in tropical Africa having been presented, it is now important to focus on the major determinants of the demand for labor in these industries.[1] The demand for labor is, of course, a derived demand and is importantly related to the demand for the products of small-scale industry. The components of this product demand must thus be examined.

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[1]For details of the analytical framework, see Liedholm [1973] and Chuta and Liedholm [1975].

6.2. Demand for Small-Scale Industry Commodities

There are three principal sources of demand for the products of small-scale industry. The primary source is that demand generated from the incomes of rural and urban consumers. A second source of demand arises from the backward and forward production linkages with the agricultural and large-scale industrial sectors. The final important source of demand for the products of small-scale industry is that provided by the foreign or export sector. Each of these demand sources will now be examined.

The income elasticity of demand is one of the crucial parameters required for analyzing the linkage between rural and urban incomes and the quantity of small-scale industry products demanded. Indeed, both the magnitude and sign of the income elasticity demand coefficients for small-scale industrial products are central figures in the debate over the future role of these activities. Hymer and Resnick [1969] argue forcefully that in the rural areas the products of local small-scale industries (Z goods) are "inferior" goods and thus that the demand for and production of these goods will decline as rural incomes rise.

The available empirical evidence, however, indicates that the income elasticity of demand for these products are not only positive, but rather high. The rural consumption component of the Sierra Leone project, which is described in Chapter 3, has found that the expenditure elasticity coefficient for all small-scale industry products in Sierra Leone was approximately 0.9. Moreover, except for the consumer goods produced by the blacksmiths, the elasticities of demand for each of the major small-scale industry products in Sierra Leone were above one (see Table 7.3 and Liedholm and Chuta [1976, p. 60]). Leurquin's [1969, p. 313] Ruanda-Urundi study, which is the only other consumption survey in Africa that distin-

guished between small-scale, large-scale and imported industrial products,[1] also indirectly reveals that the income elasticity of demand for small-scale industrial goods are positive. Consequently, these goods generally are not "inferior" and rather than being viewed as an overriding constraint, the demand induced from rising incomes should be viewed as a positive force for the growth of small-scale industry in tropical Africa. Indeed, the demand for these products should be expected to increase strongly as rural and urban incomes increase.

A second important source of demand arises from the backward and forward production linkages with the agricultural sector.[2] The backward linkages from agricultural processing, for example, are quite extensive as the preceding chapter has revealed. The forward linkages from small-scale industry to the agricultural sector are also of some importance in tropical Africa. Many of the products of the blacksmithing industry are destined for use as farm inputs. Our Sierra Leone study reveals, for example, that approximately one dollar of domestic blacksmithing output, primarily in the form of matchets, hoes, knives and axes, was demanded for every one hundred dollars of agricultural output [Liedholm and Chuta, 1976, p. 64]. Indirect evidence of the importance of locally produced farm inputs are also noted in studies of Ethiopia [Kartsen, 1972] and Zambia [Bessell and Roberts, 1971]. Thus, the agricultural sector does provide an important source of intermediate demand for small-scale industries in many areas of tropical Africa.

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[1] There have been numerous consumer expenditure surveys in tropical Africa (see Liedholm [1973] for a review of some of these), but, except for the two surveys mentioned in the text, none have distinguished the commodities by origin of production.

[2] The available empirical evidence indicates that the linkages with the large-scale industrial sector are currently rather limited in tropical Africa (see Liedholm and Chuta [1976, p. 62]).

The final source of demand for the products of the small-scale industrial sector is the export or foreign market. Huddle and Ho [1972], for example, have argued that the international demand for traditional goods produced by small-scale industries is quite high. Indeed, their study indicated that the income elasticity of demand in high income countries for a broad group of culturally oriented products was greater than one. Our Sierra Leone survey indicates that there is an important international demand for the products of the gara dyeing industry, where 18 percent of the production of that industry was exported. Thus, failure to include the export market in an analysis of the demand for the products of small-scale industry may understate the existing and potential market size.

In summary, the analysis of the three major sources of demand for the small-scale industries indicates that the existing and potential market for the products of small-scale industry is strong and provides little support for the contention of Hymer and Resnick [1969] that the demand for and supply of these products will necessarily decline as income and output increase.

6.3. Choice of Technique and the Demand for Labor

These output demands for small-scale industry commodities are subsequently transformed into a demand for labor through the production function. An examination of both neoclassical production functions and alternative production processes can thus provide useful insights into the choice of techniques and the nature of the demand for labor in small-scale industries. The results of the neoclassical production function analysis undertaken in our Sierra Leone study [Liedholm and Chuta, 1976, p. 70], indicate, for example, that there is no evidence of increasing

returns to large-scale production in the various industrial categories examined; thus relatively large firms possess no apparent production advantage over the relatively small industrial firms. A similar result was reported for industries in Eastern Nigeria [Liedholm, 1966]. Moreover, the neoclassical production function analysis in our Sierra Leone study also reveals that the marginal productivities of all the labor groups, including apprentices, are positive. The marginal productivities of proprietors and hired workers, however, are significantly higher than those of the apprentices. There is also evidence that the marginal productivity of the hired workers is remarkably similar to the wage rate in Sierra Leone, thus suggesting that a high degree of allocative efficiency exists within this sector. Finally, the neoclassical analysis reveals that the opportunity for factor substitution between capital and labor exists within each industry.

The analysis of the alternative production processes available within each industry in our Sierra Leone study also indicates that at least two process or production technique choices exist within each major small-scale industry. An examination of Table 6.1 reveals that the factor or input proportions of these processes or techniques are found to differ significantly from one another. Moreover, the more "traditional"[1] processes within each small-scale industry are not only more labor intensive (i.e., possess higher labor-capital ratios), but also possess higher output-capital ratios than do the more "modern" small-scale industrial processes. The more "traditional" processes thus generate both a higher

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[1]The terms "traditional" and "modern" do not necessarily accurately portray the technique used. For a complete description of these processes, see Liedholm and Chuta [1976]. As an example, however, "traditional" bakers use mud ovens while "modern" bakers use electric ovens.

Table 6.1
SIERRA LEONE: MEAN VALUES OF THE OUTPUT-CAPITAL, OUTPUT-LABOR, AND LABOR-CAPITAL RATIOS BY PROCESS FOR MAJOR SMALL-SCALE INDUSTRY CATEGORIES, 1974/1975

Industrial Categories[a]	Output-Capital	Output-Labor	Labor Capital
Tailors			
"Traditional"	7.5	.46	18.3
"Modern"	6.2	.55	14.0
Gara dyers			
"Traditional"	82.7	.84	98.0
"Modern"	72.1	.97	70.0
Carpenters			
"Traditional"	29.6	.61	68.1
"Modern"	3.0	.98	3.6
Blacksmiths			
"Traditional"	11.9	.36	42.1
"Modern"	.5	.25	2.1
Baking			
"Traditional"	27.8	.40	68.0
"Modern"	5.0	1.18	5.9

SOURCE: Liedholm and Chuta [1976, p. 81].

[a]Includes both randomly and purposively sampled firms in those localities with 2,000 or more inhabitants.

output and a larger amount of employment per unit of the relatively scarce factor, capital. Consequently, there appears to be no conflict, at least in a static sense, between output and employment when choosing between industrial processes in Sierra Leone.

There are also important differences in the factor proportions between the small-scale industry groups. Among the "traditional" processes in Sierra Leone, for example, the gara dyeing, carpentry and baking industries possess the highest output-capital and labor-capital ratios, while tailoring and blacksmithing possess the lowest. Thus the output-employment conflict also disappears even between the small-scale industry groups.

The factor proportions also appear to vary significantly by location. The output-capital and labor-capital ratios in our Sierra Leone study increase as the size of localities declines and reach their maximum values in those localities with 2,000 to 20,000 inhabitants. Both ratios are lower in the smaller villages, however, due importantly to the part-time nature of small-scale industrial activity in these locations. The importance of incorporating location in small-scale industry analyses is thus once again demonstrated.

The factor proportions in the industrial sector in tropical Africa also vary significantly with the size of firm. The available evidence indicates that the labor-intensity of the small-scale industries is substantially higher than that of the large-scale industries. In Steel's study of industries in Ghana [1977], for example, the firms with no wage workers possessed an original cost of capital per workers of $435, while those firms with over one hundred workers possessed approximately $9,000

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[1]Gara dyeing is a form of cloth tie-dyeing.

per worker. In Sierra Leone [Liedholm and Chuta, 1976], the capital per worker for small firms was only $418 and rose to $7,318 for those large firms with fifty or more workers.[1] Moreover, the evidence from Ghana [Steel, 1977], Kenya [Child, 1973] and Sierra Leone [Liedholm and Chuta, 1976] indicate that the output-capital ratio for small-scale firms is above that of the large-scale industries. Thus, since the small-scale industries are shown to generate more employment and output per unit of capital than do their large-scale counterparts, it would appear that small-scale industries generate the maximum industrial output and employment per unit of scarce capital.

An examination of the economic profit generated by small-scale industries reinforces the findings derived from the factor proportion and production function analyses. The small-scale processes and industries possessing the highest labor-intensities and average capital productivities in our Sierra Leone study [Liedholm and Chuta, 1976], also tend to generate the highest rates of economic profit. Thus, these ratios may be useful substitutes when profit figures are not available.

A particularly striking finding, however, is the indication that economic profit rates in small-scale industries in tropical Africa may be quite high. Child [1973] reports that the medium gross profit as percent of the total capital stock in rural Kenyan small-scale industries is approximately 75 percent. Similar results are reported in our Sierra Leone study [Liedholm and Chuta, 1976. With the exception of "modern" blacksmithing, all the small-scale industries and

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[1] Child's study of rural industry in Kenya [1973] reports a ratio of $795 for the small rural industries he studied; the comparable ratio estimated for all the "modern" sector activities, including industry, was approximately $9,000.

processes in Sierra Leone generate a positive rate of "economic profit"; thus, except for the "modern" blacksmiths, all the major types of small-scale industries and processes in Sierra Leone must be considered to be economically viable. "Traditional" and "modern" gara dyers, "traditional" carpenters and "traditional" bakers generated the highest rate of economic profit, exceeding 100 percent in each instance and were thus deserving of particular attention within Sierra Leone.

These studies have thus indicated that significant processes as well as size choices exist within the industrial sectors in tropical Africa. The small-scale industries, and generally the more "traditional processes", are found to be not only more labor intensive but also more effective in the utilization of scarce capital than their large-scale or more "modern" counterparts.

6.4. Policy Recommendations

In view of the strong economic justification for small-scale industries, the major policies that either directly or indirectly influence small-scale industry deserve attention. The two major policies designed to influence directly these industries, credit and training schemes, will be considered first, followed by an examination of several policies that indirectly affect small-scale industries.

The provision of capital or credit is one of the most commonly utilized methods of directly affecting small-scale industries. It is thus of importance to ascertain the need for such a policy measure and the form it might most effectively take. The small-scale industry studies in Sierra Leone [Liedholm and Chuta, 1976], Ghana [Steel, 1977] and Kenya [Child, 1973] reveal that self-financing has been of over-

whelming importance in this sector.[1] The crucial question is whether the extensive use of self-financing reflects an underlying capital shortage and a corresponding need for improved access to credit through the formal financial system. The small-scale entrepreneurs themselves will generally argue that the shortage of capital and credit is one of the primary constraints they face. Indeed, approximately two-thirds of the entrepreneurs interviewed in our Sierra Leone small-scale industry study felt that the shortage of capital or credit was the "greatest difficulty encountered in their business". It is of importance to ascertain whether the perceived difficulty was real or whether it was simply an easy response to give the interviewer.

There is, for example, some force to the contention that capital and credit may not be a crucial constraint for small-scale industry. The initial capital requirements for small-scale industries are generally quite modest. In rural Kenya the modal initial investment was less than $75 [Child, 1973], while in Sierra Leone, the mean initial investment in all the major small-scale industries did not exceed $90. Moreover, the results of analyses of enterpreneurial characteristics undertaken in both Nigeria [Harris, 1971] and Sierra Leone [Liedholm and Chuta, 1976] indicate that firms with access to only small amounts of initial capital were as successful in generating economic profits as those with larger amounts of initial capital. In addition, the Sierra Leone analysis also revealed that those firms that expanded with only reinvested profits were apparently more successful in generating high levels of economic profits than those that had access to outside funds.

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[1] Approximately 80 percent of the funds used to establish these industries came from personal and family savings, while generally 90 percent of the funds required for expansion were reinvested profits.

Finally, there is evidence that excess capacity exists in the major small-scale industries examined in Sierra Leone [Liedholm and Chuta, 1976], Ghana [Steel, 1977] and Nigeria [Harris, 1971]. These findings, while not conclusive, provide some support for the contention that capital may not necessarily be the overriding constraint facing small-scale industry.

These considerations, however, do not necessarily obviate the need for policies designed to improve the small-scale industry's access to the formal credit market. The capital market in most African countries is highly "fragmented" with artifically low rates existing on credit from the commercial sources and unduly high rates existing on that credit available from sources in the noncommercial sector. Since relatively low ceilings on the interest rates exist in most commercial banks for even their most risky loans, it is not surprising that they tend to limit their lending almost exclusively to their traditional customers in the trading sector and have made very few loans to manufacturing establishments. There are, however, only a few countries in tropical Africa that have made any extensive efforts to develop formal institutional mechanisms outside the commercial banking system for making credit available to small-scale firms.[1] It would thus appear to be important to develop improved institutional mechanisms to increase the access to credit for small-scale industries.[2]

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[1]Kenya (through the Joint District Loan Board and the Kenya Industrial Estates), Senegal (through S.O.N.E.P.I.), Cameroon (through the Banque Camerounaise de Developpement), the Ivory Coast (through the Credit de la Cote D'Ivoire and Nigeria (through the Small Industries Credit Scheme) have made attempts to develop new methods to deliver credit to small-scale firms. Several countries (including Sierra Leone, Ghana, Nigeria, Ivory Coast, Senegal and Zaire) have used credit guarantee schemes, but the majority of loans have been for trading rather than manufacturing (see Liedholm and Chuta, 1976].

[2]Several useful suggestions with respect to the relevant institutional mechanisms are found in I.B.R.D. [1974].

