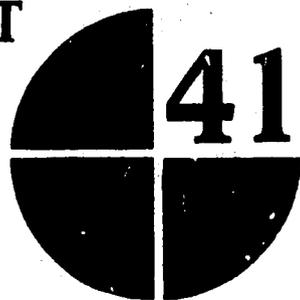


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**RURAL GROWTH LINKAGES:
HOUSEHOLD EXPENDITURE
PATTERNS IN MALAYSIA AND
NIGERIA**

**Peter B. R. Hazell
Ailsa Röell**

September 1983

**INTERNATIONAL
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FOREWORD

This research report by Peter Hazell and Ailsa Röell represents part of a continuing research effort at IFPRI to better understand the linkages between agricultural growth and growth in incomes and employment in the nonfarm economy.

In Research Report 33, *Agricultural Growth and Industrial Performance in India*, C. Rangarajan showed that for the Indian economy as a whole, agricultural growth has had a significant stimulative effect on the growth rate of both industrial output and national income. Rural household demands for industrial consumption goods were identified as an important source of these indirect growth effects. The World Bank's study of the Muda irrigation project in Malaysia, with which Peter Hazell was associated, showed similarly large indirect growth effects arising from increased productivity in agriculture, though in this case measurement was limited to the regional economy in which the project was located. Again, rural household consumption links to the nonfarm economy proved to be their prime source.

These studies confirm some of the key arguments in my 1976 book, *The New Economics of Growth*. The strength of the growth linkage multipliers and their concentration on labor-intensive goods and services produced within rural areas for local household consumption suggests that agricultural growth has the potential to significantly enhance rural nonfarm employment, thereby broadening the participation of the poor in the benefits of growth and generating a greater market for agricultural output. Given also the importance of the direct benefits from agricultural growth in increasing rural incomes and employment, there emerges a strong argument in support of public expenditures on agricultural research and investment.

IFPRI's research on growth linkages is attempting to define the details of the linkage

relations in order to confront the larger objective of explicitly identifying policies for enhancing the size of the income and employment multipliers. In this research report Hazell and Röell take up the important household consumption links and examine in detail the expenditure patterns of farm households in Malaysia and Nigeria. They use their results to address the question of which types of farm households have the most desired expenditure patterns for stimulating secondary rounds of labor-intensive growth within the rural economy. They find that in this study the households operating the larger farms have the most desired expenditure behavior. These farms are not very large by most standards, and Hazell and Röell are able to present a good case for ensuring that research and public investments that increase agricultural productivity reach this group. This is not to argue that small farms should be neglected, but only to suggest that the larger and more commercial farms have an important role to play in broadening the participation of the poor in the benefits of growth.

This analysis serves as an intermediate step toward more comprehensive studies of rural regions in which other linkage relations are also considered and integrated with a detailed understanding of the supply structure of the rural nonfarm economy. Current IFPRI field work in collaboration with the Tamil Nadu Agricultural University in Coimbatore, India, with the Jawaharlal Nehru University in Delhi, India, and with the Bangladesh Institute of Development Studies in Dacca, Bangladesh, will lead to such analysis.

John W. Mellor

Washington, D.C.
September 1983

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The authors are indebted to the World Bank and the Agricultural Projects Monitoring, Evaluation and Planning Unit (APMEPU) of the Federal Department of Rural Development in Nigeria for their permission to use the survey data. Roger Slade was an invaluable guide to the use and interpretation of the data, and John Mellor, Michael Lipton, and Ammar Siamwalla provided valuable comments on earlier drafts.

1

SUMMARY

Agricultural growth can lead to substantial indirect growth in nonfarm incomes and employment. These effects arise partly as a result of increases in the use of farm inputs and in processing, marketing, and transport services to handle the larger output. More importantly, they arise from increases in household expenditures on consumer goods and services as a result of increased farm incomes.

These demand links to the nonfarm economy are important for national economic growth. They are also attractive because the rounds of growth they induce are predominantly concentrated within rural areas and because the kinds of goods and services demanded are typically produced by small, labor-intensive enterprises. Consequently, the indirect effects of agricultural growth have the potential to help alleviate rural underemployment and to contribute to the reduction of rural poverty and malnutrition.

Which kinds of farm households spend the larger shares of incremental income on labor-intensive goods and services that are produced in rural areas? If this can be determined, it may be feasible to target technology or public investment to increase the agricultural output of these households.

Household expenditures for this study were obtained from two regional case studies that used samples of households directly benefiting from agricultural projects funded by the World Bank. One data set was obtained from the Muda irrigation project in northwest Malaysia and the other from the Gusau agricultural development project in northern Nigeria.

The two study areas are typical of countless poor regions in the developing world. Their aggregate incomes depend primarily on the production of agricultural crops, mostly foodgrains, the greater part of which are exported out of the regions at given prices. In return, goods are imported from outside the regions for purposes of investment, production, and consumption. In addition to agricultural crops, nonfood goods

and services and some horticultural and livestock products are produced, mostly for consumption within the regions. The production of the major agricultural crops is typically constrained by the available land and technology, but the supplies of nonfoods and specialty agricultural products are usually elastic, because the supply of their major input—labor—is also elastic.

Within this setting, the households whose expenditure patterns most promote labor-intensive growth within the surrounding region are those that spend the largest share of incremental income on goods and services that are not traded with the nonregional economy. These nontradables include all locally produced goods and services that are consumed entirely within the region. They are mostly nonfoods but include some horticultural and livestock products. Household expenditures on tradables are undesirable for regional growth because they represent a direct leakage of purchasing power. This is most obvious for expenditures on regional imports. But expenditure on foodgrains that could be exported from the region at constant prices represents a loss in export earnings to the region just as much as if the money had been spent on imported goods.

Each of the two regions comprises a total land area of about 1 million acres and has an average population density of 0.6 persons per acre. In Muda, however, the population is concentrated along a coastal plain where the land is devoted to intensive paddy farming under irrigation. The land in Gusau is much less productive, and the population is more evenly spread throughout the area. Only dryland farming is practiced; the important crops are millet, sorghum, cowpeas, cotton, and groundnuts. The infrastructure is more highly developed in Muda, and farm households have much better access to the local towns. The average person in Muda also had about twice the income of the average person in Gusau at the time the surveys were conducted.

The household data used in this analysis

were collected weekly for about one year. The Muda survey was conducted during the 1972/73 agricultural year, which coincided with the latter stages of the construction of the irrigation project. The Gusau survey covers the 1976/77 agricultural year and was undertaken during the early stages of the agricultural development project.

The principal objective of this study is to estimate the relationships between income and consumption for different commodities and to establish how these change with the income and socioeconomic characteristics of the households. These relationships are estimated for individual commodities and for interesting commodity groups, such as total foods, locally produced nonfoods, and total nontradables.

Total per capita expenditure is used as a proxy for income, and Engel relations are estimated in budget share form using a variant of the Working-Leser model. All the expenditures are aggregated to an annual basis, thereby avoiding problems of seasonality and lumpiness in expenditure patterns. Socioeconomic variables characterizing the households are included in the model in a way that allows them to influence both the intercept and the slope of the consumption-income relationships. These variables include the size and composition of the family, the age and education of the household head, farm size, access to consumer credit, and various dummy variables to capture the effects of race or tribe and religion. The equations were specified and estimated in a way that ensures that the usual adding-up requirements are met.

Food, alcohol, and tobacco is by far the most important commodity group in the total budget of the average household in each region. It accounts for two-thirds of total household expenditure in Muda and for 80 percent in Gusau. In Muda 40 percent of the average household's total budget outlay on foods is spent on cereals and cereal products, while the comparable figure for Gusau is 62 percent. Expenditure on fruits, vegetables, and nuts is similar at about 8 percent of the average household's budget in both regions, but the average household in Muda allocates a larger share of its budget to meat and fish (12 percent in Muda compared to 9 percent in Gusau). The average household in Gusau allocates a larger share of its budget to eggs and dairy products, nearly 6 percent in Gusau compared to less than 2 percent in

Muda, and meat, eggs, and dairy products account for larger shares of incremental expenditure.

The expenditure patterns of the average household on clothing and footwear, consumer expendables, and transport are similar in the two regions, but the average household in Muda allocates significantly larger shares of both its total and marginal budget to housing, durables, education and health, personal services and entertainment, and social obligations. Together, these commodity groups account for 22 percent of the average budget in Muda and for 6 percent of the average budget in Gusau. They also account for 47 percent of any incremental expenditure in Muda, but for only 8 percent in Gusau.

Linkages to the local nonfarm economy are much stronger in Muda. The average household spends 18 percent of its total budget on locally produced nonfood goods and services, and it allocates to these items 37 percent of any increment in its total expenditure. In contrast, these figures are 8 percent and 11 percent in Gusau. The share of the total budget allocated to all nontradables is actually the same in both regions, accounting for about one quarter of the budget. The marginal budget share for nontradables is a little higher in Muda: 41 percent compared to 32 percent in Gusau. The more important difference is that the nontradables consumed in Muda are mainly nonfoods, whereas in Gusau they are mostly horticultural and livestock products. This distinction is even sharper in terms of the composition of the marginal budget share for nontradables in the two regions.

Regional differences in the structure of the household demand links to the local economy are more apparent when expenditure behavior is analyzed by households representing different income or farm size groups. In Muda the marginal budget share for nontradables increases from 24 percent for the households in the lowest per capita expenditure decile to 55 percent for households in the top decile. The marginal budget share for locally produced nonfoods also increases from 18 percent for the lowest decile to 53 percent for the top decile. These patterns are weaker in Gusau, where the marginal budget share for nontradables increases from 27 percent for households in the lowest per capita expenditure decile to 36 percent for households in the top decile.

But the marginal budget share for locally produced nonfoods remains virtually constant across the per capita expenditure deciles in Gusau. In fact, increases in nontradable expenditures are due entirely to increased expenditures on horticultural and livestock products that are locally produced.

The unusually low share of incremental expenditure allocated to locally produced nonfoods by those with the highest incomes in Gusau may be due to their relative isolation. People are widely dispersed and roads are poor, which may make it difficult to reach local towns where nonfood goods and services are available.

Similar linkage relations hold when household expenditure is analyzed by farm size deciles instead of per capita income deciles, even though farm size and per capita expenditures are not highly correlated in either region.

This analysis suggests that households on the larger farms in both regions have the most desired expenditure patterns for stimulating secondary rounds of growth in the local economy. They are therefore suitable targets for technology or public investments that increase agricultural output. In Muda increased incomes for these farmers will lead to particularly strong linkage effects to the local nonfarm economy, and the amounts of employment created could be large. In Gusau the larger farms have the stronger

links to the local economy, but these links are mostly to other agricultural households producing horticultural and livestock products. While increases in the incomes of the households on the larger farms in Gusau will stimulate the regional income, it is less clear that the additional employment created will be large because the livestock grazing system is not labor intensive.

This conclusion that larger farms should be targeted for technology and public investment must be qualified before applying it to other regions.

First, the largest farms in these regions are not very large by most standards; the expenditure patterns of larger farms might be quite different. Second, richer households save proportionately more and these savings may not stay in the local economy. Third, the expenditure patterns of smaller farms may create more regional growth if either the supply of nontradables or the demand for the region's agricultural exports is inelastic. Fourth, this analysis considers only regional growth; beneficial effects on other regions of the nation are not considered. It is argued that areas like Muda and Gusau, which are relatively disadvantaged parts of their national economies, should receive priority treatment, but this argument cannot be applied to all rural regions.

2

INTRODUCTION

The indirect effects arising from agricultural growth can be substantial. In a study of agricultural and industrial performance in India, Rangarajan found that a 1 percent addition to the agricultural growth rate stimulated a 0.5 percent addition to the growth rate of industrial output, and a 0.7 percent addition to the growth rate of national income.¹ At a regional level, Gibb found that each 1 percent increase in agricultural income in the Nueva Ecija Province of Central Luzon in the Philippines generated a 1-2 percent increase in employment in most sectors of the local nonfarm economy.² Similarly, in a study of the Muda irrigation project in Malaysia, Bell, Hazell, and Slade found that for each dollar of income created directly in agriculture by the project, an additional 80 cents of value added was created indirectly in the local nonfarm economy.³

An important aspect of growth linkages to the nonfarm economy is that they are predominantly due to increases in household consumption expenditure. Bell, Hazell, and Slade report that about two-thirds of the 80-cent income multiplier in Muda was due to increased rural household demands for consumer goods and services; only one-third was due to agriculture's increased demands for inputs and processing, transport, and marketing services.⁴ Gibb also found strong employment links to the nonfood consumer-oriented sectors in his study of Nueva Ecija.⁵

These findings strongly support Mellor's contention that because much of the received wisdom on development strategy ignores these consumption linkages, it has tended to seriously underestimate the potential importance of agriculture.⁶ Hirschman, for example, in his influential study of the importance of linkages in promoting development, focused only on production linkages, and he found these to be weak for agriculture compared to most other sectors of the economy.⁷ On this basis, he recommended that greatest priority be given to public investment in nonagriculture.

In addition to enhancing agriculture's contribution to national economic growth, the existence of strong consumer expenditure linkages between agricultural households and the nonfarm economy is important for two other reasons.

First, the income and employment generated by these linkages is predominantly concentrated in rural areas. Rurally focused growth has much to commend it in many countries where rural areas have been severely disadvantaged in the past through urban-biased policies.⁸ Such policies have encouraged excessive migration from rural to urban areas and have exacerbated problems of rural underemployment.

Second, the kinds of goods and services demanded are typically produced by small, labor-intensive enterprises. They are focused on such sectors as transportation, hotels

¹ C. Rangarajan, *Agricultural Growth and Industrial Performance in India*, Research Report 33 (Washington, D.C.: International Food Policy Research Institute, 1982).

² Arthur Gibb, Jr., "Agricultural Modernization, Non-farm Employment and Low-level Urbanization: A Case Study of a Central Luzon Sub-region" (Ph.D. thesis, University of Michigan, 1974).