There is considerable force to the argument, however, that this credit to small-scale industries should be provided at higher rates of interest than are currently being charged by the commercial banking system. It has been pointed out earlier, for example, not only that small-scale industries generate a high rate of "economic" profit but also that "process choices" exist within the major small-scale industries. Thus an unduly low or subsidized rate of interest may result in more capital intensive processes and industries being established than would be the case with interest rates that reflected more closely the opportunity cost of capital.[1]

There is also evidence to indicate that policies designed to improve the technical and managerial skills within the small-scale industry sector can be effective. The apprenticeship system serves as the primary vehicle for providing technical training in small-scale industry. In Sierra Leone, for example, 42 percent of the small-scale industry workers were apprentices [Chuta and Liedholm, 1975]. Moreover, the vast majority of the proprietors in Kenya [Child, 1973], Sierra Leone [Liedholm and Chuta, 1976] and Nigeria [Harris, 1971 and Callaway, 1967] had previously served as apprentices and few had received any formal vocational training. The level of formal education of the proprietor appears to vary quite widely in tropical Africa, ranging from Sierra Leone, where only 23 percent possess any formal education, to Kenya [Child, 1973] and Nigeria [Harris, 1971], where over 75 percent possess some formal education. Yet, analyses in both Sierra Leone [Chuta and Liedholm, 1976]

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[1]The results of a linear programming model of small-scale industry in Sierra Leone indicates that changing the opportunity cost of capital does tend to alter the intensities of the "processes" that operate [Chuta, 1976].

and Nigeria [Harris, 1971] have indicated that there was no correlation between the economic profitability of the firm and the formal education of the proprietor. Unfortunately, no information exists about the relative cost and benefits of alternative methods of providing technical training.[1] In view of the importance and ubiquity of the apprenticeship system, however, some attention should perhaps be paid to programs designed to upgrade and expand the existing apprenticeship system.

In addition there is some evidence to indicate that policies designed to provide managerial training may be of some value. The majority of small-scale industry proprietors do not keep even a rudimentary set of books or accounts. Moreoever, the results of our analysis of proprietors in Sierra Leone has indicated that a high positive correlation existed between those firms that keep books and the level of "economic" profits. Thus policies designed to improve both technical and managerial skills may be of importance. The exact specifications of these as well as other policies, however, will require more detailed studies of the individual small-scale industries themselves.

There are also numerous policies that have an indirect impact on small-scale industries. Fiscal, monetary, and wage policies, for example, or policies designed primarily to affect agriculture, large-scale industries, and the infrastructure will also have an influence, often unintended, on small-scale industrial firms. Fiscal policies, particularly as reflected in tax incentive ordinances and the import duty structure often tend to discriminate against small-scale firms. Policies designed to expand the infrastructure, on the other hand,

[1] Research currently being undertaken in Nigeria by W. Mabawonku is attempting to quantify the costs and benefits of alternative methods of small-scale industry training.

may have a differential indirect effect on small-scale industries, providing a positive benefit to some small-scale industries and having a negative impact on others. As a final example, policies designed to increase agricultural output and incomes generally have an important positive, though indirect, influence on small-scale industries. These effects will occur because, as our Sierra Leone study demonstrates, the agricultural and small-scale industrial sectors are closely linked to one another through both income and production linkages. These results point to the importance of incorporating these indirect effects into the evaluation of alternative policies or programs.[1] They also highlight the important role that small-scale industries play in employment and rural development in tropical Africa.

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[1]For a more detailed discussion of these indirect policy effects, see Liedholm and Chuta [1976].

7. RURAL AND URBAN LABOR MARKETS AND RURAL-URBAN MIGRATION[1]

The previous chapters have focused on the demand for labor in rural and urban small-scale sectors and the demand for the output of these sectors. We now turn to a discussion of the rural and urban labor markets, and rural-urban migration as the linkage between these labor markets. Rural-urban migration is of major importance in African countries not only as a linkage between rural and urban labor markets but also as a major process of structural transformation in countries which are experiencing rapid rates of urbanization. Hence a major part of this chapter deals with the characteristics and process of rural-urban migration in Africa.

7.1. Theoretical Framework

The analysis of rural-urban labor market interactions depends on an adequate understanding of migration decision making. In Figure 7.1 we present a schema for viewing the decision to migrate. Factors affecting the migration decision can be conveniently segmented into (a) monetary costs and returns relating to incomes and employment in the rural and urban labor markets and (b) nonmonetary costs and returns relating to risk, attitudinal characteristics, social ties and expectations. Also a distinction is made between actual and perceived returns to migration according to the availability of information on urban life.

The monetary benefits of migration are determined by differences in incomes determined in the rural and urban labor market. However measuring rural incomes to an individual is difficult where work and

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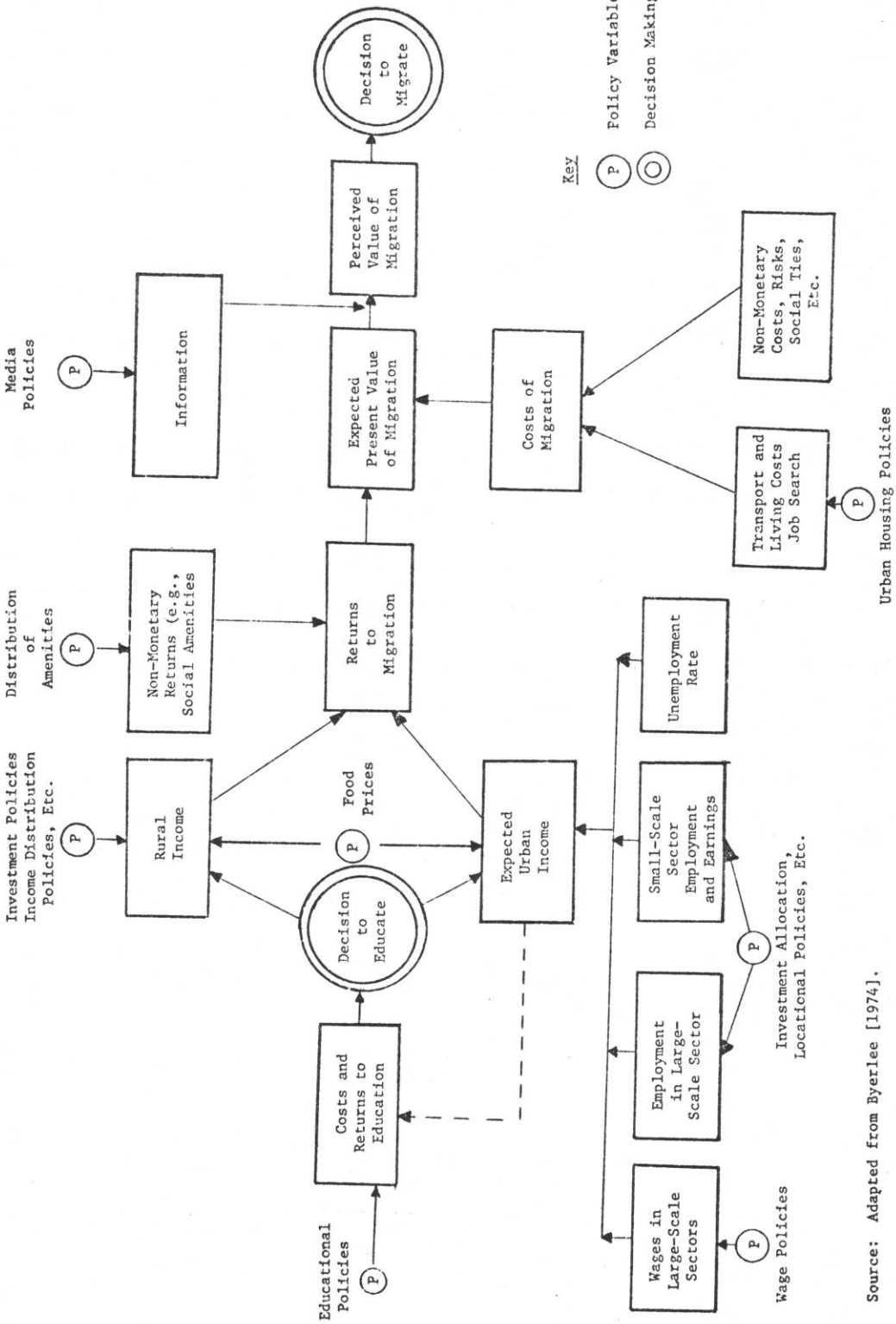
[1] This is a condensed version of a 113 page report on migration by Byerlee et al. [1976]. For details, consult this report.

FIGURE 7.1. A SCHEMA OF THE DECISION TO MIGRATE



Source: Adapted from Byerlee [1974].

income is shared by a household [Knight, 1972]. Nonetheless a useful measure of foregone income is the marginal productivity of labor which depends on the age and sex of the migrant as well as a host of other variables such as capital stock and technology. If the rural labor market is functioning efficiently the MVP of rural labor is approximated by the rural wage rate.

In the urban labor market, the schema in Figure 7.1 follows Todaro's [1969] expected income model which is based on the probability that a migrant will obtain a job in the large-scale sector with a high wage or alternatively remain unemployed. The probability that a migrant will be absorbed in the urban traditional sector with lower wages is however explicitly recognized in our schema. There are also nonmonetary returns to migration, particularly the benefits from improved social amenities such as schools and hospitals and attainment of higher social status.

Costs of migration include the transport costs of moving, the opportunity costs of looking for a job in the urban area, the higher cost of living in urban areas and the cost of "setting up house". This latter cost can be greatly reduced by the presence of friends and relatives in urban areas. Finally, there are also costs that cannot be readily measured in monetary units, particularly the cost of breaking old and establishing new life styles which is most acute for older people.

Education enters into the migration decision in various ways. First it may increase a migrant's access to knowledge of urban areas. Second it may enable migrants to derive additional value from urban life styles (and perhaps devalue rural life styles). Finally and most

important there is ample evidence that despite urban unemployment, the wage rates for educated persons are considerably higher in urban areas than rural areas (e.g., Todaro [1971], Sabot [1971], Hutton [1973]). An important issue is the extent to which education affects the decision to migrate through each of these three mechanisms.

It is also essential for long run analysis of migration to understand who gets educated -- that is, we need to look also at the decision to educate. Again a costs-returns framework is a useful analytical device providing account is taken of how these costs and returns vary with individuals. It is generally true that the costs of education are relatively lower for high income families because of their ability to sacrifice present consumption for investment in education. Thus higher income households invest more in the education of their children [Kinyanjui, 1974; Mbilinyi, 1974].

The difference between costs and returns to migration is the expected present value of migration. However the migration decision is based on the perceived value of migration which differs from the actual value depending on the information available to rural people on the urban labor market. Although it is generally recognized that informal channels are the most important sources of information there is little evidence on the quality of the information received by rural people before migrating.

From this schema it can be hypothesized that migrants will often be young since their time horizon for reaping the benefits of migration is longer and the cost of breaking old and establishing new life styles is less for young people. Moreover it is convenient to distinguish

between the educated and the uneducated in this stream. The significance of this for policy purposes is that we hypothesize that uneducated migrants are likely to conform to the conventional notion that urban migrants originate in poor rural households and in poor regions of the country, whereas educated migrants tend to originate in higher income rural households and more developed sections of the country with long established educational institutions.

7.2. The Rural Labor Market

It has previously been shown in Chapter 2 that the bulk of labor in African small farms is provided by unpaid family labor. However, about 20 percent of all labor is hired so an active labor market does exist with a well defined wage rate. Since this wage rate can be related to variables such as sex and season, it is used in the analysis of the rural labor market rather than returns to family labor.

In estimating wage rates in rural areas some difficulties are incurred in valuation since the majority of payments are in kind (particularly meals) rather than cash. The most comprehensive evidence on rural wages is provided by some 17,000 observations in our nationwide survey in rural areas of Sierra Leone [Spencer and Byerlee, 1976]. In this sample only one-third of the payments included a cash payment. The most common payment was a meal which was valued according to the farmer's assessment of the costs of providing the meal.

In the Sierra Leone survey analysis of variance procedures were used to analyze the effects of labor type by age and sex, season and region on wage rates. When labor was classified into three groups --

men, women and children -- men consistently had the highest wage rate. On the average, men had a wage rate of Le 0.59 per day or one-third above women and twice as high as for children. There was some evidence that this differential was largely due to differences in tasks performed by men and women. Significantly in one area where mechanical cultivation is extensively practiced and most work is confined to planting and harvesting the wage rate for women was equal to men.

The wage rate in the Sierra Leone sample also showed a distinct seasonal variation. In general, a seasonal peak occurred at the planting-weeding period in June to August. At this period labor demands are at a peak and since most hired labor was provided by neighboring farmers, the wage rate increases to accommodate this scarcity. A smaller peak also occurs in December, the peak of the harvest season. Significantly also a peak often occurred in February and March which for most regions is the slack season. It is possible that with cash in hand after the sale of farm produce the supply price of labor increases at this period.

Evidence of sex and seasonal variations in wage rates from other African countries is limited. In Kenya the rural wage for women is also observed to be less than men being 83 percent of male wages on small farms and 63 percent of males wages on large farms [ILO, 1972, p. 77]. However, seasonal variations in wage rates were not investigated. In the north of Nigeria, Norman [1973] examined wage rates by season and found no evidence of seasonal variations although there was clearly a very pronounced peak season in labor demands. Norman speculated that at this period farmers may not have the cash available to hire labor

therefore reducing demands for hired labor even though demands for family labor are at a peak.

Wage rates also vary by region. Again the Sierra Leone data show a significant regional effect on wage rates although the differences are not large ranging from the lowest wage rate of Le .40 per day in the Northern Plateau to the highest wage rate of Le .73 per day in the Scarcies Area. One implication of regional differences in wage rates is the response of rural-rural migration to these differences and the role of this migration in equalizing regional differences in wage rates and efficient interregional allocation of labor. One important type of rural-rural migration observed in West Africa is the seasonal movement of workers from the savannah areas during the dry season to the forest zone where cocoa and coffee are harvested. Beals and Menezes [1970] in Ghana show that this seasonal movement promotes the efficient allocation of labor. In Sierra Leone, rural-rural migration of a more permanent type was shown to be highly responsive to regional wage differentials with labor moving from low wage regions to high wage regions. However in Kenya, Gwyer and Ruigu [1971] concluded that immobility of rural labor between regions was a limiting factor in efficient allocation of rural labor.