³ Clive Bell, Peter Hazell, and Roger Slade, *Project Evaluation in Regional Perspective* (Baltimore and London: The Johns Hopkins University Press, 1982).

⁴ *Ibid.*

⁵ Gibb, "Agricultural Modernization."

⁶ John W. Mellor, *The New Economics of Growth* (Ithaca, N.Y.: Cornell University Press, 1976).

⁷ A. O. Hirschman, *The Strategy of Economic Development* (New Haven, Conn. and London: Yale University Press, 1959).

⁸ Michael Lipton, *Why Poor People Stay Poor: Urban Bias in World Development* (Cambridge, Mass.: Harvard University Press, 1977).

and restaurants, entertainment, personal services, health, distributive trades, and housing and residential construction. Increased household demands for specialty agricultural products, particularly fresh fruits and vegetables, and fish and livestock products can also provide important increases in rural employment.

Strong household links to the rural non-farm economy not only help alleviate problems of rural underemployment, but, because the major beneficiaries of the increased employment earnings are typically the poor, they also contribute to the reduction of rural poverty and malnutrition. Survey evidence from many countries confirms that the families operating small farms and landless workers obtain substantial shares of their total income from nonagricultural sources. Consequently, the beneficiaries of the indirect employment gains generated by agricultural growth need not be limited to poor, nonagricultural households residing in towns. Rather, they have the potential to touch a wide range of occupation groups within the poorer segments of society.

The indirect benefits from agricultural growth are not restricted to the poor. They can increase the earnings of skilled workers as well as providing lucrative returns to capital and to managerial skills. In the Muda study, for example, Bell, Hazell, and Slade found that the indirect benefits of the project were skewed in favor of the nonfarm households in the region, many of whom were relatively well off.⁹ They also found that even among agricultural households, the landed households fared better than the landless. The point to be made is that although the indirect effects of agricultural growth do not necessarily improve the relative distribution of income within rural areas, they can still have wide-reaching effects in alleviating absolute poverty.

Given the importance of household consumption linkages, it is pertinent to ask which kinds of agricultural households have the most beneficial expenditure patterns for

stimulating secondary rounds of employment-intensive growth within rural areas. More specifically, which kinds of agricultural households spend the larger share of incremental income on labor-intensive goods and services that are also rurally produced? The households with these characteristics might warrant special attention when agricultural technology or public investments in agriculture are targeted.

The prevalent view in the literature is that the labor intensity of goods and services consumed by households decreases as incomes rise (see, for example, the International Labour Office study on Colombia).¹⁰ The available empirical evidence on the factor intensity of expenditure patterns by income groups, though sparse, provides some support for this view. King and Byerlee report that households in the lowest income decile in rural Sierra Leone have expenditure patterns that lead to about 20 percent more employment per additional leone of expenditure than do the expenditure patterns of households in the top income decile. Soligo found even more pronounced relations of this kind for the labor intensity of household expenditure patterns by income groups in both rural and urban Pakistan.¹¹

King and Byerlee also analyzed the locational linkages of the goods and services consumed by rural households in Sierra Leone. They found that households in the lowest income decile have expenditure patterns that lead to a 7 percent higher content of rurally produced goods and services per additional leone of expenditure than do the expenditure patterns of households in the top income decile.

If these findings are correct, then patterns of agricultural growth that are focused directly on poorer farms should have the potential to generate important secondary rounds of labor-intensive growth in the rural nonfarm economy. Given also the powerful direct effects on poverty reduction that could be obtained by targeting agricultural growth to the poorer farm households, then

⁹ Bell, Hazell, and Slade, *Project Evaluation*.

¹⁰ International Labour Office, *Towards Full Employment* (Geneva: ILO, 1970).

¹¹ R. P. King and D. Byerlee, *Income Distribution, Consumption Patterns and Consumption Linkages in Rural Sierra Leone*, African Rural Economy Paper 16 (East Lansing, Mich.: Michigan State University, 1977); and R. Soligo, *Factor Intensity of Consumption Patterns, Income Distribution and Employment Growth in Pakistan*, Program of Development Studies Paper 44 (Houston, Tex.: William Marsh Rice University, 1973).

the relationship between growth and equity in rural areas is seen to be complementary.

There are at least three difficulties with this conclusion. First, poorer households have lower savings rates and hence contribute less to capital accumulation and long-term economic growth than do richer households.

Second, expenditure patterns by themselves do not determine the size of the income and employment multipliers. If the multipliers are to be large, it is also necessary that the extra goods and services demanded have elastic supplies. Foodgrain production is typically inelastic to price in developing countries,¹² and because poorer households spend larger shares of incremental income on foodgrains than do rich households, this has adverse effects on the size of the indirect benefits poor households can generate through their expenditure patterns. Of course, if the initial source of growth is an increase in foodgrain production, then the extra demand can be met. But, unless the marketed surplus faces a price-inelastic demand, larger rural multipliers can always be attained by selling the extra foodgrain output and diverting household expenditures to other rural goods and services that have elastic supplies.¹³ Richer households may have more desirable expenditure patterns from this point of view.

Third, only part of the income multipliers accrue to the poor; part (often the biggest part) accrues to the richer households through increased returns to capital, managerial skills, and skilled labor. If the share of indirect income accruing to the richer households is large during the early rounds of the multiplier, then the labor intensity of the full multiplier may be much lower than expected. Whether richer households have better expenditure patterns from this point of view is a moot point: the answer depends on the evaluation of a whole sequence of incremental supply and demand changes.

Enough has been said to indicate that the question of which kinds of agricultural households have the most beneficial expenditure patterns to induce employment-

intensive growth in rural areas cannot yet be answered satisfactorily. And there are strong indications that growth and equity are not as complementary as one might wish. A bold approach toward resolving these issues is through the use of country growth models that include detailed specification of the linkage structures. Mellor and Mudahar have pioneered such an approach for India, demonstrating favorable increases in total employment as a consequence of moderate increases in the growth of foodgrain production.¹⁴

The objectives of this study are more modest. The availability of unusually detailed data sets on rural household expenditure behavior in two regions is taken advantage of to learn more about the structure of rural consumption linkages. Then, within the context of realistic assumptions about the responsiveness of the supply structure in these regional economies, an attempt is made to draw some broader conclusions about which households should be targeted for agricultural growth and about the trade-offs between regional growth and equity in the two regions.

There are three particularly attractive features about the data sets for Muda and Gusau, which are used for this report. First, they include exceptionally detailed information about the individual goods and services consumed by the sample households, which are interesting in their own right. In conjunction with geographically well-defined regional economies surrounding the projects, it is also possible to measure some of the locational linkages of household expenditure patterns. Second, the two regions have a number of similarities as well as interesting contrasts, which contribute to a useful comparative analysis. Third, the comparability of the two data sets is greatly enhanced by the fact that both surveys were designed and administered by Roger Slade, and the questionnaires and variable definitions are similar.

Because the data are taken only from the project areas, the discussion of rural growth

¹² Mellor, *New Economics of Growth*.

¹³ Ammar Siamwalla, "Growth Linkages: A Trade-Theoretic Approach," International Food Policy Research Institute, Washington, D.C., 1982. (Mimeographed.)

¹⁴ John W. Mellor and Mohinder S. Mudahar, "Simulating a Developing Economy with Modernizing Agricultural Sector: Implications for Employment and Economic Growth in India," Cornell Agricultural Economics Occasional Paper 76, Cornell University, Ithaca, N.Y., June 1974.

must be correspondingly narrowed to the project regions. This presents difficulties in that household demand links to other rural areas will be viewed as leakages from the project areas and therefore undesirable for local growth. This position is tenable in that the two project areas are economically backward within the context of their national economies and therefore deserve priority treatment. Both regions are also isolated; their communication routes are poor except for those leading to major urban centers. Although incomplete, the available evidence suggests that household demand leakages to other rural regions are insignificant.

Like many other regions in the developing world, the major output of the study areas is foodgrains, the greater part of which is exported out of the region at a given price. In return, these regions import from outside the region goods for investment, production, and household consumption. The production of foodgrains is typically fixed by the availability of land and technology, but the

supplies of locally produced nonfood goods and services, as well as the supply of some specialty agricultural commodities, are typically elastic, because the supply of labor, which is their major input, is also elastic.

Within this simplifying framework, the households whose expenditure patterns most promote labor-intensive growth within the surrounding region are those households that spend the largest share of incremental income on commodities that are regional nontradables.¹⁵ Nontradables include all locally produced goods and services that are entirely consumed within the region. These are mostly nonfoods but also include some specialty agricultural commodities. Foodgrains are not included by definition.

This analysis is weakened by the lack of reliable household savings and investment data and by the lack of any information on the expenditure behavior of nonagricultural households within the regions. These and other limitations will be taken up in the conclusion.

¹⁵ Siamwalla, "Growth Linkages."

3

THE CASE STUDIES

The Muda Irrigation Project

The region that embraces the Muda irrigation project lies in the northwest of peninsular Malaysia and comprises the state of Perlis and the greater part of the four most northerly administrative districts of the state of Kedah (see Figure 1). The core of the region is the northern Kedah plain, most of which is less than 10 feet above sea level.¹⁶

The estimates of land use in the region are based on a 1966 aerial survey (see Table 1). The importance of rice cultivation is evident. For the most part, it is confined to the coastal plain, which embraces most of the project area. In northern Perlis, valley bottoms are also under paddy cultivation, and there is a series of independent small irrigation schemes, some benefiting from controlled drainage or irrigation facilities. Outside the plain, land is put to other uses. Since 1970 scattered pockets of tobacco cultivation have appeared, together with two sugar plantations. But these are small exceptions in a landscape dominated by rubber plantations and smallholdings divided by stretches of secondary jungle. In the extreme east, in the foothills of the mountains, logging, charcoal burning, and upland paddy cultivation are widespread. Large areas with little if any productivity are concentrated mainly in the upland part of the region.

In 1972 the region's population was 687,000 persons living in 125,240 households, fewer than 20 percent of whom were living in urban areas (towns containing 5,000 or more persons). Alor Setar, with a population of 110,000, is the only major town in the region but there are 30 or more smaller towns with populations of 9,000 or fewer.

In the early 1970s rice production provided a livelihood in whole or in part for some 60-65,000 farming families, about

5,000 landless workers, and many others engaged in occupations that depended on or serviced the farming community.

Since 1974 the region has produced about 45 percent of Malaysia's annual output of rice, as well as important amounts of fish, rubber, and timber. However, other than agroprocessing, the region's industrial base is not well developed.

Traditionally, Muda's paddy farmers grew one crop of rice each year in harmony with the summer monsoons. But in 1966 work began on the Muda irrigation project, and since its completion in 1974, about 250,000 acres of paddy land—about 75 percent of the region's total paddy area—are now double cropped. The introduction of im-

Figure 1—Location of the Muda irrigation project, peninsular Malaysia



¹⁶ A detailed description of the Muda irrigation project and its surrounding region is to be found in Bell, Hazell, and Slade, *Project Evaluation*.

Table 1—General land use in Muda, 1966

Land Use	Percentage of Area
Forest (including unproductive secondary jungle)	34.0
Paddy	28.6
Scrub (mainly unproductive)	13.1
Rubber	9.9
Mixed horticulture (mainly <i>kampong</i> land ^a)	5.8
Other productive area	1.8
Urban area	0.5
Other unproductive area (swamp, cliffs, quarries)	6.3
Total	100.0

Source: Clive Bell, Peter Hazell, and Roger Slade, *Project Evaluation in Regional Perspective* (Baltimore and London: The Johns Hopkins University Press, 1982), Table 2-1.

^a Village land occupied by houses, fruit trees, and gardens.

proved rice varieties in the late 1960s accentuated the project's impact, and the region's production of paddy increased by about 140 percent between 1967 and 1974. Bell, Hazell, and Slade estimate that paddy farming incomes increased by 380 percent in nominal terms during this period and that employment in paddy farming doubled.¹⁷

The Gusau Agricultural Project

The Gusau project area lies in the eastern fringe of the state of Sokoto on the high plains of Hausaland in northern Nigeria (see Figure 2).¹⁸ This is an undulating plain at a general elevation of 1,500-3,000 feet.

The rainfall pattern is markedly seasonal: on average 85 percent of the annual rainfall of 37 inches falls during the period June to September, and none at all falls during November, December, or January. Major uncertainty surrounds both the commencement and duration of the rains, and this

uncertainty tends to dominate the traditional farming practices. There is virtually no supplementary irrigation in the area, and farming is restricted to a single crop season each year.

About 40 percent of the total land area is cropped (Table 2), usually under mixed cropping systems using only small amounts of modern inputs. The important crops are millet, sorghum, cowpeas, cotton, and groundnuts, and these are cultivated mostly by the settled Hausa-speaking farmers. However, the land is also shared with nomadic Fulani herders.

The Hausa villagers often own some small livestock such as goats, sheep, and donkeys, and a few of them own one or several pairs of oxen. But raising large animals is a specialized occupation placed in the hands of the Fulani. The Fulani herders graze the livestock in the Hausa fields during the dry season, thereby providing an important source of manure, but during the rainy season they drift on to uncropped lands. This traditionally symbiotic relationship between Hausa and Fulani is more and more threatened as population pressures increase.

Figure 2—Location of the Gusau agricultural development project, Nigeria



¹⁷ Ibid.

¹⁸ Detailed descriptions of the Gusau region and its project are given in R. H. Slade, "The Monitoring and Evaluation of the Funtua, Gusau and Gombe Agricultural Development Projects," Agricultural Projects Monitoring, Evaluation and Planning Unit, Federal Department of Rural Development, Nigeria, 1980 (mimeographed); and Jean-Claude Balcet and Wilfred Candler, *Farm Technology Adoption in Northern Nigeria*, vol. 1, main report (Washington, D.C.: International Bank for Reconstruction and Development, 1982).