Finally the foregoing discussion of the rural labor market has focuses on rural wage rates. Returns to family labor are in many cases higher than the wage rate partly because returns to family labor include managerial ability. Also other resources may be undervalued or difficult to value. For example, in Sierra Leone and many other African countries it is difficult to value land because there is no land market.

Also the true opportunity cost of capital is difficult to establish since there is usually a fragmented capital market. Unfortunately there have been few attempts to estimate the MVP of family labor in relation to the wage rate but our findings in Nigeria [Norman, 1973] and Sierra Leone [Spencer and Byerlee, 1976] indicate that there is very good correspondence between the MVP of labor and the mean annual wage rate.

The evidence assembled here on the rural labor market indicates that wage rates vary by labor type and season, that rural-rural migration is responsive to rural wage differentials and that the MVP of family labor is approximated by the wage rate. These results all point to an active and efficiently operated labor market in which the wage rate is a reasonable measure of the opportunity cost of labor.

7.3. The Urban Labor Market

The urban labor market, unlike the rural labor market, has been extensively studied in several African countries although the emphasis has nearly always been on employment in the large-scale or formal urban sector where statistics are more readily available. In this section evidence is summarized from a survey of migrants in urban areas of Sierra Leone and comparisons made with similar surveys in other countries, particularly Kenya and Tanzania. The urban labor matket is analyzed with respect to (a) the structure of employment, (b) earnings and (c) unemployment.

7.3.1. The Structure of Urban Employment

African urban labor markets are generally characterized by two structurally distinct employers. First is the large-scale or formal sector which provides a large proportion of wage employment. Within the

large-scale sectors a further distinction can be made between public sector employment (in the government) and private sector employment in industry and commerce. In fact, the government usually accounts for half or more of total employment in large-scale sectors. In Sierra Leone, 57 percent of all employed urban male migrants are employed in the government sector as opposed to only 13 percent in the large-scale private sector (Table 7.1). In Kenya, the government accounts for 40 percent of all wage earning jobs in the formal sector [ILO, 1972] and in Nigeria this proportion is about 50 percent [Byerlee, 1973].

In addition to employment in the large-scale sector, employment in small-scale sectors is important in most African cities. Data shown in Table 7.1 indicate that in Sierra Leone urban areas, 36 percent of employed migrants were in the small-scale sector.[1] Comparable figures indicate that this proportion is somewhat smaller in Kenya (20 percent for Nairobi) but as high as 75 percent of all urban employment in Nigeria [Frank, 1967]. Employment in small-scale sectors may be wage employment or self employment. Most observers note the predominance of self employment although the only available estimate appears to be in Sierra Leone where self employment comprises three-quarters of total employment in small-scale sectors.

The division of employment between small and large-scale sectors differs significantly with education and sex. Details of this difference

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[1]These figures refer to migrants only but available evidence indicates that the earnings and employment of migrants are similar to the urban population as a whole [Byerlee et al., 1976].

TABLE 7.1
PERCENTAGE EMPLOYED IN LARGE-SCALE AND SMALL-SCALE SECTORS BY SEX AND EDUCATION IN SIERRA LEONE

	By Sex and Education					
	Males			Females		
	Uneducated	Educated	All Males	Uneducated	Educated	All Females
Government sector[a]	40	73	57	7	48	20
Large private firms	9	16	13	0	14	5
Total large-scale sector	49	89	70	7	62	25
Small-scale wage employed	14	4	9	0	10	3
Small-scale self-employed	37	7	21	93	29	72
Total small-scale sectors	51	11	30	93	39	75
Total	100	100	100	100	100	100

SOURCE: Byerlee et al. [1976].

[a]Includes local government.

in Sierra Leone are shown in Table 7.1. One-half of the employed migrants without education are employed in small-scale sectors but almost all educated males are employed in large-scale sectors. Female migrants with and without education have a stronger tendency than males to be employed in small-scale sectors. This reflects to a large extent the dominance of females in the food retailing sector. Figures from other countries are not readily available but these findings from Sierra Leone appear to be quite representative. For example in Kenya only about 12 percent of the labor force employed in large-scale sectors are female.

Finally the structure of urban employment needs to be examined in a dynamic as well as static sense. A characteristic of most countries has been the stagnation in growth of employment in large-scale sectors. Reasons are varied but a major factor that is well documented is the capital intensive nature of much large scale production [ILO, 1972; Eicher et al., 1976; Frank, 1967]. An additional factor is the trend in large scale sectors to employ persons of increasingly higher levels of education for jobs previously held by persons with less education. This "filtering down" process is extensively documented in Tanzania by Barnum and Sabot [1975]. The result of this process is the more rapid growth in employment of persons with secondary education in the large-scale sectors and a stagnation in employment of persons with primary or no education.

In contrast trends in employment in small-scale sectors are not well documented but they can be deduced by computing the residual labor force after subtracting large-scale employment and the unemployed from

the total urban labor force. Byerlee and Tommy [1976] apply this method to data from three urban areas -- Freetown, Abidjan and Nairobi -- and deduce that employment in small-scale sectors must be increasing in the order of at least 10 percent per year in these urban areas. Since we know that employment in large-scale sectors has been favoring the educated we can further deduce that workers with little or no education account for much of this rapid increase in employment in small-scale sectors.

7.3.2. Earnings in the Urban Labor Market

A number of factors determine wage rates in the urban labor market. In particular several studies have noted the pronounced effect of education on earnings particularly in large scale sectors. Sabot [1976] in Tanzania notes that earnings of persons with some secondary education is three to four times higher than those without education. Hoerr [1973] in Ethiopia notes a higher return on education so that even primary school-leavers receive earnings three times larger than uneducated workers. In Sierra Leone the differences are smaller although still large so that educated migrants received only about twice the earnings of uneducated migrants. Sex is also important in determining wage rates with females generally receiving a lower wage than males [Byerlee et al., 1976; ILO, 1972].

Finally earnings in the urban labor market depend upon the type of employer. After standardizing for age, sex and education, Byerlee et al [1976] in Sierra Leone and Hoerr [1973] in Ethiopia found that the private large-scale sector usually pays a higher wage than the government

sector. However the largest differential is between the large-scale and small-scale sectors. In both Kenya and Sierra Leone earnings in the small scale sector are below the minimum wage established for government employment. Moreover in both countries this difference is apparently greater for wage employed compared to the self employed in small-scale sectors. In Kenya the wage rate in the informal or small-scale sector is only 40 percent of the minimum wage rate in the large scale sector [ILO, 1972].

During the 1960s many observers noted that wages increased rapidly in the urban large-scale sector (e.g., Frank [1967], Eicher et al. [1970]). However there is some evidence that in the late 1960s and 1970s wages have stabilized. Part of the reason may be that in the 1960s there was a sharp upward adjustment in wages immediately after independence in an effort to promote equality within the large-scale sectors. With recognition of the inequality between large-scale and small-scale sectors and the rapid inflation of the 1970s real wages have in many cases declined [Byerlee and Tommy, 1976].

The trend in earnings in small-scale sectors is less clear largely because of a lack of information in most African countries. It is tempting to hypothesize that earnings in this sector have also stagnated or declined as a result of the rapid absorption of labor, forcing labor productivity down. Partial support for this phenomena is provided in a simulation analysis of the Nigeria labor market [Byerlee, 1973].

7.3.3. Urban Unemployment

Urban unemployment has been widely observed and reported in African countries. There is also surprising consistency among countries with

respect to rates and characteristics of the unemployed. Aggregate rates of urban unemployment are generally between 10 and 15 percent of the labor force. However the rate is usually highest among youth aged 15 to 24 years of age who comprise most new migrants where between 30 and 35 percent are unemployed in Ghana [Caldwell, 1969], Kenya [ILO, 1972] and Sierra Leone [Byerlee et al., 1976]. The rates of unemployment by educational level are less clear partly because education is confounded with age. In Sierra Leone when we adjusted for age, educated migrants did not have a singificantly higher level of unemployment. Also the rate of educated unemployment may change very rapidly obscuring long-term trends. In Kenya there was apparently a rapid increase in unemployment of secondary school-leavers during the late 1960s [ILO, 1972].

Surveys in Sierra Leone [Byerlee et al., 1976] and Uganda [Hutton, 1973] both identify two main types of unemployed. First is the unemployed school-leaver who is young and who has usually not worked before. Second is an uneducated older group of unemployed persons many of whom are heads of households. Among the school-leavers there was an element of voluntariness in unemployment as they waited for the "right" job. They also received considerable support from relatives and friends and in fact our Sierra Leone survey showed that the educated unemployed (most of whom are recent school-leavers) resided in households with above average incomes.

Trends in unemployment over time in urban areas of Africa suggest that in the 1960s rates of unemployment were on the rise but during the 1970s may have steadied. However, this trend probably varies with education. In Tanzania and Kenya there is evidence that unemployment

rates among primary school-leavers have increased during the 1960s followed by rising unemployment among secondary school-leavers in the late 1960s and early 1970s [Barnum and Sabot, 1975; ILO, 1972].

7.4. Rural-Urban Migration

Throughout Africa urbanization has been proceeding rapidly through rural-urban migration. This migration has important implications for both the functioning of the rural and urban labor markets and for government policy.

7.4.1. Rates of Migration

Rates of migration are difficult to measure since there are rarely two consecutive censuses of sufficient accuracy in most African countries to compute migration rates. However we know that in most countries approximately 0.5 to 1 percent of the rural population migrate to urban areas each year. The rural population with a natural population growth rate in excess of 2 percent per year is therefore continuing to grow by 1 to 1.5 percent per year after netting out migration. Urban areas which are still a relatively small proportion of the total population are growing at rates often in excess of 6 percent per year largely as a result of this migration. These figures record only net migration flows. Figures on gross flows are almost nonexistent, although our survey in Sierra Leone indicates that gross rates of rural-urban migration are three times higher than net rates of migration. That is, for every three rural-urban migrants in our sample, there were two urban migrants who returned to rural areas so

that migrants from urban areas constitute about 8 percent of the rural population. Caldwell [1969] reports a similar percentage of return urban migrants in rural areas of Ghana.

7.4.2. Characteristics of Migrants

Aggregate figures on rates of rural-urban migration do not reveal the selective nature of rural-urban migration with respect to age and education. Overwhelmingly rural-urban migrants are young. Both our survey in Sierra Leone (Table 7.2) and Rempel's survey in Kenya show that about half of all rural-urban migrants are between the ages of 15 and 24. Similarly over half of the male migrants have at least primary school education although the number of educated persons in rural areas may be quite small. Thus the propensity to migrate for persons with primary school education and above is seven times greater in Sierra Leone than for persons without education. In Tanzania, Barnum and Sabot [1976] report that rates of migration for persons with some secondary schooling are twenty times higher. However there is ample evidence that the education of migrants tends to be highly specific to certain rural regions which have long established schools. In four southern rural regions of Sierra Leone where schools had been established for up to fifty years less than one-quarter of male migrants had no education while in the four northern regions where schools had been established only in the last twenty years uneducated migrants accounted for three-quarters of all migrants. Rempel's [1971] survey in Kenya also shows a similar dichotomy between rural regions in the educational level of out-migrants.

TABLE 7.2

EDUCATION, AGE AND SEX OF NONMIGRANTS, RURAL-RURAL MIGRANTS, URBAN-RURAL MIGRANTS AND RURAL-URBAN MIGRANTS IN SIERRA LEONE

Type of Migrant	Education[a]			Mean Education	Age[a]				Mean Age	Percent Male
	None	Primary	Secondary		<15	15-24	25-34	>35		
	(Percent Distribution)			(Years)	(Percent Distribution)				(Years)	
Nonmigrant	91	8	1	.31	49	15	11	26	22.5	47
Rural-rural migrant	89	7	4	.47	32	24	17	27	23.7	45
Return migrants	87	8	5	.63	8	22	28	42	33.0	61
Migrants born elsewhere	90	7	4	.43	38	24	15	23	21.9	42
Urban-rural migrants	81	10	9	1.23	30	22	22	26	23.5	53
Return migrants	83	8	9	1.35	11	28	28	33	28.5	61
Urban born migrants	78	13	9	1.10	48	20	14	18	18.3	48
Total rural population[b]	90	8	2	.44	40	16	13	30	25.1	47
Rural-urban migrants	55	12	33	2.82	28	41	20	10	17.5	54

SOURCE: Byerlee et al. [1976].

[a]Age and education are computed for the year when migration occurred. Education is for persons 15 years old and above.

[b]Total rural population includes nonmigrants, rural-rural migrants and urban-rural migrants.

Despite the considerable knowledge of demographic characteristics of rural-urban migrants in Africa, evidence on the rural economic status of migrants and non-migrants is confusing. Caldwell's [1969] finding in Ghana that rural-urban migrants originate in above average income households (as judged by enumerator's rough assessments of housing quality) is widely cited but other writers (e.g., Rempel [1971]) point to the fact that migrants frequently come from landless households or from densely populated regions suggesting that migrants originate in households with below average incomes.

In Sierra Leone, disaggregation of migration streams suggests that both views may be correct. Rural per capita incomes for migrants and non-migrants between 15 and 35 years old were estimated from a detailed survey of 500 rural households (see Spencer and Byerlee [1976]). The results of this analysis indicated that uneducated migrants originate in households with below average incomes while educated migrants originate in households with above average incomes. Although part of these differences arise out of the origin of educated migrants in higher income regions, even within a region and within a village these differences in the rural household incomes of educated migrants and uneducated migrants show the same relationship.

7.4.3. The Process of Migration

The process of rural-urban migration in Africa with respect to movements to town and settling in town are well documented [Rempel, 1971; Byerlee et al., 1976]. In this section we highlight aspects of the migration process which are not well documented elsewhere. These include (a) rural perceptions of the urban labor market, (b) income transfers associated with migration and (c) return migration.

One component of our theoretical schema in Figure 7.1 deals with the gap between rural perceptions of the urban labor market and urban reality--that is, the quality of information available to rural people. In our Sierra Leone survey, we questioned potential migrants in rural areas about earnings of four primarily urban occupations: government clerks, drivers, doctors, and policemen. Except for government clerks, the earnings estimated by rural people were quite close to actual earnings of migrants in those positions although the variance of the estimated earnings was quite high. A second experiment was conducted in which potential migrants were asked about what earnings they expected if they move to an urban area.[1] In this case, potential migrants who were intending to migrate had significantly higher expected earnings than potential migrants who were not intending to migrate. Moreover, intending migrants had higher expectations than migrants in urban areas with similar age and education were actually receiving. These results suggest that rural-urban migration is somewhat selective of rural persons with high expectations of urban incomes, although the rural population as a whole has quite good information on earnings in specific occupations.

A second important component of our research on the migration process in Sierra Leone was to quantify the magnitude of intra-urban and urban-rural income transfers. Table 7.3 shows the extent of these transfers for different groups of migrants. Within urban areas there was substantial income transfers from working migrants to nonworking migrants usually friends and relatives who are scholars, apprentices,

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[1]Potential migrants were randomly sampled from male residents 15 to 24 years of age--the group with the highest propensity to migrate.

TABLE 7.3
SUPPORT IN TOWN AND RURAL-URBAN REMITTANCES FOR WORKING MIGRANTS
BY INCOME GROUP AND FOR NONWORKING MIGRANTS IN SIERRA LEONE

	Working						Not Working					All Migrants
	Income (Le./Month)[a]					All Income Groups	Unemployed	Housewives	Scholars	Apprentices	Other	
	<32	32-50	50-90	90-150	150+							
Support in Town												
Value given (Le./month)	7.2	10.8	18.1	24.2	30.6	12.9	3.6	2.8	.7	.5	2.0	7.0
Value received (Le./month)	4.5	3.3	4.0	--	--	3.4	12.4	2.5	16.4	16.7	4.9	6.2
Net value given (Le./month)	2.7	7.5	12.1	24.2	30.6	9.5	-8.8	.3	-15.7	-16.2	-2.0	-.8
Percent giving	41	48	64	77	70	55	20	17	--	--	20	28
Percent receiving	29	21	16	--	--	20	55	18	80	82	30	37
Rural-Urban Remittances												
Value given (Le./month)	1.6	2.8	3.0	6.1	12.0	3.1	.5	.8	.2	.1	.8	1.5
Value received (Le./month)	.7	1.0	1.3	2.3	1.9	1.9	1.0	.9	1.4	.5	1.2	1.1
Net value given (Le./month)	.9	1.8	1.7	3.8	10.1	1.2	-.5	-.1	-1.2	-.4	-.4	.4
Percent giving	77	80	86	100	90	82	44	62	23	41	43	57
Percent receiving	56	69	63	--	50	66	63	63	73	41	52	64

SOURCE: Byerlee et al (1976).

[a]Migrants' incomes are distributed as follows: 25 percent less than 32 Le./month, 50 percent less than 50 Le./month, 90 percent less than 90 Le./month and 95 percent less than 150 Le./month.

or unemployed. About 17 percent of the income of working migrants is used to support relatives and friends in this way. However migrants as a whole have a net intra-urban income transfer of almost zero indicating that migrants as a group do not depend on urban nonmigrants or rural relatives for support.

In contrast, urban-rural income transfers, i.e., remittances, are a good deal smaller (about 5 percent of earnings) although they follow a similar pattern with working migrants who have a net transfer to rural areas while nonworking migrants receive a net transfer from rural areas.

The support of relatives and friends in urban areas is widely observed in African towns although we know of no other attempts to quantify the extent of the income transfers involved. However evidence from Kenya and Ghana indicate that the urban-rural transfers may be somewhat larger than in Sierra Leone. In Kenya where 60 percent of male married migrants have a wife in rural areas remittances account for about 20 percent of urban earnings [Johnson and Whitelaw, 1974]. Crude estimates from Ghana indicate that about 10 percent of urban earnings are remitted to rural areas [Caldwell, 1969]. However in Nigeria, Essang and Mabawonku [1974] estimate that there is actually a net transfer from rural to urban areas.

Finally return migration from urban to rural areas is quantitatively important although rarely analyzed. In Sierra Leone, our survey showed that return migrants were older and less educated than migrants leaving for urban areas (see Table 7.2). Return migration consists in part of those returning for retirement and in part of those who return because of economic hardship in town. Significantly return

migrants had little difficulty in obtaining land in rural areas. This is also important in explaining the substantial back and forth movement of uneducated migrants between rural and urban areas because rural youths with easy access to land and support in town have little to lose by moving to town to seek work.

7.5 Response of Rural-Urban Migration to Rural-Urban Income Differentials

The foregoing analysis of rural and urban labor markets enables some conclusions to be drawn concerning the magnitude of rural-urban income differentials and the effect these differentials have on the rate of rural-urban migration.

Comparison of rural and urban incomes is difficult for both theoretical and empirical reasons. As we have seen there are various measures of rural incomes including (a) per capita incomes, (b) returns per unit of family labor and (c) rural wage rates, which may be theoretically appropriate under different assumptions about household decision making and the agrarian system [Knight, 1972]. In urban areas the structural differences in earnings between and within small scale and large sectors have already been noted. We have argued that the relevant urban income is the expected wage from obtaining a job in each of these sectors or alternatively remaining unemployed. Finally even if the relevant rural and urban incomes are known there are difficulties in making comparisons since (a) prices are higher in urban areas (b) rural people generally work less hours per year than urban persons (c) labor force participation, particularly for women and

children, is less in urban areas and (d) urban people have access to social amenities such as health and education which increase real income.

Within these limitations some efforts have been made to compare rural and urban earnings. Results from our survey in Sierra Leone show that the average urban hourly wage for all sectors for uneducated migrants was three times the average rural wage. However, the wage rate in the small-scale sectors was only slightly higher than the rural wage rate (Table 7.4). Moreover, expected wage rates for young uneducated migrants (15 to 24 years old) which take into account the probability of unemployment, were lower than the rural wage rate in two rural regions. Educated migrants still receive an expected wage double the average rural wage rate. A careful comparison of rural-urban earnings differentials in one region of Ghana using per capita household incomes also showed that rural-urban earnings differentials were very small for the uneducated. Finally, the ILO [1972] report on Kenya notes a similar pattern to Sierra Leone with rural wages on small farms being quite competitive with wage rates in the urban small-scale sector but only half the minimum wage set for urban large-scale sectors. The substantial back and forth mobility between rural areas and urban small-scale sectors and the comparable wage rates in these sectors both indicate that the labor market for urban small-scale sectors is quite competitive with rural areas.

It is probable that rural-urban income differentials have been reduced over time in many countries in the 1970s as a result of (a) increased food prices, (b) reduced export crop taxes, and (c) reduced urban real wages as a result of inflation.

An important policy question is the responsiveness of rates of rural-urban migration to rural-urban income differentials. Since time

TABLE 7.4
COMPARISON OF RURAL AND URBAN WAGE RATES
IN SIERRA LEONE

Rural Areas		Urban Areas		
Region	Wage (Le./Hr.)	Employer	No Education (Le./Hr.)	Educated (Le./Hr.)
1. Scarcies	.13	Government	.19	.35
2. Southern coast	.08	Private large-scale sector	.38	.37
3. Northern plains	.07	Small-scale sector	.15	.21
4. Riverain	.08	Average urban wage[a]	.25	.35
5. Bolilands	.07	Expected wage of youth 15. to 24 given probability of unemployment[b]	.11	.18
6. Moa basin	.08			
7. Northern plateau	.08			
8. Southern plains	.11			
Average rural wage	.08			

[a] Average over all employers and all age cohorts.

[b] Average wage for youths 15 to 24 years of age multiplied by probability of employment for that age and education group.

SOURCE: Byerlee et al. [1976].

series data are not available the only available estimates are from cross-sectional data. Some of this data is derived from census information, but is of limited usefulness in estimating migration response [Byerlee, 1974]. However surveys in Sierra Leone, Nigeria, Kenya and Tanzania do provide some estimates of the elasticity of migration response to rural-urban income differentials. Essang and Mabawonku [1974] in an analysis of migration in the Western State of Nigeria note that the rate of out-migration from rural households is significantly determined by the rural-urban income differential although they do not estimate elasticities of migration response to this differential. However Rempel [1971] in Kenya found no consistent evidence that migration responded to rural-urban income differentials. In Tanzania, Barnum and Sabot [1976] did find that migration was responsive to rural-urban income differentials and that the use of an expected wage variable taking into account the probability of employment provided greater explanatory power. In Sierra Leone, Byerlee et al. [1976] found that urban wages had a significant positive impact and rural wages had a negative but not significant effect on migration. Urban unemployment rates however had no consistent effect on migration. Significantly the elasticity of migration in both Tanzania and Sierra Leone was above one for urban wage rates and below one for rural wage rates indicating that changes in rural wage rates have relatively less impact than urban wage rates on migration.

7.6. Some Policy Implications

The foregoing analysis of rural and urban labor markets reveals important differences between the operations of the rural and urban

labor markets. There is now considerable evidence that the rural labor market is quite competitive reflecting differences in the opportunity cost of labor of different labor types and at different seasons of the year. Rural-rural mobility between regions also appears to respond to interregional wage differentials although in some regions restrictive land tenure practices may inhibit the establishment of "stranger" farmers.

On the other hand the urban labor market is more fragmented. Wage rates in small-scale sectors reflect supply and demand for labor in those sectors. However wage rates in large-scale sectors are influenced by government policy and are usually above the wage rate that would prevail in the absence of government intervention. Moreover in urban areas the supply of labor is importantly differentiated by the level of education. There is again evidence that the wage differential between uneducated and educated workers is above that which would be produced by a more competitive market.

The evidence also indicates that rural-urban migration is quite responsive to disequilibrium between rural and urban labor markets. However, distortions in the urban labor market induce higher rates of migration--particularly of the educated to the largest urban areas--than is socially and economically desirable.

One important implication of these findings concerns the shadow wage rate used in project appraisal. In rural areas we believe the wage rate is a good approximation of the opportunity cost of labor both in the peak and slack season and should be used to value labor in rural projects. There are of course problems in measurement (because of payments

in kind) but these are minor compared with the arbitrary methods now widely used to shadow price labor. In urban areas however the shadow wage rate should reflect the loss of rural ouput from migration induced by creating one job in urban areas [Harris and Todaro, 1970].

We turn now to a discussion of some specific policy implications which could help alleviate problems caused by the present rate, direction and composition of rural-urban migration. Variables of the migration decision such as rural and urban incomes are affected by almost every policy decision. In fact, migration is more often influenced unintentionally by policy decisions on rural investment, urban wages, etc., than by policies designed and evaluated for their effect on migration.

The most important policy variables and the elements of the migration decision they influence are identified in Figure 7.1. We discuss each of these in relation to the three dimensions of the migration problem: (1) the rate, (2) the concentration and (3) the composition of rural-urban migration.

7.6.1. Policies to Raise Rural Incomes

Raising rural incomes is the most widely expounded method for reducing rural-urban migration. However, through disaggregation of migration streams by educational level we have shown that compared to uneducated migrants (a) educated migrants originate in higher income households and regions of the country, (b) the rural-urban earnings differential for educated migrants is large and (c) the rate of migration with respect to rural incomes is much more inelastic for educated migrants. Hence our analysis in Sierra Leone indicates that raising

rural incomes by 1 percent will reduce migration of the uneducated by 0.4 percent compared to a negligible 0.065 percent decline in the number of educated migrants. Raising rural incomes is therefore only useful as a policy instrument for uneducated migrants.

Furthermore raising average rural incomes is not a sufficient condition for reducing out-migration from agriculture, since we have shown that unskilled migrants originate in poorer households. That is, a policy of raising rural incomes must ensure that income distribution is also improved.

7.6.2. Policies Affecting Urban Incomes

Our analysis consistently demonstrates that one of the most important factors determining the rate of migration is the urban wage rate. Moreover the elasticity of migration with respect to urban wages is particularly high for educated migrants -- a 1 percent increase in urban wages increases rural-urban migration of the educated by more than 4 percent in Sierra Leone and 2 percent in Tanzania. Furthermore the government wage policies are critical in determining urban wages.

Government minimum wage policies have often been criticized for artificially increasing urban incomes for reasons of social justice (e.g., Eicher, et al. [1970] and Todaro [1970]). In many countries government wages increased much faster than rural incomes in the 1960's following independence although urban wage increases have been less in recent years as a result of inflation. Nonetheless we have shown

that a considerable wage gap still exists between large-scale and small-scale sectors in urban areas and between rural and urban areas which should be considered in setting future government wage scales.

Employment in large-scale sectors at these relatively higher wages is a major attractive force of urban sectors. Policy makers and planners influence employment in this sector through the allocation of investment resources between large-scale and small-scale sectors particularly in manufacturing. Large-scale modern manufacturing for import substitution is widely believed to be the driving force in development and hence receives a large share of investment despite the fact that investment in small sectors is highly profitable (see Chapter 6).

A second important aspect of the large-scale sectors is location which influences the concentration of migration. Two-thirds of large-scale sectors (including government) employment in Sierra Leone is located in the largest urban area, Freetown, where infrastructure is best developed. Only mining, which is determined by location of mineral resources is the exception. Likewise in Kenya and Ivory Coast half of all formal sector employment is in the capital city [ILO, 1972; Joshi et al., 1975] and in Tanzania this proportion rises to 75 percent. In contrast small-scale industry which is less dependent on infrastructure is more evenly distributed with the majority of employment being in rural areas (Chapter 6).

Although it is unrealistic to locate large-scale industry in rural areas to reduce the rate of migration, the concentration of migration can be influenced through decentralization to middle size urban areas throughout the country. One vehicle for achieving this is through

provision of adequate infrastructure such as industrial parks and electricity. Furthermore a shift in emphasis away from import substituting industries using imported raw materials to agro-based industries clearly aids in such a decentralization policy since industry can be located near the source of raw materials. In Tanzania, the current development plan has an explicit objective of encouraging this type of decentralization [Government of Tanzania, 1969].