Table 2—Crop area in Gusau, 1976/77

Crop	Crop Area
	(1,000 hectares)
Cotton	73.3
Cowpeas	110.2
Groundnuts	55.3
Maize	3.6
Millet	119.8
Peppers	1.8
Rice	5.8
Sorghum	149.3
Sweet potatoes	22.5
Total crop area	231.0
Noncrop area	380.8

Source: Roger H. Slade, "The Monitoring and Evaluation of the Funtua, Gusau and Gombe Agricultural Development Projects," Agricultural Projects Monitoring, Evaluation and Planning Unit, Federal Department of Rural Development, Nigeria, 1980. (Mimeographed.)

Note: The areas shown are those on which the crop was planted, irrespective of whether the crop was grown alone or with other crops.

In 1976 the project area had a population of about 570,000 people, of whom about 100,000 lived in the only two towns of any significance in the area.¹⁹ Gusau is the largest town with a population of about 70,000 people, and Kaura Namoda has about 30,000 people.

The regional economy is dominated by agriculture, and agroprocessing is the core of the region's industrial base. In 1976 some 63,600 of the region's 77,000 households depended primarily on farming for their livelihood.

The agricultural development project, which was initiated in 1976/77, was premised on the assumption that better farming technologies existed than were being used by local farmers at that time. The project consisted of a package of recommended technologies, farm extension services, farm credit,

improved deliveries of fertilizers and pesticides, and oxen-drawn plows. In addition, an extensive network of farm roads was constructed, together with village schools, water storage tanks, health centers, and agricultural markets. At the time of the project's implementation, farm prices increased substantially in Nigeria, and the project's impact on farm production and incomes was greatly enhanced by these price increases.

Comparison of Project Areas

One objective of this study is to compare the expenditure behavior of households in Muda and Gusau. Similarities and differences between the two regions are therefore of some importance.

Geographically, the two areas have much in common. The total land area of each is about 1 million acres (1.09 million acres for Muda and 0.94 million acres for Gusau), and their population density is about 0.6 persons per acre (including nonagricultural land). However, in Muda the population is concentrated along the coastal plain whereas in Gusau it is more widely dispersed. Both regions are predominantly agricultural and depend on agricultural exports to the larger national economy for their livelihood. In each, only one or two large towns (Alor Setar in Muda, Gusau and Kaura Namoda in Gusau) dominate a rural network of much smaller towns and villages and provide the focal points for local trade and commerce. The Muda region is well defined by geographic boundaries,²⁰ but the Gusau project area follows administrative boundaries. Nevertheless, the long distances of more than 100 miles to other major towns and the few roads and public transportation facilities serve to define the Gusau project area as a reasonable economic watershed around its focal towns. This is important because any meaningful analysis of the spatial aspects of

¹⁹ Population data for Nigeria are particularly unreliable. This estimate was obtained by using 1976 data from the Agricultural Projects Monitoring, Evaluation and Planning Unit (APMEPU), Federal Department of Rural Development in Nigeria (Slade, "Funtua, Gusau and Gombe Projects") and 1963 census data for the townships of Gusau and Kaura Namoda (Nigeria, Federal Office of Statistics, *Annual Abstract of Statistics* [Lagos: Federal Government Printer, 1975]).

²⁰ The Muda region is bounded to the west by the Straits of Malacca and to the north by the border with Thailand. To the east it terminates in the jungled mountain ranges of Inner Malaysia and to the south it ends abruptly in the forested slopes of Kedah Peak (nearly 4,000 feet high). These boundaries define a natural economic "watershed."

household expenditure behavior depends on a regional definition that encompasses all the places where the households do their shopping, as well as the places in which local nontradable goods and services are produced.

The inhabitants of both regions are Islamic. Muda's farmers are predominantly Malay. The household structure is generally nuclear and comprises 5.6 persons on average. Each household typically lives in a separate house surrounded by its own garden, called *kampong* land, and these houses are strung in linear settlement patterns along the roads and rivers. The large towns in Muda are populated predominantly by Chinese.

The social structure in Gusau is more complex.²¹ Most farmers are Hausa, and live in close-knit village communities. At first appearance, the basic family unit would seem to include everyone who lives in a compound, which comprises a collection of huts within a well-fenced boundary. But the nucleus household is really the conjugal family (*iyali*) comprising a man, his wife or wives, and children. The average *iyali* consists of 7.4 persons. It is common for more than one *iyali* to live within a compound, and,

typically, the *iyalai* within a compound will be related through their male heads of household. The *iyalai* in one compound often comprise a single farming unit, though it is not unusual for persons living in different compounds to participate in a common farming unit.

Land is a communal asset in Gusau, and individuals only have usufructuary rights for specified time periods. In contrast, land is privately owned in Muda, but there is an active land-leasing market. Although there is some absentee landlordism, most land contracts appear to involve kin, and there is considerable variation in the rents paid per acre.

The distribution of holdings by the size of their operated areas is shown in Table 3 for both Muda and Gusau. The average farm size in Muda was 4 acres in 1973, and 93.8 percent of the farmers operated holdings of less than 8 acres. In Gusau the average holding size in 1976 was 9 acres. Though this is more than twice the size of the average Muda holding, the productivity of the land is much lower. 96.5 percent of Gusau's farmers operated holdings of less than 30 acres, and more than half had holdings of

Table 3—Distribution of farms by size of operated area in Muda, 1972/73, and Gusau, 1976/77

Size (acres)	Muda		Gusau	
	Percentage of Farms	Cumulative Percentage of Farms	Percentage of Farms	Cumulative Percentage of Farms
0 - 1	10.37	10.37	0.69	0.69
1 - 2	17.04	27.41	6.23	6.92
2 - 3	24.08	51.49	8.65	15.57
3 - 4	15.73	67.22	10.38	25.95
4 - 5	10.85	78.07	9.69	35.64
5 - 6	6.91	84.98	7.27	42.91
6 - 8	8.82	93.80	15.92	58.82
8 - 10	2.86	96.66	9.00	67.82
10 - 15	2.74	99.40	17.30	85.12
15 - 20	0.36	99.76	6.92	92.04
20 - 30	0.24	100.00	4.50	96.54
Greater than 30	3.46	100.00

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

²¹ For a more detailed discussion, see David W. Norman, "An Economic Survey of Three Villages in Zaria Province," Samaru Miscellaneous Paper 37, Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria, 1972.

less than 8 acres. The Gini coefficient for the operated holding size was 0.39 in Muda in 1972, which is similar to a coefficient of 0.41 for Gusau in 1976.

The Food and Agriculture Organization of the United Nations (FAO) gives an average net household income (farm and nonfarm) of 1,967 Malay dollars (M\$) for Muda's farmers in 1973. This is equivalent to M\$ 351 per capita.²² Slade gives a figure of 711 naira (₦) per farm (or 96 naira per capita) for Gusau's farmers in 1976.²³ If Muda incomes are inflated by the national consumer price index, which increased by 25.9 percent between 1973 and 1976, and then the incomes from both regions are converted to U.S. dollars at the 1976 international exchange rates, the average per capita income for Muda would be \$174 and that for Gusau would be \$152.²⁴

This comparison suggests that in 1976 the farm population in Gusau enjoyed a standard of living comparable to that attained by Muda's farmers in 1973. But this contrasts markedly with the observations of one of the authors during field trips to Muda in 1975 and Gusau in 1978. The farming population in Muda appeared to be better dressed; they lived in more capital-intensive housing; and they displayed far more jewelry and other durable goods than were seen in Gusau. Many of Muda's residents also owned mopeds or motor bikes and visited town

much more frequently than their foot or bicycle-bound counterparts in Gusau.

The discrepancy can be explained by the overvalued Nigerian exchange rate. If the "black-market" rate prevailing in 1976 is used as a measure of this overvaluation, the per capita income in Gusau would have been about \$96, or only 55 percent of the per capita income in Muda in 1973.

This disparity in living conditions is also reflected in the different levels of social infrastructure available in the regions. In 1970 the Muda region had more than twice as many roads per square mile as Gusau had in 1980. On a per-1000-person basis, Muda in 1970 also had 4 times as many hospital beds, 11 times as many health centers, one third more primary school pupils, and 16 times more secondary school pupils than did Gusau in 1980.²⁵ Public water and electricity supplies were also widely available in Muda, whereas Gusau still relies largely on hand-dug wells and kerosene lighting.

The Household Surveys

The two surveys, which were funded by the World Bank, had broader purposes than this study, but both involved farm household income and expenditure surveys that proved to be well-suited for this study.²⁶ These surveys were designed to be representative

²² Food and Agriculture Organization of the United Nations, *The Muda Study: A First Report*, 2 vols. (Rome: FAO, 1975), Table 37.

²³ Slade, "Funtua, Gusau and Gombe Projects," Table III-c-15.

²⁴ In 1976, U.S. \$1.00 equalled 2.54 Malaysian dollars (M\$) and 0.63 Nigerian naira (₦).

²⁵ Figures for Muda are calculated from Food and Agriculture Organization of the United Nations, *Muda Study*, Table 4, and those for the local government area of Gusau are taken from Francis S. Idachaba et al., *Rural Infrastructures in Nigeria: Basic Needs of the Rural Majority* (Lagos: Federal Department of Rural Development, October 1981). More precisely, the data are as follows:

	Muda (1970)	Gusau (1980)
Population per hospital bed	809	3,179
Population per health center	27,484	311,500
Primary school pupils per 100 persons	70.7	52.6
Secondary school pupils per 100 persons	41.1	2.6

For Muda, information on roads is taken from Bell, Hill, and Slade, *Project Evaluation*; and for Gusau, from Idachaba et al., *Rural Infrastructures in Nigeria*.

²⁶ The Muda and Gusau projects were two of the earliest World Bank agricultural projects to be monitored and evaluated through field surveys. In the case of Muda the initiative for the surveys came from the Food and Agriculture Organization of the United Nations (FAO), and the World Bank funded a special evaluation unit in 1972 through the FAO/World Bank Cooperative Program. The Gusau project was monitored as part of a larger effort in northern Nigeria. APMEPU was initially set up in 1975 as part of a World Bank loan for the three agricultural development projects of Gusau, Funtua, and Gombe (APMEPU now monitors a much larger number of projects). Both efforts depended heavily on government support, particularly the Muda Agricultural Development Authority in Malaysia and the Federal Department of Rural Development in Nigeria.

of all the households living within the project boundaries who benefited directly from the projects. In Muda this meant a sample of paddy farmers and landless workers who derive most of their income from employment on paddy farms.²⁷ It did not include seasonal migrants who came from outside the region or farmers and farm workers living within the study area but beyond the irrigation project boundaries. In Gusau the survey included only settled farmers; it excluded the nomadic Fulani; there are no landless farm workers in Gusau. Neither survey included households whose primary source of income was from other than agriculture.

Because both household surveys were designed by Roger Slade, there is a useful degree of similarity between them. The sampling unit in each survey was the household. This is defined as the family head, his wife or wives, children, and any other relatives, workers, or servants who normally live in the house and eat from the same pot. The concept of eating from the same pot, in the sense of eating at the same time and from the same table, is crucial to the definition of the household, particularly in Gusau where different *iyalai* living in the same compound can only be firmly distinguished on this basis.

The two surveys were conducted weekly. The Muda data cover the period November 1972 to November 1973, and the Gusau data cover the period May 1976 to April 1977. The sample sizes are 839 for Muda and 321 for Gusau. Complete information was recorded on the use of family labor (for farm and nonfarm purposes), hired farm labor, farm expenditures and income, nonfarm income, borrowings, and the household's consump-

tion and expenditures on foods and all non-food goods and services. The latter were recorded with enough detail to permit each item to be classified as produced locally or imported into the region and to be aggregated in ways that are useful for comparison. Regrettably, full information on the factor composition of each good and service is not available, and the analysis of the factor intensity of expenditure patterns by different types of households is limited. Supplementary surveys also provide details of the household's ownership of farm assets and household durables, as well as the composition and the socioeconomic characteristics of the family.

With the exception of a few small pilot areas, the Muda scheme was implemented in annual phases starting in 1970, and each phase was related to a distinct geographical area. Therefore, when the farm household survey was undertaken, it was possible to distinguish five main groups of farmers; those who double cropped for the first time in 1970 or earlier, 1971, 1972, 1973, and 1974. This phasing of the project permits what is essentially a cross-sectional survey to provide a crude proxy for the trajectory of the project's impact. The farmers who were scheduled to come into the scheme in 1974 (that is, those who had not begun to double crop at the time of the survey) represent, with certain qualifications, the "without project" situation,²⁸ whereas those from earlier phases provide some basis for inferring the train of adjustments to the new economic circumstances created by the project.

Additional details about the two surveys are to be found in Appendix I.

²⁷ Very few of the landless are without a small parcel of land that they cultivate; however, such parcels are invariably rented.

²⁸ The employment opportunities for these farmers on other paddy farms were undoubtedly more favorable in 1972/73 than they would have been if there were no project at all. The prospects of their imminent participation in double cropping may also have led to some anticipatory biases in their expenditure behavior.

4

METHOD OF ANALYSIS

The principal purposes of this analysis are to estimate income-consumption relationships for individual commodities and to establish how these relationships change as the income and socioeconomic characteristics of the households change. For these purposes the complications of household expenditure response to price changes need not enter the analysis. Also, because household expenditures on some items, such as specific foods, are seasonal, whereas others, such as clothes and durables, are only purchased infrequently, more robust and useful income-consumption relationships are to be found by aggregating the weekly data to an annual basis. The model is therefore a set of Engel functions relating annual expenditures on different goods and services to a measure of total income; it is fitted to cross-sectional data.

Although household income data were available from the household surveys, the annual consumption expenditure for each household was used as a proxy for income. There were two reasons for this. First, the income data proved to be noisy, and the reported income was often less than household expenditure, even after dissavings were allowed for. Second, consumption expenditure is usually considered a better indicator of permanent income, which itself is considered to be the more important determinant of consumption behavior.²⁹ This consideration is particularly relevant for Gusau where annual incomes fluctuate much more than in Muda. But, because of the project, Muda's respondents were also having to readjust their incomes at the time of the survey. Under these conditions, total consumption expenditure is likely to provide a better measure of the households' perceptions of

their future income than the actual incomes recorded in the surveys.