Finally the government itself is the major employer in the large-scale sector. Again except for local government, government employment is concentrated in the largest urban area. To a large extent, this reflects centralization of administration, but higher per capita government services such as utilities, education, etc., in urban areas are also a factor. Thus government efforts to decentralize administration and provide more equitable distribution of services are one way to lower migration, particularly of educated migrants to the largest urban areas.

7.6.3. Food Pricing Policies

Perhaps the strongest weapon for changing the balance between rural and urban incomes is food prices. On the one hand prices of domestically produced foods are a major determinant of rural incomes. On the other hand, food is the main commodity purchased by urban consumers. Thus a policy of raising food prices has the double effect of raising rural incomes and lowering urban real incomes ceteris paribus. Of course to the extent that urban wages are tied to a cost of living index, this decrease in urban incomes can be negated but even here there is likely to be a considerable delay in raising urban wages.

Sierra Leone rice import and pricing policy provides an interesting example of food pricing policy. In 1973 the government subsidized urban rice prices to the extent of twelve million dollars per year thus simultaneously keeping farm incomes low and preventing a loss of purchasing power by urban consumers in a period of substantial increases in world rice prices. However, as a result of the heavy drain on the government budget and the lack of incentive to rice producers the government completely reversed itself and doubled rice prices in 1974. Since rice production appears to have increased substantially and at the same time urban wages have not changed we can expect a substantial reduction in migration although we have no data as yet to support it.

The major drawback to raising food prices is its adverse impact on lower income urban consumers because food is a large proportion of their expenditures. Hence, uneducated migrants with low incomes experience a larger drop in real income than educated migrants who may not be much affected by this policy. The policy also requires a government to have considerable rural political support for its implementation.

7.6.4. Educational Policies

Throughout this chapter we have noted that investment in education in rural areas and the rate of migration are positively related. Hence policies which influence the amount of investment in education in rural areas will also affect migration of school-leavers. We can conveniently subdivide educational policies into those that affect (a) the returns to education and (b) the location and quality of educational institutions.

The comparison of urban wages by education level indicated substantial returns to educational investment. Part of the reason for this stems from a salary structure inherited from the colonial period. Also the private returns to education are increased by the tendency to use education qualifications as a criteria for employment even for unskilled jobs [Sabot, 1971]. Although it may be possible to reduce migration through changes in salary structures and hiring practices to reduce rural investment in education, education is a major cause of growth and it will not be economically sound to discourage educational investment for reasons of reducing migration.

A more acceptable approach is to change the relative returns to education in rural and urban areas. One such policy would be to increase returns to education in rural areas by reorienting curriculums toward rural vocations such as agricultue and through rural development programs that require educated manpower. Interviews with urban migrants in Sierra Leone indicated that rural areas could be attractive to school-leavers when these conditions prevailed and rural earnings were equivalent to urban jobs.

A significant number of rural-urban migrants are scholars. Both the location and quality of schools are variables amenable to policy. Kinyanjui [1974] in Kenya and Gould [1973] in Uganda note a heavy concentration of secondary schools in urban areas. In Uganda this concentration appears to have increased in recent years leading to further rural-urban migration of scholars [Gould, 1973]. In addition in many countries there are several schools with a national reputation for quality almost all of which are located in large urban areas. Government policies to establish more and better quality secondary schools in rural areas therefore have potential for reducing rural-urban migration.

7.6.5. Distribution of Social Amenities

Our Sierra Leone migration survey revealed that migrants in urban areas regard availability of social amenities such as schools, hospitals and water supply as significant benefits of migration. As with the concentration of manufacturing and government services in large urban centers, there is also a heavy concentration of social amenities in urban areas,particularly the capital city. Referring to this phenomenon as urban hypertrophy, Duru [1974] notes that Dakar with 16 percent of Senegal's population uses 95 percent of the nation's electricity, while Khartoum contains 50 percent of all Sudan's public utilities. Any policy of decentralization of social amenities would also be important in locating industry outside of capital cities.

7.6.6. Policies Affecting Urban Living Costs

Migrants moving to urban areas have to take account of higher urban costs of living. At times governments have implemented policies to alleviate the higher cost of living. In particular low cost housing schemes have been set up and subsidized to try to improve housing standards and lower rents. However, in a variant of the Todaro model, these schemes may be frustrated since they raise real incomes, induce more migration and create still more housing problems. It is significant too that low cost housing schemes are rarely implemented in small towns and rural areas.

7.6.7. Policies Affecting Information Flows

There is some evidence from our Sierra Leone survey that migrants come to urban areas with unrealistic expectations of economic oppor-

tunities. In most cases information is provided by relatives and friends or by prior visits of the migrant to the urban area and as such, information flows are outside the policy arena. However, employment registration and the media do play a role in disseminating employment opportunities. For example, a policy could be adopted, providing free advertisements for job openings outside of the large cities.

7.6.8. Policies Directly Controlling Migration

Beyond the above policies, it is possible to influence rural-urban migration through direct control of the movement of people into urban areas. In Sierra Leone and several other countries a special permit is needed to enter the diamond mining towns. However, it is doubtful that this has had much effect on migration because of the difficulty of policing the system. On a nationwide scale such a system would be even more unworkable.

The above analysis of policies affecting rural-urban migration considers only the micro-economic impact of policies on the decision to migrate. Clearly policies to raise rural incomes or change food prices have broader macro-economic impacts on all sectors of the economy and have additional implications for migration. This analysis of migration in a broader macro-economic framework is considered in Chapter 8.

8. MACRO-ECONOMIC ANALYSIS OF OUTPUT AND EMPLOYMENT

The previous chapters have described and analyzed at the micro-level, agricultural production, processing, small-scale industry, rural and urban labor markets and rural consumption. In each case, the analysis of output and employment has been concerned with a particular sector or factor market in isolation from other sectors and markets. Output and employment in the rural economy and in the national economy are, however, importantly affected by inter-sectoral linkages in the product and factor markets. The purpose of this chapter is to integrate our micro-economic information on particular sectors into an macro-economic analysis of output and employment that considers linkages between sectors. In particular we are interested in the linkages between agriculture and small-scale industrial sectors and between rural and urban sectors.

We first provide a theoretical framework for aggregate analysis of output and employment.[1] We then use this framework to construct a dynamic simulation model of the Nigerian economy and a more static but disaggregated model of the Sierra Leone economy. These models are used to project future trends in output and employment under alternative policies. Particular emphasis is given to the effects of agricultural policies on aggregate output, income and employment.

8.1. Theoretical Framework

Of major importance to any aggregate analysis of output and employment is the sectoral disaggregation of the economy. In this chapter we depart

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[1] For a discussion of similar modeling efforts, see Mellor [1976], Thorbecke and Sengupta [1972], and Blitzer [1975].

from conventional macro-economic models and employ the sectoral disaggregation developed in Chapter 1 when sectors were classified by firm size into small-scale and large-scale sectors, by commodity type into agriculture and nonagriculture and by location into rural and urban sectors.

Within this sectoral framework several types of linkages are analyzed. First, the backward and forward linkages of agricultural production are analyzed in an input-output framework with particular emphasis on the the linkages between agriculture and other small scale sectors. These linkages may arise through use of intermediate and capital goods. Second, consumption linkages following increases in rural incomes are of major importance and are represented by the income elasticities for sector outputs.

The modeling of the labor market is important in an aggregate analysis of output and employment. The models presented in this chapter are based on our analysis of labor markets presented in previous chapters. The urban labor market is disaggregated into a small scale sector where wages are competitively determined and a large scale sector where wages are exogenously fixed. A further refinement is introduced in the Sierra Leone model by disaggregating the labor force into educational levels to reflect different demand and supply conditions for educated labor. Migration between rural and urban areas occurs in response to the differential between a competitively determined rural wage and the expected urban wage.

On the demand side of the labor market, employment is assumed to grow at the same rate as output with adjustments for productivity changes. However employment in agriculture and small-scale industrial sectors can be analysed in more detail as a function of choice of technology and factor substitution in separate sectoral models.

8.2. Indirect Output and Employment Effects of Agricultural Development Strategies in Nigeria

A simulation model to analyse the indirect effects of Nigerian agricultural development strategies was developed by Byerlee (1973). The core of this model represented in Figure 8.1 is a simple but dynamic macro-economic model built on an input-output framework. Ten sectors are distinguished in this model corresponding to (a) two agricultural sectors (b) two small scale nonagricultural sectors and (c) six large scale sectors. Output, consumption, investment and imports are endogenous in the model.

The macro-economic model is linked to an employment-incomes model (shown in Figure 8.1) which provides details on the nonagricultural labor market, migration out of agriculture and income distribution. The nonagricultural labor market is modeled as a dual market with an exogenously (policy) determined wage rate in the large scale sectors and a competitively determined wage rate in the small scale sectors. Migration responds to the differential between rural wages (regionally disaggregated) and the expected urban wage. A Gini coefficient of income distribution is constructed from a functional distribution of income into seventeen classes as described in Byerlee (1973).

The macro-model is also linked to an agricultural sector model developed by Manetsch et al (1971) to provide more detail on the agricultural sector and to simulate the effects of alternative agricultural policies.

Simulated growth rates of variables measuring output and employment up to 1983 are shown in Table 8.1.[1]

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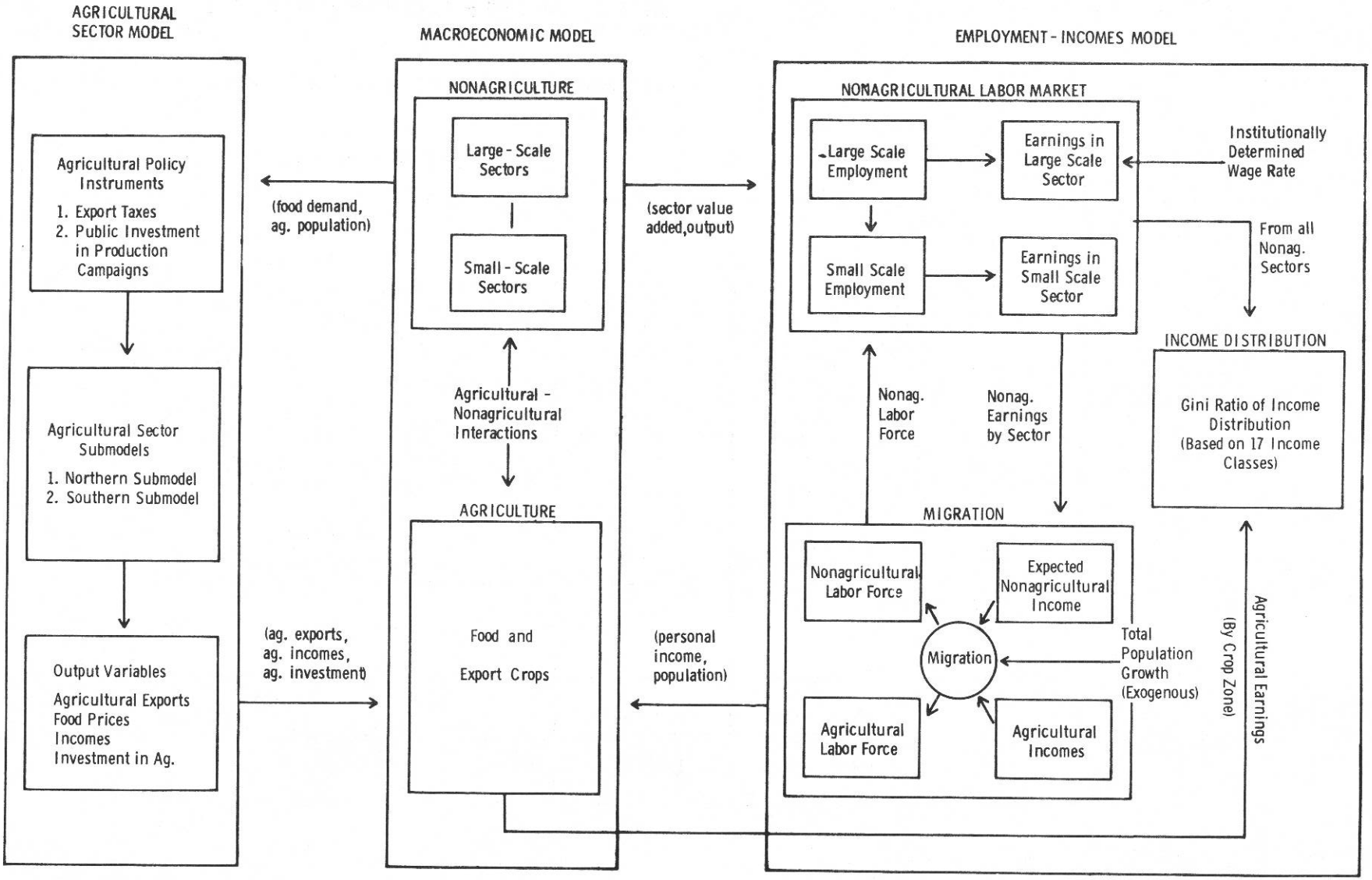
[1] In making these projections, oil output was estimated prior to the 1973 price increase and hence the projections are substantially underestimated Nonetheless they do provide estimates of likely trends.

Figure 8.1 Interrelationships Between the Macro-economic Model, the Agricultural Sector Model and the Employment - Incomes Model.



SOURCE: Byerlee [1973].

Table 8.1 Simulated Growth of Output and Employment in Nigeria 1966-1983 Compared to Historic Growth, 1950-1966.