Choice of Functional Form

In order to meet the objectives of this study, a flexible functional form is required. For one thing, the chosen function must provide a good statistical fit to a wide range of commodities. But also, since a common set of Engel relations is to be estimated for all the households in each survey, the function must have a slope that is free to change with income. Policies that redistribute income from one household group to another will only affect aggregate regional demand within the analysis if the marginal expenditure patterns of each household group are different. A model specification that imposes the same slope (or marginal budget share) for all incomes would assume away any distributional consequences.

Assume for the moment that all households differ only in their total consumption expenditure. A linear functional form would then be too restrictive for these purposes. The linear Engel curve

$$E_i = \alpha_i + \beta_i E, \quad (1)$$

where E_i is expenditure on good i , E is total consumption expenditure, and α is a constant, does not permit the marginal budget share (β_i) to vary at all. Thus, redistribution is implicitly assumed to have no effect on the aggregate expenditure of good i .

A nonlinear function is clearly required, and a modified form of the Working-Leser model was chosen:³⁰

²⁹ Milton Friedman, *A Theory of the Consumption Function* (Princeton, N.J.: Princeton University Press, 1952).

³⁰ The model differs from the Working-Leser model because it includes an intercept in equation (3). In theory, E_i should always equal zero whenever total expenditure E is zero, and this restriction should be built into the function. But zero observations on E invariably lie well outside the sample range. Also, observing this restriction with the Working-Leser model can lead to poorer statistical fits, as well as to unwarranted changes in the sign of the second derivative of the estimated curve. Inclusion of the intercept term has little effect on the marginal budget shares for the average person, but it can make a significant difference for income redistribution results. It seems likely that the zero intercept specification is only relevant if higher order nonlinear terms are also included in the model.

$$S_i = \beta_i + \alpha_i/E + \gamma_i \log E. \quad (2)$$

where $S_i = E_i/E$ is the share of good i in total expenditure, and γ_i is a constant.

Equation (2) is equivalent to the Engel function

$$E_i = \alpha_i + \beta_i E + \gamma_i E \log E. \quad (3)$$

In Figure 3 it can be seen that when graphed the Engel function is convex when $\gamma_i > 0$, but concave when $\gamma_i < 0$. For $\gamma_i < 0$, the function also reaches a maximum for some value of E , after which the marginal budget share declines, indicating an inferior good. This maximum typically lies beyond the sample range of observations but not always.

The function is inflexible in the sense that it cannot be convex for some income levels and concave for others—at least not if it is fitted to a single cross-sectional sample. In the initial estimations, higher order terms were also included, which permitted considerably more flexibility in the shape of the function. These additional terms, however, turned out not to be statistically significant, and they were dropped from the final analysis.

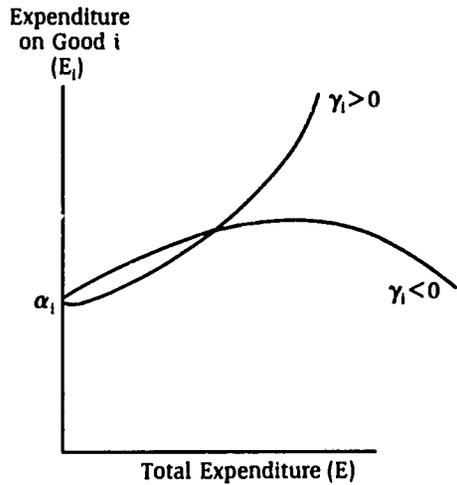
In comparing the expenditure behavior of households with different incomes, allowance must be made for differences in their other socioeconomic characteristics. Part of the observed differences in expenditure behavior may be due, for example, to different family or farm sizes, or to differences in education and age. A number of household characteristic variables are included in the Engel functions, and this has been done in a way that allows them to shift both the intercept and the slope of the Engel functions. Let Z_j denote the j th household characteristic variable and let μ_{ij} and λ_{ij} be constants. The complete model is then:

$$E_i = \alpha_i + \beta_i E + \gamma_i E \log E + \sum_j (\mu_{ij} Z_j + \lambda_{ij} E \cdot Z_j). \quad (4)$$

In expenditure share form, this is equivalent to:

$$S_i = \beta_i + \alpha_i/E + \gamma_i \log E + \sum_j (\mu_{ij} Z_j/E + \lambda_{ij} Z_j). \quad (5)$$

Figure 3—Possible Engel curves for the equation $E_i = \alpha_i + \beta_i E + \gamma_i E \log E$



Inclusion of these additional terms also introduces considerably more flexibility in the way that the marginal budget shares can vary by household types. They therefore have an important bearing on income redistribution results.³¹

Given the chosen Engel function, the marginal and average budget shares for the i th good (the MBS_i and ABS_i , respectively) and the expenditure elasticity ξ_i can be derived as follows:

$$MBS_i = dE_i/dE = \beta_i + \gamma_i (1 + \log E) + \sum_j \gamma_{ij} Z_j. \quad (6)$$

$$ABS_i = S_i = \text{equation (5)}. \quad (7)$$

and

$$\xi_i = MBS_i/ABS_i. \quad (8)$$

For the average household, these terms are evaluated at the sample mean values for E and Z_j . But for income redistribution experiments, say across expenditure deciles, then E and Z_j are assigned their mean values for the relevant deciles.

So far, the issue of whether the variables are to be expressed in per capita or household terms has been avoided. Because the use of

³¹ Omission of these variables could also bias the estimated expenditure coefficients.

per capita variables more readily permits comparisons between households and between the two study areas, this option is taken. But family size is also included as one of the Z_j variables, so that the model permits family size to influence both the intercept and the slope of the individual commodity Engel functions.

In defining family size no attempt was made to use equivalence scales; the family size is taken simply as the number of persons. This is because different equivalence scales would be needed for different food and nonfood items, and there is no satisfactory way of estimating all these weights. In order to capture some family composition effects, additional Z_j variables were added that directly characterize the structure of the family. Typical variables are the percentage of women, babies, and children in the family, and each of these variables is allowed to affect both the intercept and the slope of the individual Engel functions.

Estimation of the Model

The model can be estimated using either equation (4) or (5). The expenditure share version, equation (5), was chosen. It is obtained by dividing the Engel function, equation (4), by E . This normalization removed an otherwise troublesome heteroskedasticity problem, an inevitable consequence of the fact that variability in E_i increases with total expenditure E in cross-sectional data.³² A disadvantage of estimating share equations is that the R^2 coefficients are typically smaller.³³

In estimating the model it is not necessary to impose any restrictions to ensure that $\sum_i \beta_i = 1$ and $\sum_i \alpha_i = \sum_j \mu_{ij} = \sum_i \lambda_{ij} = \sum_i \gamma_i = 0$ in equation (4). These conditions are automatically fulfilled because of the way in

which the model is specified. Specifically, Prais and Houthakker³⁴ have shown that, providing each budget share equation has an intercept on the right-hand side³⁵ and providing each equation contains all the same variables and is estimated by least squares regression, adding up is assured. This result is affected neither by the inclusion of additional nonlinear terms in E , nor by the inclusion of household Z variables.

There are two drawbacks to this approach to ensuring adding up. First, the inclusion of all the explanatory variables in the equation for every commodity inevitably wastes some degrees of freedom. Many Z_j variables are chosen because they are likely to influence expenditures on certain types of commodities, and they are not expected to significantly affect all commodities. Fortunately, given the large sample sizes in Muda and Gusau, the loss of degrees of freedom from retention of insignificant coefficients was not important. Second, the need to use the same functional form in each equation rules out a common practice of fitting several different functions for each commodity, and then choosing the one that fits best.

The parameters of the share equations were estimated for each commodity using ordinary least squares regression (OLS). As suggested by Massell, two-stage least squares (TSLS) were also tried to correct for the problem, first noted by Summers, of correlation between independent variables and the disturbance term when total consumption expenditure is used as an independent variable.³⁶ But the results from TSLS proved inconclusive. The results obtained were sensitive to the auxiliary specification assumed, the t -statistics dropped sharply, and the estimated coefficients did not change in any systematic way from those obtained by OLS. Therefore, OLS was retained as the estimating procedure. This had the added and persuasive advantage of permitting the

³² See S. J. Prais and H. S. Houthakker, *The Analysis of Family Budgets* (Cambridge: Cambridge University Press, 1971), pp. 55-56.

³³ This is because the constant term corresponds to a constant budget share, which by itself can be a good fit to the original expenditure data. In fact, if a constant budget share explains all of the sample variation in expenditure on good i , then the R^2 of equation (4) will be unity, whereas the R^2 for equation (5) will be zero.

³⁴ Prais and Houthakker, *Analysis of Family Budgets*, pp. 84-85.

³⁵ An intercept term in the i th budget share equation is equivalent to a linear term in total expenditure in the corresponding expenditure equation.

³⁶ See B. F. Massell, "Consistent Estimation of Expenditure Elasticities from Cross-Section Data on Households Producing Partly for Subsistence," *Review of Economics and Statistics* 51 (1969): 136-142; and Robert Summers, "Note on Least Squares Bias in Household Expenditure Analysis," *Econometrica* 27 (1959): 121-126.

nonlinear terms in E to be retained in the equations.

The measure of total consumption expenditure used in the regression includes the value of any foods grown and consumed by the households. These foods were valued at market prices, which are typically higher than farm-gate prices for food sales. Unless all the households in the sample are net buyers of these consumed foods, consumption by those households that sell food will be determined using a different set of prices than consumption by those households that are net buyers. This problem is not likely to be serious in either the Muda or Gusau data sets, since nearly all the farms produced a net surplus of basic foodstuffs in the survey years. It may, however, be a problem for the landless farm workers included in the Muda survey, though the problem is mitigated somewhat because they receive part of their wage earnings in paddy. Massell suggests that a subsistence ratio variable be included in the Engel functions to correct for this problem.³⁷ Farm size was used instead in this model.

Because the marginal and average budget shares in equations (6) and (7) are linear combinations of the estimated parameters, their t-statistics can be readily calculated from the standard errors of the estimated parameters. Furthermore, it is a simple matter to test whether there are significant differences in the marginal or average budget shares of households with different characteristics (for example, between different income deciles). In this case the differences in the marginal and average budget shares are again linear combinations of the estimated coefficients. Finally, the hypothesis that the expenditure elasticity ξ_1 is greater (or less) than unity can be tested approximately using the t-statistics for the hypothesis that $MBS_1 - ABS_1$ is greater (or less) than zero.

Choice of Independent Variables

Tables 4 and 5 summarize the explanatory variables that were selected for inclusion in

the budget share equations for Muda and Gusau. Fewer variables were available in Gusau than Muda, and statistically significant coefficients were also harder to obtain in Gusau. The variables in Tables 4 and 5 were selected after initial screening tests for significant results. Most of the variables are self-explanatory, and discussion is limited to a few observations.

It is presumed that households with larger farms will have access to larger amounts of homegrown foods at farm-gate prices; thus, variables for farm size act as a proxy for Massell's subsistence ratio. In Muda, the farmland of the sample households is devoted exclusively to paddy, so a variable is also included for *kampong* land around the house. This land is used for the production of tree crops and vegetables and for rearing small livestock and poultry.

The variables for farm size also serve to differentiate the landless farm workers from farming households in the Muda survey data. Initial trials with dummy variables for landless workers showed that they were not significantly different in their expenditure behavior from farm households if the land variable for the latter is set equal to zero.

The credit variables measure the share of a household's total expenditure (including the value of homegrown foods) that is financed with consumer loans. Such credit is typically provided by traditional money-lenders and shopkeepers. Because credit availability can be influenced by government policy, it is of some interest to discover whether credit can be used to manipulate household expenditure patterns in any useful way.

Dummy variables are used to capture the effects of religion, race or tribe, and, in Muda, of education. Two dummy variables are also included in Muda to capture the dynamics of adjustment to double cropping. It is hypothesized that households with four or more years of double-cropping experience have different expenditure behavior than households with one to three years experience. Similarly, households that are still single cropping are also hypothesized to have different expenditure behavior.

³⁷ Massell, "Consistent Estimation of Expenditure Elasticities."

Table 4—Independent variables included in the Muda regressions

Description	Name	Unit
Intercept.	INTERCEPT	M\$
Reciprocal of per capita expenditure.	1/E	M\$
Log of per capita expenditure.	Log E	...
Log of family size.	Log N	Log people
Log of family size ÷ per capita expenditure.	(Log N)/E	...
Operated paddy area per capita.	FARM	Relongs ^a
Operated paddy area ÷ total expenditure.	FARM/E	...
House garden area per capita.	GARDEN	Relongs
House garden area ÷ total expenditure.	GARDEN/E	...
Number of babies (less than one year old) as proportion of family size.	BABY	Percent
Babies ÷ per capita expenditure.	BABY/E	...
Number of children (one to five years old) as proportion of family size.	CHILD	Percent
Children ÷ per capita expenditure.	CHILD/E	...
Number of youths (6 to 15 years old) as proportion of family size.	YOUTH	Percent
Youths ÷ per capita expenditure.	YOUTH/E	...
Number of adult women as proportion of family size.	WOMEN	Percent
Women ÷ per capita expenditure.	WOMEN/E	...
Age of household head.	AGE	Years
Age of household head ÷ per capita expenditure.	AGE/E	...
Dummy for long-term double cropping: Double cropped four or more years = 1; otherwise = 0.	DCLONG	...
Dummy for long-term double cropping ÷ per capita expenditure.	DCLONG/E	...
Dummy for short-term double cropping: Double cropped one to three years = 1; otherwise = 0.	DCSHORT	...
Dummy for short-term double cropping ÷ per capita expenditure.	DCSHORT/E	...
Dummy for race: Malay = 1; other = 0.	RACE	...
Education of household head: No formal education = 0; some education = 1.	EDUCATION	...
Loans for consumption as proportion of total expenditure.	CREDIT	Percent

^a A relong is equal to 0.71 acres or 0.29 hectares.