Variable [a/]	Actual Growth Rate 1950-1966	Simulated Growth Rate 1966-1983	Simulated Value 1983	
				Unit [b/]
Output				
1. Value Added - Agriculture	3.2	3.7	2242	N m
Agricultural Exports	4.0	2.4	246	N m
Food Staples	3.0	3.9	1996	N m
2. Value Added - Nonagriculture	7.0	8.7	6076	N m
Small Scale Sectors	n.a.	5.8	1378	N m
Large Scale Sectors	n.a.	10.2	4786	N m
Employment	2.0	2.7	37.90	m
1. Agricultural Employment	1.1	1.7	21.60	m
2. Nonagricultural Employment	6.0	4.3	15.40	m
Small Scale	n.a.	4.0	13.50	m
Large Scale	2.5	5.9	1.80	m

n.a. indicates not available

a/ Income variables in constant 1960 prices

b/ N 1.00 approximately equal $U.S. 1.50

Source: Byerlee (1973)

The largest increase in output occurs in the large-scale nonagricultural sectors. As a result, employment in these sectors grows more rapidly than in the 1950-1967 period when growth in the nonagricultural labor force substantially exceeded growth in employment in large scale sectors. This expansion of large scale employment with a relatively high wage rate stimulates a higher rate of migration out of agriculture. Nonetheless the rate of labor absorption in agriculture is expected to increase. In 1983, small scale sectors including agriculture still account for 88 percent of total employment. Finally there is also a differential growth rate in earnings with the small scale sectors -- agriculture, small scale manufacturing and small scale trading - experiencing a much slower growth in earnings than large scale sectors. This contributes to an increase in income disparities as measured by the Gini ratio and a worsening of urban unemployment.

Three broad agricultural investment strategies were analysed by the model--(a) agricultural export promotion where public investment is allocated to export crops and export taxes eliminated, (b) food crop promotion where all public investment is allocated to food crops and (c) balanced food and export crop promotion where investment is allocated between both food and export crops. Some results of these strategies are presented in Table 8.2.

The export promotion strategy produces a substantial increase in agricultural value added and a smaller but important increase in non-agricultural output. Most of this increase in nonagricultural value added results from induced consumption effects rather than the backward and forward linkages of agricultural production. Significantly however the largest increase occurs in the large scale sectors where processing and

Table 8.2 Simulated Effects of Alternative Agricultural Policies on Macro-Economic Variables, Employment and Income Distribution in Nigeria

Variable[a/]	Value in Base Run 1983	Unit	Run 1 Export Production Campaign and Lower Export Taxes	Run 2 Food Production Campaign	Run 3 Balanced Food and Export Promotion Strategy	Run 4 Balanced Strategy of Run 4 with Lower Nonag. Wage Rate
			Percent Deviation from Base Run			
Macro-Economic Variables						
1. Value Added in Agriculture	2242	N m	34.8	6.1	37.3	36.4
1.1. Agricultural Exports	424	N m	144.2	-.1	136.7	137.7
1.2. Food Staples	1608	N m	5.7	8.2	10.6	10.4
2. Market Price of Staple Foods	.0304	N/lb.	2.6	-20.4	-9.9	-11.1
3. Value Added in Nonagriculture	6164	N m	12.1	.5	11.5	9.7
3.1. Small-Scale Sectors	1378	N m	7.5	1.0	7.7	6.8
3.2. Large-Scale Sectors	4786	N m	13.0	.3	12.6	10.5
4. GDP at Market Prices	8820	N m	17.3	1.9	17.5	16.0
5. Rate of Migration Out of Agriculture	.992	%/yr.	-18.2	12.6	-12.9	-18.3
6. Agricultural Employment	21.6	m	2.5	-.7	2.2	3.0
7. Nonagricultural Employment	15.4	m	-3.6	1.0	-3.1	-4.6
7.1. Large Scale	1.81	m	8.9	.1	8.4	31.5
7.2. Small Scale	13.5	m	-5.2	1.1	-4.6	-8.7
Incomes and Income Distribution						
8. Real Earnings/Worker in Agriculture	102.8	N/yr.	26.5	-6.8	21.8	19.2
9. Real Earnings/Worker in Nonagriculture	169.0	N/yr.	17.4	7.0	20.5	16.0
9.1. Small Scale	101.2	N/yr.	25.2	11.3	30.5	38.9
9.2. Large Scale-Unskilled Wage Earners	347.6	N/yr.	-.4	3.5	1.8	-32.1
10. Gini Ration of Income Distribution	.64	--	-12.7	.5	-15.4	-20.3

[a/] All income variables are expressed in constant 1960 prices. One Nigerian Naira is approximately equal to $US 1.50.

Source: Byerlee (1973)

marketing of export crops occurs. Employment in agriculture increases by 2.5 percent and migration out of agriculture declines by 18 percent.

The food production strategy results in a twenty percent decline in food prices relative to the base run because of an assumed price inelastic demand for food staples.[1] Nonetheless total food production increases by 8.2 percent resulting in a 6 percent increase in agricultural value added. There is only a slight increase in nonagricultural value added with the largest increase being in the small-scale sectors where most processing and marketing of food takes place. The decline in food prices causes a transfer of purchasing power from agricultural consumers to nonagricultural consumers. This fall in agricultural incomes and the concurrent rise in real nonagricultural incomes causes an increase in the rate of migration out of agriculture of 12 percent. Almost all the additional nonagricultural labor force is absorbed in small-scale sectors since there is virtually no change in large-scale employment. Nonetheless real earnings in the small-scale nonagricultural sector increase significantly largely because of a drop in the price of food which is a large proportion of the expenditure of workers in this sector.

The concentration of public investment on both food and export crop production campaigns combined with lower export taxes has favorable effects on all sectors of the economy. Value added in agriculture increases by 37 percent both as a result of higher exports and expanded food production. This strategy produces the largest increase in GDP of all runs tested by the model and an 11.5 percent increase in nonagricultural value added.

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[1]It is also implicitly assumed that production and marketing costs are too high to export food staples.

The rate of migration out of agriculture declines markedly although not as much as for the export promotion strategy alone. This is because a 10 percent drop in food prices tends to lower agricultural incomes and increase real nonagricultural incomes. Within the nonagricultural sectors, large-scale employment increases by 8.4 percent and small-scale employment decreases by 4.6 percent. All groups of the population experience an increase in incomes with the largest increase of 30.5 percent in the nonagricultural small-scale sectors. The Gini ratio indicates the most equitable distribution of income of all the runs in 1983 although there is still some increase in income disparities from 1960.

Finally the balanced food and export promotion strategy is repeated under the assumption that the growth of the urban wage rate is decreased to a rate comparable to the increase in agricultural incomes (i.e., 1.5 percent per year). As expected, migration out of agriculture declines markedly resulting in the largest agricultural employment of all the policy runs. The higher agricultural labor force results in lower food prices and increased exports compared to the previous run. Because of a large reduction of 32 percent in the nonagricultural wage rates, the Gini ratio of income distribution decreases by 20 percent to .51 which is only slightly larger than in 1959. That is, a balanced export and food crop development strategy combined with lower urban wages is necessary if income disparities are not to become wider and unemployment is not to increase in the 1970's.

The various agricultural policies tested by the simulation model all produce significant increases in agricultural output which in turn induces expansion of employment in the nonagricultural sectors and reduced urban unemployment. The analysis indicates that agricultural policy in Nigeria should give more emphasis to food production then in the past although

this should be balanced with agricultural export promotion and a reduced growth of urban wages in order to maximize both output and employment and prevent unemployment from increasing.

8.3. Macro-analysis of Output, Employment and Migration in Sierra Leone

The macro-economic model used in the analysis of the Sierra Leone economy builds upon the model developed for Nigeria. However there are several major differences. First, the sectoral disaggregation of the Nigerian model was further refined to distinguish between rural areas, small urban areas and large urban areas. Second, parameters of the model were in most cases derived from survey information which improved the empirical base of the model. Third the macro-model was simplified by solving the model in a comparative static framework rather than a dynamic mode. Finally foreign exchange availability was constrained to reflect the reality of the situation in Sierra Leone which lacks the oil revenues of Nigeria.

The sectoral disaggregation of the model is shown in Figure 8.2. There are five rural sectors, two small urban sectors and four large urban sectors. Two sectors are common to more than one location but parameters of these sectors are assumed to be uniform across location. As in the Nigeria model, the Sierra Leone macro-model is designed to operate in conjunction with more detailed sectoral models - particularly an agricultural production model [Rose, 1977]; a processing model [Spencer et al., 1976] and a small-scale industry model [Chuta, 1977]; and a labor market model [Byerlee et al., 1976]. Linkages between these various component models are shown in Figure 8.3.

Figure 8.2 Stratification of Sectors and Geographical Areas in Sierra Leone Model

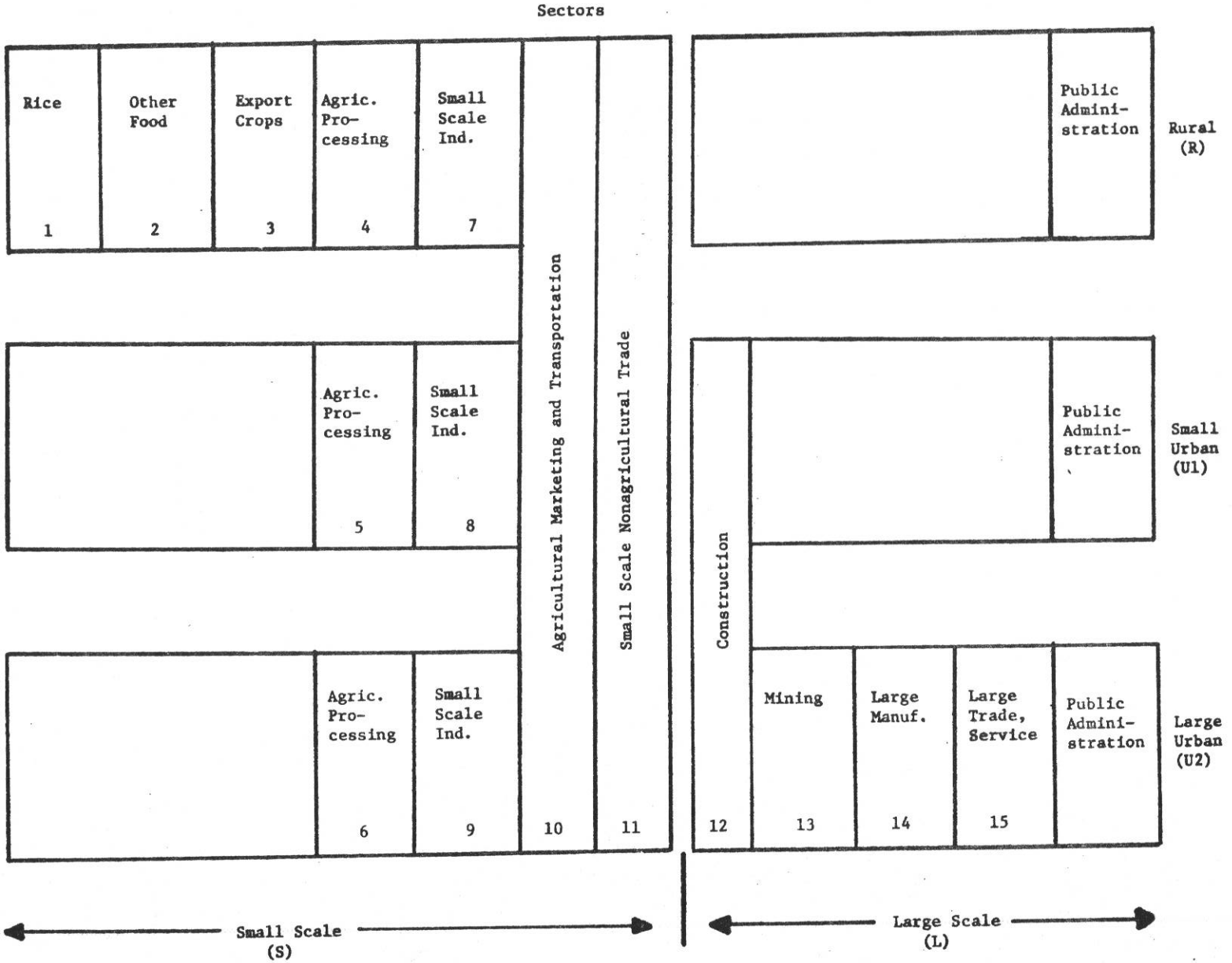
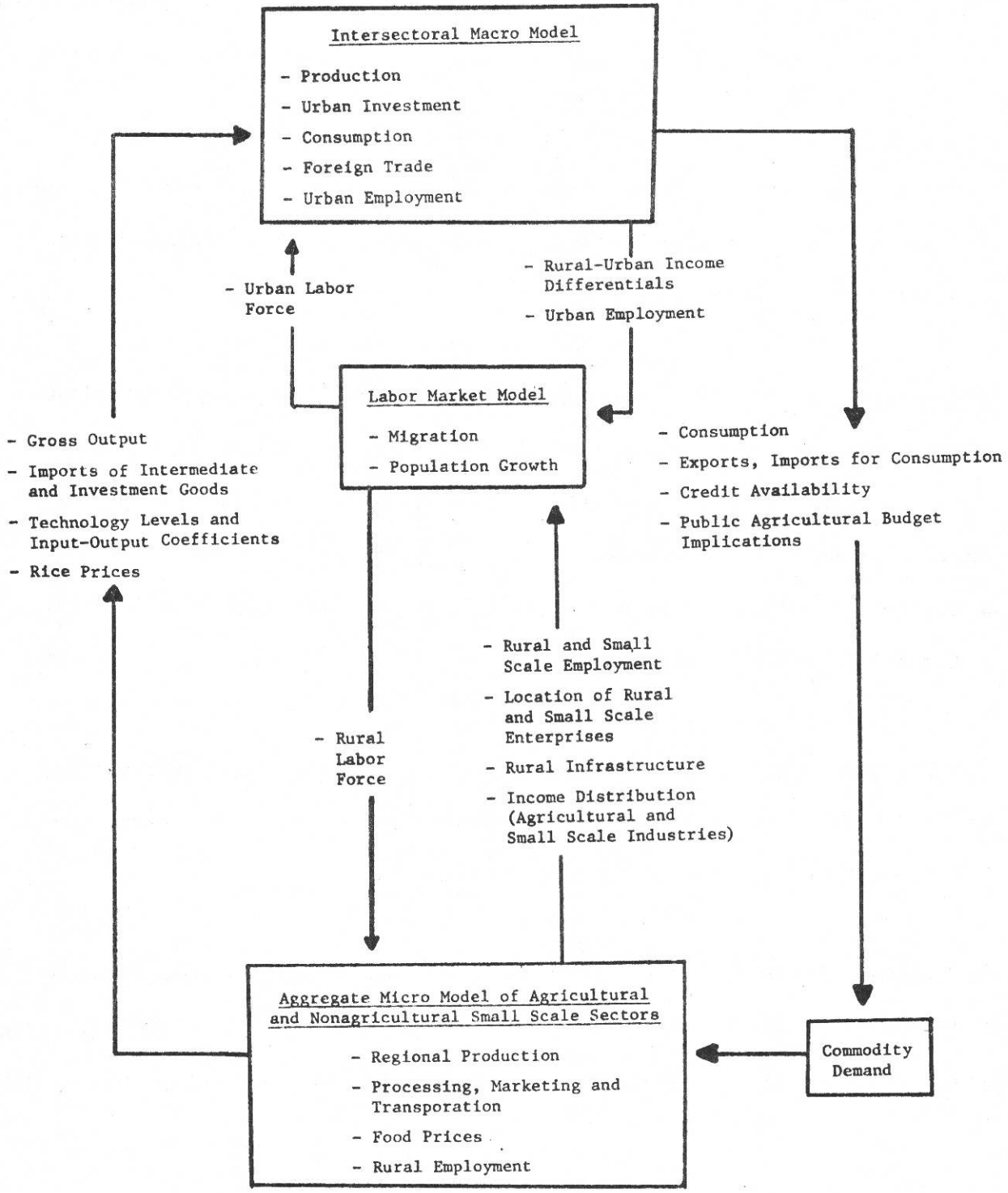


Figure 8.3 Schematic Representation of Linkage Within an Integrated Rural Employment Model of Sierra Leone



8.3.1. The Macro-model

A fuller description of model equations are provided in deHaen, Byerlee and Spencer (1974). In this chapter we provide only a brief description of key relationships and present some of the equations in the Appendix.

Consumption. Three classes of consumers are distinguished - rural, small urban and large urban. Projections of consumer demand are based on population growth and per capita incomes. Income elasticities have previously been described in Chapter 3.

Investment. Investment in each sector is based on investment requirements computed through the use of a capital-output ratio. In general the small scale and rural sectors are considerably less capital intensive than the large scale sectors. For example, the estimated capital-output ratios in agriculture, small industry and large industry in Sierra Leone were 0.69, .850 and 2.50 respectively.

Input-Output Balances. Given consumption and investment and an exogenous specification of exports, government expenditures, etc., total output are computed in an input-output table of the economy.

Employment. Projections of employment are based on assumed productivity changes in each sector. The labor force is disaggregated into two educational groups--those with less than four years education and those with four or more

years education - reflecting the different supply and demand factors affecting each group (See Chapter 7). Wages in the large scale sectors are exogenuously determined while wages in the small scale sectors including agriculture are related to productivity growth. Unemployment in urban areas is determined in the model as the difference between supply and demand for labor in urban areas.

Migration. Migration between rural and urban sectors is determined endogenously but in a separate model to the macro-model. Parameters for this model, particularly the response of migration to rural-urban income differentials were estimated for each educational subgroup in Byerlee et al (1976). Informal iterations are performed to ensure consistency between incomes estimated in the macro-model and rural-urban division of the labor force projected by the migration model.

8.3.2. Projections of the Sierra Leone Economy to 1978/79

The macro-model was used to make projections of the Sierra Leone economy assuming rates of investment, savings behavior, foreign exchange earnings, and changes in labor productivity reflecting historical trends. Projected output and growth rates of each sector are shown by the base run in Table 8.3. Under these assumptions large-scale sectors have the highest growth rate followed by small scale nonagricultural sectors and agriculture.

The rate of employment growth projected by the model is optimistic since no allowance is made for increases in labor productivity. Thus Table 8.4 shows that urban employment is projected to grow at a rate

Table 8.3. Sierra Leone; Value Added by Sector in 1979 under Alternative Development Strategies

Value Added [a]	Base Run		Run 1	Run 2	Run 3	Run 4	Run 5
	Growth Rate 1974-1979	Value of Output 1979	Increased Agricultural Exports	Increase in Food Crop Productivity	Shift in Govt. Purchases to Small-Scale Sectors	Reduced Capital Output Ratio in Large Scale Industry	Increased Foreign Capital Inflow
	(percent)	(Le'000)	----------	----------	(Le'000)	----------	----------
Agriculture	2.4	141455	147136	148597	141166	141445	141382
Rice	2.0	47597	46205	49666	47002	47505	46205
Other Food	2.6	52615	54058	57415	52884	52684	53717
Export Crops	2.2	27030	32436	27030	27030	27030	27030
Fish & Livestock	2.7	14211	14437	14486	14250	14226	14430
Small-Scale Nonagriculture	3.9	154648	155031	157279	157678	155110	158752
Small-Scale Industry	4.2	25111	24464	25648	27698	25157	24833
Trade	4.2	58837	59407	59538	59089	59140	61163
Transport	3.5	70700	71160	72093	70891	70813	72756
Large Scale Nonagriculture	4.8	147678	149691	147094	146140	148050	155713
Construction	7.8	33194	34356	32836	33632	33418	35879
Mining	2.7	73989	73989	73989	73989	73989	73989
Manufacturing	5.5	37886	38711	37655	35923	38029	43118
Utilities	4.3	2609	2635	2614	2596	2614	2727
Gross Domestic Product [b]	4.0	490,321	498,811	499,509	491,426	490,976	502,399

[a] Value Added in 1979 at constant 1974 prices.

[b] Includes Government Value Added.

Table 8.4. Sierra Leone: Employment by Sector in 1979 under Alternative Development Strategies.

	Base Run		Run 1	Run 2	Run 3	Run 4	Run 5
	Growth Rate 1974-1979	Number Employed	Increased Agricultural Exports	Increased in Food Crop Productivity	Shift in Govt Purchases to Small Scale Sectors	Reduced Capital-Output Ratio in Large Scale Industry	Increased Foreign Capital Inflow
	(percent)	('000)	(Number ('000) Employed)				
Employment by Sector							
Agriculture	2.6	1068.4	1070.3	1069.0	1066.3		1068.0
Small Scale Nonagriculture	3.6	186.8	185.6	190.3	193.8		189.8
Large Scale Nonagriculture	5.4	96.8	98.4	96.4	95.0		105.2
Employment by Urban Area							
Small Urban	3.2	143.1	144.3	146.2	145.5	143.3	144.5
Large Urban	5.9	179.7	181.2	180.5	181.5	180.0	185.0
All Urban Areas	4.9	322.8	325.5	326.7	327.0	323.3	329.5

of about 4.9 percent annually. However educated employment grows somewhat more rapidly by 5.5 percent annually while employment of the uneducated grows by only 3.0 percent annually. When migration is projected using these employment figures and assuming no wage increases, there is a slight increase in migration to urban areas. As a result, large urban areas have a population growth rate of 7.2 percent annually which is comparable to the growth rate experienced from 1963 to 1974 (Byerlee et al (1976).

Because urban population growth is higher than the growth of urban employment, the rate of unemployment in both small and large urban areas increases from an average of 14.2 percent to 16.0 percent unemployment rate (Table 8.5). The largest increase occurs among uneducated workers but educated workers in large urban areas remain as the group with the highest unemployment rate.

8.3.3. Tentative Policy Runs of the Macro Model

The macro-model can be used to make projections of output and employment under alternative assumptions about agricultural output, foreign exchange availability and technical coefficients of the model such as capital - output ratios and demand parameters. The model is designed to trace the effects of adoption of policies in any one sector on other sectors of the economy. The impact of policies on particular sectors is analysed in sector specific models of agriculture (Spencer and Byerlee (1976) and small scale industry (Chuta (1977).

Table 8.5. Projections of Urban Employment, Rural-Urban Migration and Urban Unemployment from 1974-1979 in Sierra Leone

	Uneducated [a]		Educated		Combined Educated and Uneducated
	Small Urban [b]	Large Urban	Small Urban	Large Urban	
Urban Employment					
Number (000) 1974	87.3	68.4	36.0	66.7	258.4
Number (000) 1979	101.2	90.6	41.9	89.1	322.8
Rural-Urban Migration					
Number (000) 1974	12.7	43.3	5.4	43.3	104.7
Number (000) 1979	13.7	46.6	5.8	46.5	112.6
Urban Unemployed					
Percent, 1974	11.3	14.9	14.9	15.9	14.2
Percent, 1979	13.0	16.9	16.9	18.4	16.0

a/ Uneducated persons are defined to have not completed primary school education.

b/ Small Urban areas have less than 100,000 population.

Only very tentative policy runs of the macro-model are reported here. Work is continuing to ensure consistency between the macro-model, the sectoral models and the rural-urban migration model.[1] Run 1 and Run 2 of the model show the effect of two changes in variables of the agricultural sector. In Run 1, agricultural exports are exogenously increased by 20 percent. The resulting increase in agricultural incomes increases the demand for goods from nonagricultural sectors. However as Table 8.3 shows the largest increase in output occurs in large scale nonagricultural sectors due to two factors. First there is a shift of rural labor from small scale industry in rural areas to agricultural production in response to the higher export prices and, as a result, the output of small scale industry declines. Second, the increase in agricultural exports lowers the implicit price of foreign exchange. Since a large proportion of capital goods are imported this lowers the price of capital and favors the more capital intensive large scale sectors.

In the Run 2, labor productivity in the production of food crops was raised 5 percent keeping foreign exchange earnings of agriculture constant. In this run, the increase in nonagricultural output occurs largely in the small scale sectors which require less capital and foreign exchange to expand output. However because small scale sectors are also more labor intensive, this run results in about a 50 percent larger increase in urban employment than in Run 1 where export crops are increased.

Demand patterns are also important in determining employment. One obvious policy measure for influencing demand is through the government's

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[1] This research is being carried out on both employment and income distribution under AID contract csd/c-1328.

purchases of goods and services. In Run 3 the government is assumed to transfer half of its purchases of goods and services (Le3M) from large scale sectors to small scale sectors.[1] Of course output of small scale sectors increases and output of large scale sectors declines as a result of this policy but the increase in urban employment is quite significant as a result of the switch to more labor intensive techniques. Moreover there is slight increase in total output as a result of the more efficient use of scarce capital. It is significant that the increase in employment generated by this policy would be sufficient to prevent unemployment from rising between 1974 and 1979.

In Run 4 of the model the capital-output ratio in large-scale manufacturing was decreased by 20 percent to represent a switch to more labor intensive techniques in establishing new manufacturing plants. There is an increase in both output and employment but the effect is very small. A similar change in small scale manufacturing sectors had an almost negligible effect reflecting the fact that these sectors presently use relatively little capital.

Finally a run was made where the economy was allowed to grow faster by increasing the amount of foreign capital inflow. Again because the implicit price of foreign exchange is reduced, large scale sectors increase faster than small-scale sectors in this run. Overall the increase in employment is relatively smaller than the increase in output.

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[1] Many government domestic purchases such as office equipment, school desks, etc. can potentially be produced in small-scale sectors.

8.4. Implications of the Results

In both Nigeria and Sierra Leone projections of the economy under current policies indicate favorable growth rates but increasing urban unemployment and migration from rural to urban areas. In Nigeria where income distribution was also analyzed these results also translate into a widening of income disparities. An important question addressed in these analyses is whether agricultural policies are capable of reversing these trends in urban unemployment and migration. The answer depends in part on the linkages between agriculture and other sectors of the economy. On the demand side we have shown that in both Nigeria and Sierra Leone the backward and forward linkages of the agricultural sector are still quite small since agriculture uses relatively few purchased inputs. As a result, the strongest demand linkage occurs through consumption purchases by the agricultural population. However, even here a large proportion of increased income in rural areas is spent on food. There are also important linkages on the supply side through competition between agricultural and nonagricultural sectors for capital, labor, and foreign exchange.

In the Sierra Leone analysis, the impact of increases in agricultural production on small-scale nonagricultural sectors depended upon the relative strength of the demand linkages, particularly consumer demand compared to the supply linkages through competition for labor and foreign exchange. On the one hand, an increase in agricultural production increased the demand for small-scale industry products, but, on the other hand, the increase in agricultural output may draw resources from rural small-scale industry tending to decrease output of small-scale sectors. The relative strength of these demand and supply effects depends on the type of agricultural policy adopted.

Clearly migration is an important linkage between rural and urban sectors. The impact of increased agricultural output on migration is, however, dependent on the strength of the linkages between the agricultural sector and small-scale and large-scale urban sectors. The analysis of the Nigerian economy showed that if the increase in agricultural output favors urban large-scale sectors then the effectiveness in reducing rural-urban migration is dampened by the fact that migration is responsive to employment expansion in this relatively high wage urban sector.

The analysis of both the Nigerian and Sierra Leonean cases indicates that there are no major conflicts between the output and employment objectives at the macro level. In large part, this arises because (a) on the supply side the more labor intensive sectors are also more efficient users of the scarce resources of capital and foreign exchange, and (b) on the demand side the labor intensive sectors have quite high income elasticities of demand. There are, however, specific tradeoffs that are important in evaluating policies, such as the relative effects of changing food prices on rural producers and urban low income consumers.

9. SUMMARY AND CONCLUSIONS

9.1. Summary of Descriptive Findings on Employment and Unemployment in Tropical Africa

In most African countries 70 percent or more of the population reside in rural areas where natural population growth rates are in excess of 2.5 percent. Even with rapid rates of rural-urban migration, the rural population is increasing at 1.5 to 2.0 percent per annum and will continue to increase and constitute the bulk of the population for the remainder of this century.

Standard indicators of employment, such as labor force participation and unemployment rates, are not relevant in rural Africa where the bulk of the labor force is self employed in subsistence oriented agriculture. Rather, in this study, we examined employment by reference to survey data on the effect of sex, age, region, farming systems, etc. on labor utilization in rural areas.

Annual labor inputs of adults in tropical Africa average about 1,000 to 1,200 hours per annum, substantially below figures reported elsewhere in Africa, e.g., Egypt or other developing regions. As expected, climate is the most important single determinant of variations in labor utilization producing well defined peak and slack seasons in labor inputs. Peak season labor use in traditional agriculture generally occurs in the planting and weeding period in the wet season. Only occasionally is the harvest season the most demanding labor period. The slack season invariably occurs during the dry months. Since the dry season is longer in the drier northern Savannah areas compared to the forest zone in tropical Africa, total labor inputs are generally lower in the dryer regions and underutilization of labor in the slack season, particularly acute.