Table 5—Independent variables included in the Gusau regressions

Description	Name	Unit
Intercept.	INTERCEPT	Naira
Reciprocal of per capita expenditure.	1/E	Naira
Log of per capita expenditure.	Log E	...
Log of family size.	Log N	Log people
Log of family size ÷ per capita expenditure.	(Log N)/E	...
Operated farm size per capita.	FARM	Hectares
Operated farm size ÷ total expenditure.	FARM/E	...
Number of children (less than fourteen years old) as proportion of family size.	CHILD	Percent
Children ÷ per capita expenditure.	CHILD/E	...
Loans for consumption as proportion of total expenditure.	CREDIT	Percent
Dummy for tribe: Hausa = 1; other = 0.	TRIBE	...
Dummy for religion: Muslim = 1; other = 0.	RELIGION	...

5

EXPENDITURE BEHAVIOR OF THE AVERAGE HOUSEHOLD

Expenditure by Commodity Group

The expenditure data from the household surveys give detailed commodity information. In Muda there are some 80 food items and 60 nonfood items, and in Gusau there are about 100 food items and 60 nonfood items. Where relevant, items are also subdivided into those purchased or produced at home. This amount of detail is helpful in classifying individual goods and services and in identifying whether items are produced within the study regions. But some aggregation is desirable for Engel curve estimation as some commodities are strong substitutes, and an expenditure on one will not be independent of the other. Also, there are so few expenditure observations on some items or the budget share is so tiny that individual Engel curves would be difficult to estimate.

All the commodities and services are classified into nine basic groups: food, alcohol, and tobacco; clothing and footwear; consumer expendables; housing; transport; durables; education and health; personal services and entertainment; and social obligations. For some purposes only aggregate results for these groups are reported, but for other purposes results are reported for a total of 75 subgroups, of which 31 are foods and 44 are nonfoods. These subgroups were selected not only for the reasons mentioned above but also so that the data from Muda and Gusau could be matched whenever possible.

Table 6 summarizes the expenditure behavior of the average households in the Muda and Gusau samples. These results were obtained by evaluating the average and marginal budget shares and the expenditure elasticities in equations (6), (7), and (8) at the sample mean values for total expenditure E and all the household Z_j variables.

Food, alcohol, and tobacco is by far the most important commodity group in the total budget. It accounts for two thirds of total household expenditure in Muda and for 80 percent in Gusau. The expenditure elasticity is also below unity in both cases (0.57 in Muda and 0.94 in Gusau), indicating that, as a group, foods are a necessity in the household budget. There are no other commodity groups in Table 6 that have an elasticity less than unity, though there are a few cases where the expenditure elasticities are not significantly greater than one.

There is remarkable similarity in the expenditures on clothing and footwear, consumer expendables, and transport in the two study areas. In both, the average and marginal budget shares and the expenditure elasticities are almost the same. Taken together, these three groups of commodities account for 11-13 percent of the total budget and for about 16 percent of incremental expenditure. They have a combined expenditure elasticity of between 1.2 and 1.4.

Of the remaining groups, expenditures on housing and social obligations are more important in Muda than in Gusau, as a share of both total and incremental budget expenditure.

Expenditures on durables, education and health, and personal services and entertainment only account for small shares of total household expenditure in both regions, but their shares in incremental expenditure are much larger in Muda. The particularly small average budget shares for education and health can be attributed to the public provision of these services without charge in both regions.

There are few studies that are strictly comparable to this one because of differences in variable definitions, data collection, and estimating procedures. The results in Table 6 are generally compatible with King and Byerlee's work in rural Sierra Leone.³⁸ They

³⁸King and Byerlee, *Income Distribution*.

Table 6—Comparison of expenditure behavior of the average household in Muda, 1972/73, and Gusau, 1976/77

Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Commodity group						
Food, alcohol, and tobacco	66.69 (160.75)	80.66 (142.74)	37.69 (32.75)	76.10 (47.65)	0.57 (28.85)	0.94 (3.29)
Clothing and footwear	5.84 (38.80)	7.20 (24.77)	8.14 (19.50)	8.94 (10.88)	1.39 (6.31)	1.24 (2.44)
Consumer expendables	3.44 (45.07)	4.74 (25.1)	3.74 (17.68)	4.44 (8.58)	1.09 (1.64)	1.02 (0.22)
Housing	4.11 (12.52)	0.31 (5.28)	12.41 (13.63)	0.44 (2.61)	3.02 (10.44)	1.40 (0.85)
Transport	1.84 (23.42)	1.91 (9.74)	3.08 (14.09)	2.69 (4.85)	1.67 (6.46)	1.41 (1.62)
Durables	2.12 (11.48)	1.14 (6.93)	7.10 (13.88)	1.42 (3.06)	3.35 (11.16)	1.25 (0.70)
Education and health	2.90 (23.26)	1.13 (17.89)	5.18 (15.01)	1.60 (8.97)	1.79 (7.58)	1.42 (3.04)
Personal services and entertainment	1.52 (25.45)	0.94 (9.73)	2.43 (14.63)	1.08 (3.97)	1.59 (6.24)	1.15 (0.61)
Social obligations	11.54 (34.74)	2.36 (17.12)	20.23 (21.95)	3.28 (8.43)	1.75 (10.79)	1.39 (2.74)
Locational group						
Food						
Home produced	27.21 (78.37)	56.00 (45.78)	10.02 (10.41)	49.26 (14.25)	0.37 (20.43)	0.88 (2.25)
Locally produced	19.21 (78.26)	19.26 (23.62)	14.57 (21.40)	21.08 (9.15)	0.76 (7.80)	1.09 (0.91)
Imported	20.27 (87.62)	5.40 (28.17)	13.10 (20.41)	5.76 (10.63)	0.65 (12.80)	1.07 (0.77)
Nonfood						
Locally produced	18.05 (47.54)	8.43 (26.16)	36.90 (35.05)	11.28 (12.39)	2.05 (20.51)	1.34 (3.61)
Imported	15.27 (50.49)	10.91 (30.00)	25.41 (30.29)	12.62 (12.28)	1.66 (13.84)	1.16 (1.92)
Nontradables	23.51 (64.20)	24.65 (40.80)	40.63 (39.99)	32.04 (18.77)	1.73 (19.29)	1.30 (5.00)

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Note: Figures in parentheses are t-statistics for the null hypotheses that the average and marginal budget shares are zero and that the expenditure elasticity is unity.

cite average and marginal budget shares, respectively, for food, alcohol, and tobacco of 73.7 and 67.9 percent; for clothing and footwear of 7.0 and 7.4 percent; for transport of 2.2 and 3.0 percent; for education of 1.4 and 0.8 percent; and for services and ceremonial activities of 4.3 and 8.1 percent. These figures are similar to the Gusau results.

In contrast, the Gusau results differ substantially from results reported by Simmons in an analysis of household expenditure patterns in three villages of Zaria Province in northern Nigeria.³⁹ She reports an average budget share for food, alcohol, and tobacco of only 56.5 percent; for clothing of 11.4 percent; for housing of 2.6 percent; for transport of 1.3 percent; and for ceremonies, gifts, and taxes of 13.5 percent.⁴⁰ Her villages were deliberately chosen because of their close location to the urban center of Zaria, and as a consequence they have easier access to off-farm employment and to a wider range of consumer goods and services than are available in most of Gusau's villages. Her villages also seem to be much richer judging from the low average budget share for food, alcohol, and tobacco.

Detailed Commodity Results

Detailed results on the average household's expenditure patterns for food are to be found in Table 7. Cereals and cereal products account for the largest share of the food budget in both regions. In Muda, 40 percent of the total budget outlay on food is spent on cereals and cereal products, whereas the comparable figure for Gusau is 62 percent.

Considering the cereals grown in each region, it is not surprising to find that Muda's households eat predominantly rice, whereas Gusau's households eat sorghum and millet as their basic foodgrains. The expenditure elasticities are suitably low for most cereals and cereal products, though it would seem

that rice is a luxury commodity in Gusau, presumably because of the very small quantities consumed. Contrary to work by Smith, Whelan, and Schmidt in an area similar to Gusau, there is no evidence that sorghum is an inferior good for the average household.⁴¹

The average expenditure on fruits, vegetables, and nuts is similar at about 8 percent of the household budget in both regions. But Muda households allocate larger shares of their budgets to fruits and coconuts, whereas Gusau's households allocate larger shares to legumes—mostly cowpeas.

The average household in Muda has an average budget share for meat and fish that is 38 percent larger than in Gusau, but there is a much greater reliance on fish than in Gusau. This difference is probably a simple reflection of the relative supplies of fish and meat in the two regions. Fish are abundant in Muda, not only from the fishing fleets that operate along the coast but also from freshwater fishing in the irrigation canals. On the other hand, the limited grazing opportunities that exist within an intensive and double-cropped paddy regime limit the number of livestock that can be raised. In contrast, Gusau has virtually no fish resources. Fish must be imported in processed form from distant parts of Nigeria. However, small livestock kept on the farms and the cattle herds of the nomadic Fulani provide a ready supply of local fresh meat, and there are also some opportunities for hunting in the bush.

Whereas meat and fish is a luxury group in Gusau, with an expenditure elasticity of 1.31, it is a necessity in Muda with an expenditure elasticity of 0.6. As a consequence, the importance of meat and fish in incremental expenditure is more important in Gusau than in Muda; the marginal budget share is 60 percent larger.

Eggs and dairy products are considerably more important to the average household in Gusau than in Muda. The average budget share for this food group is more than three times larger, and the marginal budget share is six times larger. Most of this difference is

³⁹ E. B. Simmons, "Rural Household Expenditures in Three Villages in Zaria Province, May 1970- July 1971," Samaru Miscellaneous Paper 56, Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria, 1976.

⁴⁰ These figures were taken from Table 1 in Simmons, but they have been adjusted to exclude farm expenses and investments from total household expenditure (Simmons, "Rural Household Expenditures," Table 1).

⁴¹ V. E. Smith, W. Whelan, and P. Schmidt, *Food Consumption Behavior in Three Villages of Northern Nigeria*, Rural Development Working Paper 22 (East Lansing, Mich.: Michigan State University, 1982).

Table 7—Comparison of expenditure behavior for food, alcohol, and tobacco of the average household in Muda, 1972/73, and Gusau, 1976/77

Commodity Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Cereals and cereal products						
Sorghum and millet	...	45.60	...	31.57	...	0.69
	...	(49.52)	...	(12.13)	...	(6.22)
Rice	23.68	0.76	8.65	1.94	0.37	2.55
	(84.36)	(5.73)	(11.11)	(5.17)	(22.11)	(3.63)
Wheat	1.40	...	0.69	...	0.49	...
	(35.36)	...	(6.41)	...	(7.67)	...
Maize	0.05	0.12	0.06	-0.04	1.14	-0.356
	(17.52)	(3.70)	(7.18)	(0.47)	(0.99)	(2.05)
Bread and flour	1.23	3.20	0.71	1.81	0.58	0.57
	(35.80)	(10.35)	(7.47)	(2.08)	(6.23)	(1.83)
Noodles	0.24	...	0.29	...	1.20	...
	(18.52)	...	(7.98)	...	(1.50)	...
Total	26.61	49.68	10.40	35.28	0.39	0.71
	(95.94)	(63.07)	(13.52)	(15.85)	(24.13)	(7.47)
Fruits, vegetables, and nuts						
Fresh vegetables	2.59	1.97	1.54	2.56	0.59	1.30
	(51.51)	(16.61)	(11.04)	(7.65)	(8.62)	(2.04)
Legumes	...	3.24	...	4.44	...	1.37
	...	(15.73)	...	(7.62)	...	(2.37)
Processed vegetables	0.01	...	0.02	...	1.70	...
	(6.79)	...	(4.15)	...	(1.95)	...
Starchy roots	0.27	1.03	0.22	0.52	0.81	0.50
	(24.81)	(4.51)	(7.24)	(0.80)	(1.95)	(0.92)
Processed starchy roots	...	0.29	...	0.52	...	1.80
	...	(9.74)	...	(6.19)	...	(3.16)
Fresh fruits	3.09	0.62	3.61	0.45	1.17	0.72
	(42.66)	(7.52)	(17.96)	(1.92)	(2.95)	(0.86)
Preserved fruits	0.01	...	0.02	...	1.81	...
	(7.51)	...	(4.90)	...	(2.51)	...
Coconuts	2.38	0.01	1.07	0.01	0.45	1.72
	(44.81)	(2.88)	(7.27)	(1.75)	(10.17)	(0.84)
Other nuts	0.29	0.32	0.33	0.23	1.12	0.72
	(22.69)	(8.78)	(9.14)	(2.22)	(1.10)	(1.02)
Total	8.65	7.48	6.80	8.73	0.79	1.17
	(76.75)	(20.49)	(21.78)	(8.46)	(6.75)	(1.40)
Meat and fish						
Fresh beef	1.46	4.24	1.68	5.59	1.15	1.32
	(32.76)	(21.95)	(13.55)	(10.73)	(1.99)	(2.85)
Other fresh meat	0.51	4.06	0.93	5.57	1.83	1.37
	(12.03)	(14.58)	(7.95)	(7.09)	(4.14)	(2.22)
Fresh fish	9.35	0.04	4.24	0.00	0.45	-0.10
	(68.68)	(3.30)	(11.23)	(0.12)	(15.49)	(1.48)

(continued)

Table 7—Continued

Commodity Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Processed fish and meat	0.82 (34.88)	0.47 (8.19)	0.38 (5.83)	0.41 (2.54)	0.46 (7.73)	0.88 (0.41)
Total	12.14 (82.56)	8.80 (27.12)	7.23 (17.72)	11.57 (12.61)	0.60 (13.79)	1.31 (3.48)
Eggs and dairy products						
Eggs	0.63 (21.32)	0.09 (3.92)	0.59 (7.19)	0.17 (2.54)	0.94 (0.56)	1.83 (1.33)
Fresh and soured milk	0.13 (9.16)	4.65 (10.86)	0.13 (3.39)	7.06 (5.84)	1.03 (0.10)	1.52 (2.30)
Processed milk	0.69 (16.45)	0.01 (2.93)	0.71 (6.07)	0.04 (4.71)	1.02 (0.16)	4.55 (4.24)
Butter and margarine	0.08 (14.69)	1.07 (4.80)	0.13 (8.93)	3.02 (4.79)	1.69 (4.16)	2.82 (3.57)
Baby foods	0.07 (7.11)	...	0.11 (4.03)	...	1.57 (1.68)	...
Total	1.61 (27.58)	5.82 (11.55)	1.68 (10.40)	10.30 (7.23)	1.05 (0.52)	1.77 (3.63)
Fats and oils						
Vegetable oils	2.35 (50.23)	1.70 (19.50)	1.23 (9.49)	2.60 (10.54)	0.52 (9.87)	1.53 (4.19)
Animal fats	0.01 (7.40)	...	0.02 (5.06)	...	1.90 (2.74)	...
Total	2.36 (50.41)	1.70 (19.50)	1.26 (9.64)	2.60 (10.54)	0.53 (9.77)	1.53 (4.19)
Other foods						
Total sugar and sweets	4.90 (80.70)	1.06 (18.93)	2.09 (12.42)	1.47 (9.27)	0.43 (19.09)	1.38 (2.96)
Precooked snacks	0.65 (22.86)	1.83 (23.77)	0.87 (11.04)	2.62 (12.04)	1.34 (3.20)	1.43 (4.19)
Condiments	2.49 (52.41)	3.71 (29.63)	2.02 (15.31)	3.49 (9.86)	0.81 (4.11)	0.94 (0.72)
Beverages	2.85 (70.72)	0.02 (3.03)	1.55 (13.91)	0.09 (4.28)	0.55 (13.27)	3.99 (3.70)
Alcohol and tobacco						
Tobacco products	4.41 (38.32)	0.45 (4.16)	3.75 (11.74)	0.02 (0.07)	0.85 (2.38)	0.05 (1.62)
Beer and spirits	0.01 (3.33)	0.11 (2.01)	0.04 (3.88)	-0.05 (0.34)	3.22 (3.06)	-0.47 (1.21)
Total	4.42 (38.42)	0.56 (4.34)	3.79 (11.86)	-0.03 (0.08)	0.86 (2.28)	-0.05 (1.86)

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Note: Figures in parentheses are t-statistics for the null hypotheses that the average and marginal budget shares are zero and that the expenditure elasticity is unity.

due to milk consumption, which accounts for 4.65 percent of the budget in Gusau but is almost nonexistent in Muda. Again, the importance of the Fulani herds is apparent.

The details of the average household's expenditures on nonfood goods and services are tabulated in Table 8 for the two study areas.

Expenditure patterns for clothing and footwear and consumer expendables in the two regions are surprisingly similar. The average household in Muda allocates a smaller share of total expenditure to ready-made and tailored clothes than does the average household in Gusau, but they have identical expenditure elasticities of 1.26 for these items.

Expenditure shares for fuel are similar despite the greater reliance on firewood in Gusau and on kerosene in Muda. The average household in Gusau spends 0.43 percent of its total budget on batteries, there being no public electricity supplies in most villages. The average household in Muda allocates a modest 0.13 percent of its budget to electricity and buys virtually no batteries. The availability of piped water in Muda is also reflected in the expenditure data: the average household allocates 0.29 percent of its budget to this item. Although the average household in Gusau does not make any cash outlay for water, the hidden labor costs of carrying water from wells, often over considerable distances, is undoubtedly high.

Housing, particularly new construction and improvements to existing structures, accounts for 4.1 percent of the average household budget and for 12.4 percent of incremental expenditure in Muda. In contrast, expenditures on housing are almost nonexistent in Gusau. Much of this difference can be attributed to the more capital-intensive nature of the housing in Muda. The houses are made of wood and are delicately constructed on stilts about 7-8 feet above the ground. They are frequently decorated with paint and ornaments, particularly the houses belonging to the more prosperous households. The construction and maintenance of these houses calls for cash outlays on prepared lumber, nails, and paint, and often on the hiring of a carpenter to undertake the work as well. In contrast, the houses in Gusau are made entirely from mud, grass, or cereal stalks, and perhaps a few stout pieces of wood for support. All these materials can be had from the farm

and surrounding bush, and assembled with a minimum of skill. Housing, therefore, is a "home-produced" commodity in Gusau, involving a minimum of economic transactions.

It is interesting to note that there is almost no renting of homes in either region. Households either own the houses in which they live or perhaps obtain them from close kin.

The average household in Muda also allocates larger shares of average and incremental expenditure to public transportation and hired private transport. This is a direct reflection of the denser road network and the wider availability of buses, taxis, and rickshaws. Unfortunately, expenditure data on the repair and operation of own transport vehicles, which are mostly bicycles, motorbikes, and scooters, are not available for Muda; these costs are not separated from the costs of repairing and operating farm machinery. But they are undoubtedly higher than in Gusau.

Durables figure more prominently in household expenditure patterns in Muda than in Gusau. The most important items are jewelry, furniture, and small electrical items, and more than 10 percent of the households incurred some expenditure on these items. Moreover, a few households in the Muda sample also purchased large durable items. Fourteen households purchased sewing machines, five purchased television sets, and four purchased refrigerators. Although these undoubtedly represent significant cash outlays for the households involved, together they only account for 0.29 percent of the total budget for the average household. These items are of course not a factor in Gusau since there is no supply of electricity in the villages. The expenditure elasticities for these large expenditure items are large, for example, 9.4 for television sets.

The average expenditures on education and health are small in both regions because of the availability of publicly provided services. In Gusau the average household spends a mere 1.13 percent of its total budget on education and health, and 72 percent of this is for toiletries and cosmetics. The average household in Muda allocates 2.9 percent of its budget to education and health, but 60 percent of this is for school fees and books and papers. This is not a reflection of poorer educational facilities, for it has already been shown that Muda had more educational facilities per 1,000 people in

Table 8—Comparison of expenditure behavior for nonfoods of the average household in Muda, 1972/73, and Gusau, 1976/77

Commodity Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Clothing and footwear						
Ready-made and tailored clothes	2.20 (29.22)	4.13 (19.46)	2.78 (13.31)	5.19 (8.65)	1.26 (3.18)	1.26 (2.04)
Cloth	2.87 (31.60)	2.28 (12.05)	4.34 (17.19)	2.37 (4.43)	1.51 (6.64)	1.04 (0.20)
Shoes and sandals	0.68 (22.55)	0.48 (9.22)	0.86 (10.29)	0.84 (5.73)	1.27 (2.47)	1.76 (2.85)
Hats	0.06 (9.40)	0.29 (8.30)	0.11 (5.98)	0.47 (4.77)	1.76 (2.97)	1.63 (2.12)
Other	0.03 (6.88)	0.02 (1.92)	0.06 (5.46)	0.07 (2.05)	2.20 (3.41)	3.02 (1.58)
Total	5.84 (38.80)	7.20 (24.77)	8.14 (19.50)	8.94 (10.88)	1.39 (6.31)	1.24 (2.44)
Consumer expendables						
Crockery and kitchen utensils	0.56 (16.12)	1.00 (7.62)	0.95 (9.88)	1.26 (3.38)	1.70 (4.66)	1.26 (0.79)
Soap and cleaning powders	0.79 (47.00)	0.98 (23.09)	0.52 (11.07)	1.09 (9.12)	0.65 (6.72)	1.12 (1.10)
Fuels (kerosene, firewood, and so forth)	1.49 (36.27)	1.86 (17.47)	1.12 (9.80)	1.52 (5.06)	0.75 (3.75)	0.82 (1.30)
Electricity and batteries	0.13 (5.55)	0.43 (11.98)	0.26 (3.88)	0.53 (5.22)	1.94 (2.15)	1.23 (1.13)
Soft furnishings	0.06 (4.62)	0.16 (4.45)	2.67 (3.19)
Household tools	0.03 (13.13)	0.07 (6.41)	0.04 (6.62)	0.04 (1.22)	1.40 (2.16)	0.54 (1.21)
Water	0.29 (11.54)	...	0.50 (7.12)	...	1.71 (3.39)	...
Repairs to household equipment	0.08 (5.73)	...	0.20 (5.09)	...	2.47 (3.46)	...
Total	3.44 (45.07)	4.34 (23.71)	3.74 (17.68)	4.44 (8.58)	1.09 (1.64)	1.02 (0.22)
Housing^a						
House repairs and maintenance	0.70 (9.62)	0.04 (3.70)	1.14 (5.66)	0.09 (2.94)	1.63 (2.51)	2.25 (1.88)
Improvements	1.85 (8.88)	...	5.38 (9.30)	...	2.91 (6.99)	...
New construction	1.56 (6.22)	0.27 (4.69)	5.89 (8.48)	0.34 (2.08)	3.78 (7.14)	1.25 (0.49)
Total	4.11 (12.52)	0.31 (5.28)	12.41 (13.63)	0.44 (2.61)	3.02 (10.44)	1.40 (0.85)
Transport						
Public transport	1.36 (23.04)	0.90 (8.70)	1.90 (12.14)	1.77 (6.07)	1.46 (4.39)	1.97 (3.45)
Own transport ^b (repairs and operation)	...	0.97 (6.00)	...	1.27 (2.79)	...	1.31 (0.77)

(continued)

Table 8—Continued

Commodity Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Hired private transport	0.49 (10.60)	0.05 (0.66)	1.09 (8.59)	-0.35 (1.71)	2.25 (5.46)	-7.27 (2.24)
Total	1.84 (23.42)	1.91 (9.74)	3.08 (14.09)	2.69 (4.85)	1.67 (5.46)	1.41 (1.62)
Durables						
Jewelry	0.80 (6.30)	0.21 (5.97)	2.77 (7.87)	0.37 (3.68)	3.47 (5.42)	1.74 (1.80)
Furniture	0.45 (8.55)	0.25 (3.12)	1.05 (7.17)	0.14 (0.65)	2.33 (4.68)	0.59 (0.53)
Cookers	0.07 (5.89)	0.22 (6.73)	3.17 (5.27)
Mattresses and bedding	0.05 (3.76)	0.10 (3.34)	0.18 (4.45)	0.06 (0.71)	3.29 (3.54)	0.60 (0.55)
Mats and rugs	0.04 (6.50)	0.08 (3.64)	0.07 (4.00)	0.02 (0.35)	1.71 (1.90)	0.27 (1.08)
Small electrical items	0.41 (6.51)	0.43 (4.77)	1.28 (7.36)	0.61 (2.39)	3.14 (5.74)	1.42 (0.81)
Television sets	0.13 (1.96)	1.24 (6.61)	9.38 (6.76)
Refrigerators	0.03 (1.74)	0.13 (2.82)	4.49 (2.51)
Sewing machines	0.13 (2.67)	0.17 (1.19)	1.24 (0.27)
Weapons	0.07 (0.84)	0.22 (0.93)	3.10 (0.73)
Total	2.12 (11.48)	1.14 (6.93)	7.10 (13.88)	1.42 (3.06)	3.35 (11.16)	1.25 (0.70)
Education and health						
Modern medicine	0.59 (13.44)	0.22 (7.32)	1.14 (9.28)	0.11 (1.24)	1.92 (5.08)	0.48 (1.56)
Traditional medicine	0.25 (9.63)	0.05 (2.55)	0.22 (3.09)	0.03 (0.66)	0.89 (0.44)	0.74 (0.27)
Toiletries and cosmetics	0.34 (25.81)	0.81 (17.92)	0.45 (12.15)	1.38 (10.83)	1.31 (3.26)	1.71 (5.18)
Books and papers	1.22 (20.04)	0.05 (2.45)	1.49 (8.82)	0.08 (1.30)	1.22 (1.83)	1.50 (0.50)
School fees	0.49 (5.68)	1.88 (7.89)	3.85 (6.69)
Total	2.90 (23.26)	1.13 (17.89)	5.18 (15.01)	1.60 (8.97)	1.79 (7.58)	1.42 (3.04)
Personal services and entertainment						
Domestic help and laundry	0.01 (3.98)	0.09 (4.07)	0.01 (2.44)	0.31 (4.87)	1.70 (1.15)	3.38 (3.95)
Hairdressing	0.16 (21.22)	0.22 (13.01)	0.14 (6.36)	0.35 (7.23)	0.83 (1.48)	1.57 (3.03)

(continued)

Table 8—Continued

Commodity Group	Average Budget Share		Marginal Budget Share		Expenditure Elasticity	
	Muda	Gusau	Muda	Gusau	Muda	Gusau
	(percent)					
Meals and drinks out	1.11 (21.09)	0.54 (6.39)	1.83 (12.53)	0.40 (1.70)	1.65 (5.64)	0.75 (0.64)
Films and shows	0.17 (13.41)	0.01 (2.21)	0.28 (7.90)	0.03 (2.30)	1.63 (3.51)	2.95 (1.75)
Other	0.07 (6.08)	0.08 (2.70)	0.17 (5.82)	-0.02 (0.20)	2.40 (4.16)	-0.21 (1.34)
Total	1.52 (25.45)	0.94 (9.73)	2.43 (14.63)	1.08 (3.97)	1.59 (6.24)	1.15 (0.61)
Social obligations						
Gifts	0.94 (16.78)	1.90 (14.11)	1.97 (12.70)	3.17 (8.34)	2.10 (7.62)	1.67 (3.87)
Weddings and festivals	0.57 (4.78)	...	2.22 (6.74)	...	3.91 (5.75)	...
Dowries	0.83 (4.76)	...	2.98 (6.15)	...	3.58 (5.07)	...
Religious tithes and taxes	5.52 (24.61)	0.46 (9.22)	6.71 (10.79)	0.11 (0.78)	1.22 (2.19)	0.24 (2.87)
Pilgrimages	3.69 (20.65)	...	6.35 (12.82)	...	1.72 (6.15)	...
Total	11.54 (34.74)	2.36 (17.12)	20.23 (21.95)	3.28 (8.43)	1.75 (10.79)	1.39 (2.74)

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Note: Figures in parentheses are t-statistics for the null hypotheses that the average and marginal budget shares are zero and that the expenditure elasticity is unity.

^a Cases of home renting are so few in both Muda and Gusau that they have not been included in the analysis.