Our nationwide rural household survey in Sierra Leone in which households were visited twice weekly over the period of a year strongly confirms that peak season labor demands act as effective constraints on farm output. During this period, three-quarters of adult males worked more than 180 hours per month and one-half worked more than 200 hours per month in farming. In most areas of Sierra Leone, land has not become a binding constraint and labor availability limits the amount of land cultivated.

The Sierra Leone survey also reveals differences in labor inputs by sex. Female adults contributed an average of 900 hours per year to farm and nonfarm activities compared to 1,450 hours per year for male adults. Females, however, also performed important domestic duties, such as cooking and child rearing, which were not included in the survey. Moreover, the proportion of total labor inputs contributed by females increased substantially at the peak season, again underlining the seasonal labor constraint at this period.

An important feature of this research was the use of the household rather than the farm-firm as the basic unit of study in order to investigate the importance of nonfarm activities in rural areas. Nonfarm activities, such as trading, tailoring, blacksmithing, etc., were indeed found to be important claimants on the time of farmers and their family. The actual proportion of male labor inputs devoted to nonfarm activities does vary considerably from about 11 percent in Sierra Leone to 47 percent in the north of Nigeria, partly because of a variation in the length of the dry season when most nonfarm activity tends to be concentrated. There is evidence that nonfarm activities are reduced to supply labor for the peak farming season or for the introduction of tree crops which require dry season labor.

The most important component of nonfarm activities is small-scale industries--tailoring, carpentry, blacksmithing, cloth dying, baking, etc. The nature and extent of these small-scale industries was accurately documented in the Sierra Leone small-scale industry survey, where it was found that small-scale industries account for over half of all industrial output and 95 percent of all industrial employment. Even in urban areas, small-scale industries and trading activities constituted over half of all urban employment.

Although labor was widely identified as a constraint, labor productivity under traditional agricultural technologies was very low with returns to family labor around $0.80 per person per day. Only where new technologies had been introduced, such as tree crops, new seeds, fertilizer, mechanization, etc., was labor productivity significantly higher. Although there is only a limited rural labor market with farmers working on nearby farms on a daily basis, the rural wage rate confirms this low productivity and reflects rather well the returns to family labor. Moreover, this wage rate shows seasonal variation quite consistent with seasonal demands for labor. There is also considerable evidence of interregional movement of rural labor in response to wage differentials. In parts of West Africa, this rural-rural migration is seasonal in nature with migrants from the Savannah areas moving during the dry season to harvest tree crops in the coastal areas. In Sierra Leone, there is a more permanent interregional migration from low wage to high wage areas.

Although rural-rural migration is important in some regions, rapid rural-urban migration is occurring in almost all countries of tropical Africa. Between .5 and 1 percent of the rural population move to urban areas each year, resulting in urban growth rates as high as 10 percent

per annum. Compared to the rural population, these rural-urban migrants are young, well educated and in some countries such as Kenya, predominantly male. Migrants, usually those without education, who do not obtain a job in the formal sector, often return home. In Sierra Leone, where we estimated both gross and net migration, it was found that of every three migrants who go to urban areas, about two return home so that there is substantial back and forth mobility between rural and urban areas.

The urban labor market the migrant enters is characterized by the coexistence of a high wage large-scale sector and a low wage small-scale sector where wages are competitive with rural wages. During the 1960s, wages in large-scale sectors rose rapidly while employment in these sectors stagnated. More recently with inflation the gap in wages between large-scale and small-scale sectors has apparently decreased, although large-scale employment growth still lags behind the growth of the urban labor force. Urban unemployment rates are generally in the order of 10 to 20 percent but are often as high as 33 percent among young school-leavers. Unemployed migrants in Sierra Leone had on the average been without a job a little over one year. However, there was some evidence that there was an element of voluntariness among educated migrants as they waited for the right job.

There is almost no reliable evidence on trends in unemployment and migration. However, macro-economic models for the Nigerian and Sierra Leone economy both projected an increase in rates of unemployment and rural-urban migration if current development strategies were continued. These trends underscore the urgent need for policies and programs to increase employment in rural areas in the coming decade.

9.2. Summary of Analytical Findings

The analysis conducted in this study provides important insights into the operation of factor markets, particularly the labor market, in tropical Africa. The rural labor market appears to be quite efficient in allocating labor both within and between rural regions. The wage rate reflects the seasonal variation in labor demand and supply in rural areas and to some extent differences in labor productivity by age, sex and region. By contrast the urban labor market is characterized by the co-existence of a large scale sector paying wages which are largely institutionally determined at least over the short run and a small scale sector where wages are competively determined by labor supply and demand.

A similar fragmentation also exists in the capital market with an informal capital market paying a high rate of interest and a formal market where lending institutions such as Commercial and Development Banks lend at subsidized interest rates. But again loans in the formal capital market are largely directed to large scale enterprises. In our Sierre Leone survey of almost 1000 radomly chosen small scale firms in agriculture, agricultural processing, fishing and small scale industry in both rural and urban areas less than 1 percent were currently receiving loans from formal credit institutions at 11 percent interest rates. At the same time the interest rate in small-scale sectors was estimated at 40 percent after adjusting for risk, delayed repayments, etc. Trade policy including tariff structures follow a similar pattern with large scale enterprises after benefitting from duty free imports while small scale firm pay substantial import duties. However some important inputs for small scale firms particularly in agriculture are after imported duty free and sometimes subsidized.

Given this fragmentation in both the labor and capital markets, factor price ratios vary for different sectors of the economy. In general these factor price distortions favor cheap capital in large scale sectors who pay minimum wages and have access to the formal credit market. In small scale sectors factors price distortions may raise the price of capital above its opportunity cost because of imperfections in informal credit markets. However in small-scale sectors government policy may sometimes deliberately lower prices of particular capital goods as has been the case with numerous agricultural mechanization projects in Africa.

Factor price distortions are relevant to the employment question providing that there exists a range of technologies of different labor intensities in a particular industry and that the choice of technology is responsive to factor prices. In general the results of this study provide evidence that this range of technologies does indeed exist in rural Africa. In agriculture traditional technologies using hand labor may be replaced by more capital intensive mechanical technologies on the one hand or more labor intensive biological technologies on the other hand. In agricultural processing there is a choice between hand processing and medium size and large mechanical processing units. In small scale industry a similar dichotomy exists a certain industries such as baking and blacksmithing.

The evidence assembled in this report from micro-level analysis in various rural and urban sectors indicates that there is considerable potential for labor capital substition through changes in factor prices to more correctly reflect the opportunity cost of resources. In agriculture budget analysis showed that tractor cultivation was often unprofitable when factor prices were adjusted to

reflect opportunity costs for capital and foreign exchange, and in agricultural processing the least cost technology was sensitive to interest rates in a linear programming model. Moreover, neoclassical production function analysis in agriculture and small-scale industry again provided support for a relatively high degree of substitutability between labor and capital. In some situations, however, the higher technological efficiency of more capital intensive techniques may limit substitution. For example, in the Sierra Leone rice processing study, large mills with a higher technological efficiency were also more economically efficient when rice prices were high. On the other hand, assembly and distribution costs were also higher for larger mills, partly offsetting this gain from technical efficiency.

At the macro level, our analysis in Sierra Leone demonstrated that relative growth rates between small and large-scale sectors were influenced by the availability of foreign exchange which affects the price of capital goods. Thus, an important finding of this study is that at both the micro level in the choice of technique and the macro level in the choice of growth strategy, the tradeoffs between increased output and employment generation are relatively insignificant. This arises in large part because labor intensive technologies and sectors also tend to be more efficient users of scarce resources of capital and foreign exchange.

The present study has also substantially contributed to an understanding of the rural-urban migration process as a link between the rural and urban labor markets. The evidence supports the hypothesis that the rate of migration is responsive to the rural-urban income differential, although there are marked differences between groups of migrants particularly between those with and without education. The educated migrants originate in higher income rural households, have a high propensity to migrate and

are more responsive to changes in rural-urban income differential. Nonetheless, the evidence is inconclusive in support of the important Todaro model of migration which hypothesizes that migrants respond to the expected wage differential taking into account the probability that a migrant will be unemployed. In Sierra Leone, we concluded that the support which migrants receive from relatives partially alleviates the problem of unemployment and explained the lack of importance of the unemployment variable in our analysis of migration. In Tanzania, however, Sabot using time series information does find evidence that migrants are responsive to rates of unemployment.

Rural consumer demands have been stressed as an important growth linkage between rural sectors and other sectors of the economy which has implications for employment. The labor intensity of rural consumption patterns was shown, in fact, to be high since a large proportion of rural consumption expenditures are devoted to agricultural goods--the most labor intensive sector of the economy. We also found support for the hypothesis that low income groups purchase more labor intensively produced commodities than high income groups. However, this effect was much less pronounced in our Sierra Leone data than reported in Columbia and Pakistan, partly because there was a smaller range of incomes in rural Sierra Leone.

Our consumption data do strongly support the hypothesis that the income elasticity for rural nonfarm goods (Z goods) is quite high suggesting an important linkage between rural incomes and the growth of rural nonfarm output and employment. On the other hand, there is competition between agricultural and rural nonfarm activities for labor although this is minimized to some extent by their complementarity in seasonal labor demands. Small-scale industries which are the most important component of the rural

nonfarm sector emerge as an important component of an employment generating growth strategy. The favorable demand trends, the relatively high profitability and the labor intensive nature of these industries all support the need for more emphasis on this sector.

9.3. Toward Employment Generation with Economic Growth

The empirical findings of this study strongly support the potential for designing development strategies which increase both growth and employment in rural areas. Within each sector, policy guidelines for increasing sectoral output and employment have already been given in the chapters pertaining to that sector. Across the whole economy, however, a development strategy for growth and employment requires, in the long run, fundamental changes in the allocation of resources between rural and urban sectors and between small-scale and large-scale sectors. The elements of such a strategy are summarized below.

9.3.1. Correcting Factor-Price Distortions

We have emphasized throughout this report (a) the widespread divergence of factor prices from their opportunity cost, (b) the sector and location specific nature of these distortions within an economy and (c) the fact that these distortions often favor large-scale sectors and capital intensive technologies. An immediate policy issue should be attempts to bring factor prices in different subsectors of the economy into line and closer to their true opportunity cost. There are three elements of such a strategy. First, formal lending institutions should consider raising interest rates and reorienting loans to small-scale firms. The higher interest rates would at least partly offset the cost of disbursing loans to a larger number of small producers. Furthermore, such a policy need not be

inflationary since small-scale firms would have access to capital at lower rates than the informal money market. Moreover, most of our budget studies indicated that small farms and nonfarm firms would be profitable at these higher interest rates. Second, governments should move toward a more flexible exchange rate that reflects an equilibrium exchange rate and to overhaul existing import tariff structures. In most cases, these tariffs raise the prices of inputs to small-scale sectors relative to large-scale sectors and at the same time provide protective tariffs on import substitutes only to the large-scale sectors. Of course, government revenues are also an important function of tariffs but in most cases it should be possible to transfer some of this tariff burden from small-scale to large-scale sectors without adversely affecting government revenues.

A third element of pricing strategy involves government wage structures and wage legislation. Although wage rates in the large-scale sectors have tended to increase less rapidly in recent years, they are still higher than the wage rates that would prevail in a more competitive market. Although minimum wage legislation does not usually directly affect small-scale sectors, there are important indirect effects through induced migration.

Product pricing policy also has implications for employment. Taxes on export crops are a disincentive to expanded agricultural export crops, many of which use labor in the slack season. Efforts to reduce food crop prices have a potentially greater adverse effect on employment since not only do they discourage agricultural output but also increase migration by increasing real urban incomes and reducing rural incomes.

9.3.2. Dissemination and Development of Appropriate Technology

The introduction of technology to increase output and employment in rural areas requires the dissemination of technology that is appropriate to the factor endowments of small-scale farm and rural nonfarm households. In the short run, this technology must be drawn from the existing stock of technologies but in the long run there is potential through research to develop more appropriate technologies.

The evidence assembled in this report indicates that governments have often encouraged the adoption of technologies such as large-scale mechanization of rice in Ghana or intensive methods of cotton growing in the north of Nigeria which are not suited to the seasonal labor and/or capital constraints of small farmers. In some cases, these technologies have been rapidly adopted because factor price distortions render the technology privately profitable. The evidence from our research suggests that less "extreme" types of technologies such as seed, fertilizer and oxen or small tractor cultivation are in most cases more profitable and likely to generate increased employment and output among a larger number of farmers.

Nonetheless there is also a strong case for greatly increasing research to develop new technologies. This is particularly so for agriculture compared to processing, fishing, and small-scale industry because of the location specific nature of much agricultural technology. An important element in the development of appropriate technology for small farmers is the seasonal labor bottleneck widely observed in tropical Africa. That is, biological technologies should be developed which utilize labor at other than peak seasons and mechanical technologies developed to increase labor productivity at the peak season. It is the development of mechanical technologies such as improved hand tools, animal powered cultivation,

small tractors, and hand threshers which is neglected is applied research in Africa relative to other regions, such as Asia (e.g., Khan [1975]).

9.3.3. Investment Reallocation to Rural and Small-Scale Sectors

Current investment strategy of development plans is still largely oriented toward large-scale industries and urban based projects despite increasing emphasis on agriculture in recent years. An effective strategy of growth with employment requires further increases in agricultural investment together with promotion of small-scale industries and more equitable distribution of physical and social infrastructure between rural and urban areas.

From both the demand and supply side promotion of agriculture and small-scale industry are essential to increased growth and employment. In rural areas, many African countries are importing an increasing amount of basic food staples in response to a rapidly increasing population and urbanization. On the supply side, the most labor intensive sectors are agriculture and small-scale industry. Moreover, agriculture and small-scale industry have been shown to be highly complementary in rural areas since small-scale industry employs labor in the agricultural slack season. At the same time, agriculture provides the effective demand for small-scale industrial products. A development strategy which emphasized both agriculture and rural small industries, therefore, has the potential to foster rapid economic growth, provide year-round employment, and reduce rural-urban migration.

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