^b Expenditure data on repairs and operation of own transport are not available for Muda, but they are probably much more important than in Gusau.

1970 than did Gusau in 1980. Rather, it reflects a greater emphasis on supplementary education at traditional Koranic schools, and a higher literacy rate among the populace.

Expenditure shares for personal services and entertainment are a relatively minor item in both regions, but the average household in Muda does allocate more to attending films and shows and to eating and drinking out, mostly in the local coffee shops.

Despite the commonality of their religion, there are important differences in the share of total expenditure allocated to social and religious obligations. In particular, the

average household in Muda donates 5.5 percent of its total budget to the mosque in the form of religious tithes—called *zakat* and *fitrah* taxes. These payments are supposedly distributed to the poor and are used to help maintain the mosque. A further 3.7 percent of the budget is allocated to expenses for pilgrimages to Mecca, an item that figures even more prominently as a 6.35 percent share of incremental expenditure. In contrast, the average household in Gusau allocates only 0.46 percent of its total budget to taxes, and a further 1.9 percent to gifts. The lack of any expenses recorded for weddings or dowries in Gusau is surprising,

however, and may simply reflect a failure to record these items separately in the questionnaire.

Locational Linkages

To capture the locational linkages inherent in the expenditure data, a second classification of all the goods and services was undertaken. For this purpose there are five groups: home-produced foods, locally produced but purchased foods, imported foods, locally produced nonfoods, and imported nonfoods.

Home-produced foods are identified as such in the survey data. Imported items were taken to be those goods and services supplied from outside the region, regardless of whether they originate from the larger national economy or from abroad. Both types of imports represent leakages from the regional economy. There are local trade and distribution margins on most imported items, which represent a locally produced service. But because these margins typically amount to only small shares of the value of the goods sold, they are ignored in this study.

Locally produced items are taken to be those goods or services whose production is mostly undertaken within the region. Potentially, problems could arise in delineating these items, because almost any local production involves the use of imported intermediaries. But in practice this is not a serious problem because the import content is relatively small. In Muda, for example, the value of imports as a share of sectoral gross output is only 8 percent for paddy production, 7 percent for other agricultural products, 31 percent for fishing, 2 percent for small-scale rice milling, 4 percent for entertainment, 15 percent for hotels and restaurants, 31 percent for residential construction, and 24 percent for other services.⁴² Taken together, these sectors supply nearly all of the locally produced items consumed by farm households.

Of the foods purchased by Muda's farm households, the following are classified as locally produced: rice and rice flour, noodles and bread, precooked foods, potatoes, other starchy roots, fresh fruits and vegetables, all

fresh meat and fish, salted fish, eggs, fresh milk, animal fats, and traditional beers and spirits. Home-produced items may include rice, fish, coconuts, bananas, eggs, and fresh meat.

In Gusau purchased foods classified as locally produced are sorghum, maize, millet, rice, cowpeas, groundnuts, peppers and vegetables, various nuts except coconuts, sugarcane and crude sugar, sweet potatoes, all fresh meat and fish, eggs, fresh and soured milk, cereal flours and baked breads, snack foods, all vegetable oils except palm oil and margarine, some spices, and traditional beers. As the farms in Gusau are much more diversified than in Muda, almost any of these products may be home produced.

There is a great deal of similarity in the kinds of nonfoods produced locally for purchase by farm households in Muda and Gusau. These include several items of tailored clothing; hats; wooden furniture; mats; firewood; private schooling and medical care, both traditional and modern; personal services such as domestic servants, laundering, and hairdressing; films, shows, eating and drinking out; repairs, improvements, and construction of houses; public transportation; repairs and operation of own transport (these data are missing in Muda); and taxes, gifts, and other social obligations. In addition, a number of artisan products—shoes, sandals, leather goods, pottery and calabashes—are also produced locally in Gusau but not in Muda.

Returning now to Table 6, the bottom section contains the results on the locational aspects of the expenditure patterns of the average household in Muda and Gusau.

The average household in Gusau is more dependent on home-produced foods. They account for about 70 percent of the average budget share for food compared to about 40 percent in Muda. Part of this difference may be explained by the greater diversity of agriculture in Gusau; Muda's farms, at least those in the project area, are confined to a rice-growing monoculture. Prices and yields are also much more uncertain in Gusau, and farmers may act in a more self-reliant manner simply to ensure their own survival.

The average household in both regions allocated about 19 percent of its total expenditure to locally produced but purchased

⁴² Figures are derived from Bell, Hazell, and Slade, *Project Evaluation*, Table 5-4.

foods. But the marginal budget share is higher in Gusau—21 percent compared to 15 percent in Muda. In Gusau much of this is for fresh meat and milk produced by the Fulani herdsmen, indicating that there are some interesting linkage effects to these nomadic tribes. There are also linkages to other local farmers because of increased purchases of foodgrains, fresh fruits, vegetables, and some small livestock products.

The average household in Muda spends 62 percent of any incremental income on nonfoods, and nearly two thirds of this is for locally produced nonfoods. There are clearly strong links here to the local towns and large villages, particularly to the tailors, carpenters, other artisans, and all manner of persons employed in service and entertainment activities. These kinds of linkages are much weaker in Gusau. Only 24 percent of incremental expenditure is spent on nonfoods, and a little less than half of this goes for locally produced nonfoods. Put another way, if the average household in each region were to receive a gift of \$100 for personal expenditure, then the demand for locally produced nonfood goods and services would increase by \$36.90 per household in Muda, but by only \$11.28 in Gusau.

To the local economy, household expenditures on imported goods represent a direct leakage. But as Siamwalla has argued, if incremental income is spent on locally produced goods that could be exported at a constant price, that expenditure represents a loss in export proceeds and is as much a leakage as if the money were expended upon imported goods.⁴³ Thus the stimulative effect of increased household expenditures on the local economy is appropriately captured through the expenditure behavior for all locally produced goods and services that are also nontradables. To this end, all the goods and services consumed were also classified into tradable and nontradable groups.

Of the locally produced nonfood goods and services, none are exported from the Muda region.⁴⁴ Although comparable data are not available from Gusau, there is little reason to believe that they are exported from there either. One reason is that they are mostly local services, and these can only be

exported if the customer is imported into the region. One or two items of minor vice are produced that could conceivably attract a few nonresident customers, and some households living outside the region's boundaries might well venture into the local towns to do their shopping, but such occurrences could only provide a minuscule market for local service-oriented activities. And many nonfood goods, for example items of clothing or household furnishings, cater specifically to local tastes and are not likely to be in great demand in urban areas. It is also unlikely that they can compete in other rural areas because of the poor road connections and the probable availability of similar goods that are not burdened by interregional transportation costs. Consequently, for the purposes of this study, it is assumed that all locally produced nonfood goods and services are nontradables in both regions.

Locally produced foods present a contrasting picture. The more important foods are already exported from both regions: Muda provides about 45 percent of Malaysia's national rice requirements, and Gusau is a significant producer of sorghum, millet, cowpeas, and groundnuts. In addition, both regions export some livestock products, particularly meat, and Muda has a significant fishing industry, which sells mainly to Japan.

All foods that are currently exported from the study areas are treated as tradables. In Muda the tradables are rice, fresh fruits, vegetables and starchy roots, and all fresh meat and fish. Fish are packed in ice for regional export, and meat is exported on the hoof. The tradable foods in Gusau are sorghum and millet, maize, rice, groundnuts, cowpeas, starchy roots, and fresh meat. Again the latter is sold on the hoof, in this case by the Fulani herdsmen. Although other food items could be exported in principle, the quantities involved are too small for the development of suitable marketing channels.

As shown in Table 6, the average budget share for nontradables is about the same in both regions, accounting for close to one quarter of the total budget. But the marginal budget share is higher in Muda—41 percent—compared to 32 percent in Gusau. In other words, every dollar of additional total house-

⁴³ Siamwalla, "Growth Linkages."

⁴⁴ Bell, Hazell, and Slade, *Project Evaluation*, Table 5-4.

hold expenditure has a 28 percent more stimulative first-round effect on the local economy in Muda than in Gusau.

Effect of Household Characteristic Variables

The household characteristic variables (the Z_i variables in equation (5)), can affect both the intercept and the slope of the Engel functions. Rather than report all the estimated coefficients, it is more useful to summarize the effect of each Z_i variable by calculating the change in the average budget shares given an incremental change in the Z_i variable. That is, the derivatives $\delta ABS_i / \delta Z_i$ are evaluated. As these derivatives are functions of total per capita expenditure E , they must be evaluated at some chosen value of E . In this study the mean value of E for the average household is used. The implication of this should be clear. For example, the change in the average budget share for the i th good is evaluated, given a small change in farm size, by assuming that total per capita expenditure does not change. This change in the ABS_i might be construed as a short-run effect, for in the longer term per capita expenditure will surely change with farm size. The model is not a suitable vehicle for evaluating these longer term changes in expenditure patterns, though some insights can be gleaned from the analysis of expenditure patterns according to farm size deciles reported in the next chapter.

Table 9 shows the changes in the average budget shares for the average household in Muda given a small change in each of the Z_i variables defined in Table 4. This discussion focuses on those relationships that are statistically significant at the 5 percent confidence level; that is, on those derivatives having t -statistics greater than 1.65.

Family size ($\log N$) has a significant and negative effect on food expenditures. This holds for all food groups except eggs and dairy products. If the average family size were to increase while per capita expenditure remained constant, then the average budget share for food, alcohol, and tobacco would decline. But the average budget share for all nonfoods would increase, and especially the share for locally produced nonfoods.

Changes in the composition of the family are also important. Babies and young chil-

dren increase the average budget share for fruits and vegetables, eggs and dairy products, clothing, and consumer expendables. Babies and women add to relative health costs, and youths 6-15 years old increase the average budget shares for education and weddings and dowries.

The operated paddy area and the size of the house garden are positively related to the average budget share for food, and they increase the relative dependence on home-grown foods. Not surprisingly, the paddy area is positively related to the average budget share for cereals, whereas the size of the food garden increases the share of the budget allocated to fruits, vegetables, and livestock products.

The older the household head, the greater the share of the budget allocated to non-foods, and particularly to locally produced nonfoods. The more educated the household head, the greater the importance of livestock products, clothing and footwear, transport, education and health, and personal services and entertainment in the budget. Education also reduces the average budget share for locally produced nonfood goods and services and increases the share of imports.

Malays apparently allocate lower average budget shares to all kinds of foods than their non-Malay counterparts. Their demand is also linked more closely to the local nonfood economy.

Access to consumer credit increases the average budget share for foods but mostly for imported food items. Surprisingly, credit does not have a significant effect on the share of durables, housing, or clothing expenditures in the budget, and it reduces the strength of the demand links for locally produced nonfoods.

The double-cropping variables capture some of the dynamics of adjustment to the irrigation project. Farm households that have been double cropping for four or more years spend less on purchased foods on average than all other households, and they have larger budget shares for housing and social obligations. A significant item among social obligations is the pilgrimage to Mecca. When irrigation was introduced, paving the way to greater prosperity, many farmers joined savings clubs with the explicit purpose of financing a pilgrimage by air.

Table 9 shows the differences in the change in the average budget shares for those

Table 9—Effect of household characteristics on average budget shares for selected commodity and locational groups in Muda, 1972/73

Group	Log N	FARM	GARDEN	BABY	CHILD	YOUTH	WOMEN	AGE	DCLONG	DCSHORT	RACE	EDUCA- TION	CREDIT	Difference Between DCLONG and DCSHORT	R ²
Commodity group															
Food, alcohol, and tobacco	-13.12 (12.14)	0.92 (1.68)	1.70 (0.77)	-3.44 (0.35)	-9.22 (2.78)	-5.11 (1.92)	-0.62 (0.22)	0.10 (3.12)	-0.74 (0.46)	1.22 (0.81)	-11.07 (6.06)	-0.58 (0.80)	5.88 (1.48)	-1.96 (2.48)	0.595
Cereals and cereal products	-4.78 (6.61)	0.70 (1.91)	-1.93 (1.31)	-19.97 (3.04)	-9.98 (4.49)	-2.90 (1.63)	-2.41 (1.28)	0.05 (2.52)	1.46 (1.37)	1.96 (1.96)	-2.66 (2.18)	-1.00 (2.07)	1.06 (0.40)	-0.51 (0.96)	0.550
Fruits, vegetables, and nuts	-1.25 (4.27)	0.24 (1.59)	1.89 (3.14)	4.37 (1.64)	0.54 (0.60)	-0.36 (0.80)	0.47 (0.62)	0.01 (1.00)	-0.56 (1.29)	-0.40 (0.99)	-0.50 (1.00)	0.27 (1.38)	-0.68 (0.63)	-0.15 (0.71)	0.150
Meat and fish	-2.84 (7.42)	0.41 (2.12)	1.18 (1.51)	1.11 (0.32)	-1.69 (1.44)	0.55 (0.39)	1.53 (1.54)	0.03 (2.99)	0.45 (0.80)	0.69 (1.29)	-3.96 (6.12)	0.49 (1.91)	-0.30 (0.21)	-0.24 (0.85)	0.267
Eggs and dairy products	0.30 (1.97)	-0.08 (1.09)	0.53 (1.70)	5.70 (4.13)	2.11 (4.52)	-0.14 (0.37)	0.60 (1.51)	0.00 (0.42)	-0.13 (0.56)	-0.09 (0.44)	-1.64 (6.40)	0.15 (1.48)	0.87 (1.56)	-0.03 (0.30)	0.164
Clothing and footwear	1.56 (3.98)	-0.34 (1.73)	-0.61 (0.76)	1.71 (0.48)	2.66 (2.21)	0.05 (0.05)	2.32 (2.27)	-0.05 (3.88)	-0.52 (0.91)	-0.53 (0.97)	1.97 (2.97)	0.77 (2.94)	-1.10 (0.76)	0.00 (0.00)	0.150
Consumer expendables	0.16 (0.79)	-0.13 (1.27)	0.07 (0.17)	4.10 (2.27)	0.55 (0.89)	-0.09 (0.19)	0.81 (1.57)	0.00 (0.57)	-0.86 (2.94)	-0.56 (2.02)	0.19 (0.58)	0.21 (1.61)	-0.62 (0.85)	-0.30 (2.07)	0.054
Housing	1.75 (2.05)	-1.21 (2.78)	-0.72 (0.41)	-2.87 (0.37)	5.04 (1.92)	0.47 (0.22)	-5.08 (2.29)	-0.01 (0.34)	1.98 (1.58)	-0.40 (0.33)	2.49 (1.73)	-1.78 (3.11)	-3.83 (1.22)	2.38 (3.80)	0.169
Transport	0.88 (4.30)	0.02 (0.17)	0.21 (0.50)	-2.30 (1.23)	-1.16 (1.84)	-0.09 (0.18)	0.68 (1.28)	-0.01 (1.53)	-0.75 (2.49)	-0.56 (1.98)	0.83 (2.40)	0.30 (2.21)	0.42 (0.56)	-0.19 (1.26)	0.118
Durables	1.69 (3.51)	-0.60 (2.47)	-1.34 (1.36)	-5.73 (1.31)	0.64 (0.43)	-1.34 (1.13)	0.52 (0.42)	-0.02 (1.39)	-0.81 (1.15)	-1.41 (2.12)	1.68 (2.07)	0.33 (1.04)	0.68 (0.38)	0.60 (1.71)	0.164
Education and health	1.84 (5.67)	0.05 (0.32)	-0.65 (0.98)	4.74 (1.61)	-1.34 (1.34)	2.42 (3.03)	1.56 (1.85)	0.02 (2.35)	-0.44 (0.92)	-0.32 (0.72)	-0.95 (1.73)	0.97 (4.45)	-0.82 (0.69)	-0.12 (0.49)	0.187
Personal services and entertainment	0.17 (1.08)	0.00 (0.04)	0.28 (0.91)	0.52 (0.36)	0.36 (0.75)	-0.86 (2.25)	-1.07 (2.63)	-0.03 (5.75)	0.08 (0.34)	0.13 (0.58)	-0.13 (0.50)	0.23 (2.23)	0.00 (0.00)	-0.05 (0.41)	0.185

(continued)

Table 9—Continued

Group	Log N	FARM	GARDEN	BABY	CHILD	YOUTH	WOMEN	AGE	DCLONG	DCSHORT	RACE	EDUCA- TION	CREDIT	Difference Between DCLONG and DCSHORT	R ²
Social obligations	5.07 (5.86)	1.29 (2.93)	1.05 (0.59)	3.27 (0.42)	2.48 (0.93)	4.56 (2.14)	0.87 (0.39)	-0.01 (0.38)	2.07 (1.62)	2.43 (2.02)	4.98 (3.40)	-0.46 (0.79)	-0.60 (0.19)	-0.37 (0.58)	0.265
Locational group															
Food															
Home produced	-4.87 (5.39)	1.27 (2.76)	0.69 (0.37)	-16.33 (1.99)	-9.27 (3.33)	-1.23 (0.55)	0.28 (0.12)	0.09 (3.53)	6.54 (4.92)	6.46 (5.14)	-0.58 (0.38)	-1.02 (1.69)	-1.00 (0.30)	0.09 (0.13)	0.459
Locally produced	-3.34 (5.22)	-0.15 (0.47)	1.42 (1.08)	2.52 (0.43)	-1.27 (0.64)	-1.66 (1.05)	-0.84 (0.50)	0.01 (0.67)	-4.65 (4.94)	-3.63 (4.09)	-7.77 (7.19)	0.89 (2.06)	2.01 (0.86)	-1.01 (2.17)	0.242
Imported	-4.91 (8.15)	-0.19 (0.63)	-0.40 (0.32)	10.36 (1.89)	1.31 (0.71)	-2.23 (1.50)	-0.06 (0.04)	-0.01 (0.42)	-2.63 (2.97)	-1.60 (1.91)	-2.72 (2.67)	-0.44 (1.10)	4.87 (2.21)	-1.03 (2.34)	0.280
Nonfood															
Locally produced	7.95 (8.04)	-0.12 (0.23)	-1.46 (0.72)	-1.39 (0.15)	5.52 (1.81)	-0.87 (0.36)	-4.89 (1.90)	-0.03 (1.19)	2.05 (1.41)	0.65 (0.47)	10.96 (6.56)	-1.91 (2.88)	-2.68 (0.74)	1.40 (1.93)	0.456
Imported	5.17 (6.57)	-0.81 (2.02)	-0.24 (0.15)	4.83 (0.68)	3.71 (1.53)	5.98 (3.08)	5.50 (2.69)	-0.06 (2.78)	-1.31 (1.13)	-1.87 (1.71)	0.11 (0.08)	2.49 (4.72)	-3.20 (1.11)	0.56 (0.97)	0.281
Nontradables	6.68 (7.00)	-0.09 (0.17)	0.16 (0.08)	0.63 (0.07)	6.83 (2.33)	-0.67 (0.29)	-4.13 (1.66)	-0.02 (0.78)	1.50 (1.07)	0.57 (0.43)	9.77 (6.06)	-1.65 (2.57)	-3.36 (0.96)	0.93 (1.34)	0.431

Source: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73.

Notes: Figures in parentheses are t-statistics for the null hypothesis that the tabulated coefficients are zero. All variables are evaluated at their sample means. Log N is the log of family size. FARM is operated paddy area per capita and GARDEN is house garden area per capita. BABY is the number of children less than one year old as a proportion of family size, CHILD is the number of children from one to five years old as a proportion of family size, and YOUTH is the number of children between 6 and 15 years old as a proportion of family size. Similarly, the number of women as a proportion of family size is denoted by WOMEN. AGE is the age of the head of a household. DCLONG and DCSHORT are both dummies for double cropping. The former is long term; four or more years equals 1, anything else is 0. The latter is short term; between one and three years equal 1 and anything else equals 0. RACE is also a dummy, for which Malay is 1 and others are 0. Under EDUCATION, if the head of the household has no formal education, 0 is given; if he has some, a 1 is given. CREDIT is loans for consumption as a proportion of total expenditure.

who have been double cropping for four or more years and for those who have been double cropping only one to three years, together with the t-statistics for these differences. Long-term double croppers have significantly smaller average budget shares for food, alcohol, and tobacco, but larger shares for housing and locally produced nonfood goods and services. The strength of the demand links to the local towns and villages increases with the years of double cropping.

Comparable results for Gusau are to be found in Table 10, though the selection of Z_i variables is more limited. The variables are defined in Table 5.

The effect of family size (log N) is much the same as in Muda; additions to the family while total expenditure is held constant reduce the average budget share for all foods except eggs and dairy products. Because some of the eggs and dairy products are homegrown, increases in family size raise the average budget share for home-produced foods. Increases in family size also strengthen the links to the local nonfood sectors.

The percentage of children less than 14 years old in the family has a statistically significant effect on the average budget share for foods, particularly cereals, meat and fish, and home-produced and locally grown foods. However, these children do not have a significant effect on nonfood expenditure.

Farm size has much the same effect as in Muda. An increase in farm size raises the average budget share for all foods except eggs and dairy products, and it increases the relative dependence on home-produced foods.

The Hausa have a lower average budget share for food, alcohol, and tobacco than other tribes; in particular, they consume fewer eggs and dairy products. However, their average expenditure shares for consumer expendables and locally produced nonfoods as a group are significantly larger.

Unlike in Muda, access to consumer credit reduces the average budget share for foods and increases the share of nonfoods in the budget. It has a positive effect on clothing and footwear, consumer expendables, social obligations, education and health, durables, and personal services and entertainment, although only the latter two effects are significant at the 5 percent confidence level. Credit also has a positive but insignificant effect on the average budget

share for locally produced nonfoods. Credit, therefore, is not a particularly useful policy instrument for strengthening demand links to the local economy.

The coefficients obtained for household size in Tables 9 and 10 provide some insight into any economies of scale in total consumption conferred by household size.

Consider the extreme hypothesis that household size gives no economies of scale whatsoever in total expenditure. In this case per capita expenditure would be the only relevant indicator of a household's purchasing power, and the family size variable in Tables 9 and 10 would be insignificant in predicting the average budget shares for each group of commodities. As the columns using per capita expenditure in Table 11 show, the hypothesis that there are no economies of scale can be rejected at the 10 percent confidence level in Muda using all the commodity groups except consumer expendables and personal services and entertainment. But the hypothesis can only be rejected on the basis of results for food, alcohol, and tobacco, clothing and footwear, housing, and social obligations in Gusau.

On the other hand, if there are some economies conferred by household size, then the following relations should be true. For luxury goods (those with expenditure elasticities greater than one), family size would be positively related to the average budget share if per capita expenditure is held constant and negatively related if total household expenditure is held constant. For necessities (expenditure elasticities less than one), the opposite relationships should hold. Family size should be negatively related to the average budget share if per capita expenditure is held constant and positively related if total household expenditure is held constant.

These conditions are met for all the commodity groups in Muda (Table 11). But they are only satisfied for food, alcohol, and tobacco, clothing and footwear, transport, and education and health in Gusau, and even then many of the coefficients are not significantly different from zero.

In sum, there is much stronger evidence for economies of household size in total expenditure in Muda than in Gusau. This is consistent with the higher living standards in Muda: households have more goods that they can share among their members.

Table 10—Effect of household characteristics on average budget shares for selected commodity and locational groups in Gusau, 1976/77

Group	Log N	FARM	CHILD	CREDIT	TRIBE	RELIGION	R ²
Commodity group							
Food, alcohol, and tobacco	-2.00 (1.77)	0.42 (0.26)	-1.49 (0.50)	-18.56 (1.32)	-1.84 (1.71)	1.96 (0.66)	0.092
Cereals and cereal products	-3.10 (1.97)	1.87 (0.84)	-11.22 (2.70)	-6.04 (0.31)	-0.54 (0.36)	4.42 (1.07)	0.212
Fruits, vegetables, and nuts	-0.54 (0.74)	0.34 (0.33)	2.82 (1.46)	-3.26 (0.36)	1.97 (2.83)	0.00 (0.00)	0.064
Meat and fish	-0.71 (1.10)	0.03 (0.03)	6.03 (3.52)	8.92 (1.10)	2.02 (3.28)	-0.84 (0.49)	0.156
Eggs and dairy products	3.14 (3.13)	-1.31 (0.93)	-0.38 (0.14)	-22.01 (1.75)	-6.94 (7.23)	1.32 (0.50)	0.223
Clothing and footwear	0.76 (1.30)	-0.90 (1.10)	2.43 (1.58)	1.76 (0.24)	0.56 (1.01)	-1.14 (0.75)	0.061
Consumer expendables	-0.32 (0.88)	-0.27 (0.52)	-1.03 (1.07)	3.98 (0.87)	0.81 (2.32)	0.47 (0.49)	0.038
Housing	0.19 (1.60)	0.14 (0.86)	0.32 (1.02)	-0.06 (0.04)	-0.10 (0.51)	0.08 (0.24)	0.037
Transport	0.47 (1.19)	1.15 (2.08)	0.54 (0.52)	-2.87 (0.59)	0.43 (1.14)	1.00 (0.97)	0.072
Durables	-0.03 (0.08)	0.02 (0.05)	-0.44 (0.51)	6.89 (1.67)	-0.33 (1.04)	0.16 (0.18)	0.033
Education and health	0.06 (0.46)	-0.20 (1.14)	0.23 (0.70)	2.05 (1.30)	-0.01 (0.05)	0.17 (0.50)	0.062
Personal services and entertainment	-0.02 (0.12)	-0.15 (0.54)	0.08 (0.15)	4.91 (2.04)	0.12 (0.66)	-1.65 (3.24)	0.061
Social obligations	0.90 (3.27)	-0.22 (0.56)	-0.63 (0.87)	1.90 (0.55)	0.36 (1.38)	-1.04 (1.44)	0.073
Locational group							
Food							
Home produced	4.76 (1.95)	4.88 (1.42)	-14.21 (2.20)	-70.28 (2.30)	-6.83 (2.93)	0.84 (0.13)	0.098
Locally produced	-5.82 (3.58)	-4.41 (1.92)	12.20 (2.83)	51.89 (2.55)	3.83 (2.46)	2.52 (0.59)	0.134
Imported	-0.94 (2.45)	-0.05 (0.09)	0.53 (0.52)	-0.17 (0.04)	1.15 (3.15)	-1.40 (1.39)	0.108
Nonfood							
Locally produced	1.77 (2.76)	-0.26 (0.29)	0.21 (0.13)	4.94 (0.61)	0.97 (1.58)	-2.51 (1.48)	0.105
Imported	0.23 (0.31)	-0.16 (0.15)	1.27 (0.66)	13.62 (1.50)	0.87 (1.26)	0.55 (0.29)	0.053
Nontradables	3.81 (3.16)	-1.77 (1.04)	0.04 (0.01)	3.22 (0.21)	-4.64 (4.02)	0.55 (0.17)	0.176

(continued)

Table 10—Continued

Source: Calculated from household survey data collected by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Notes: Figures in parentheses are t-statistics for the null hypothesis that the tabulated coefficients are zero. All variables are evaluated at their sample means.

Log N is the log of family size. FARM is operated farm size per capita. CHILD is the number of children less than 14 years old as a proportion of family size. CREDIT is the loans for consumption as a proportion of total expenditure. TRIBE and RELIGION are both dummies. For the first, the Hausa are given 1 and others, 0. For the second, Muslims are given 1 and others, 0.

Table 11—Effect of family size on average budget shares under different scale hypotheses, Muda, 1972/73, and Gusau, 1976/77

Commodity Group	Muda			Gusau		
	Expenditure Elasticity	Log N with Constant Per Capita Expenditure	Log N with Constant Household Expenditure	Expenditure Elasticity	Log N with Constant Per Capita Expenditure	Log N with Constant Household Expenditure
Food, alcohol, and tobacco	0.57 (28.85)	-13.12 (12.14) ^a	14.69 (13.90)	0.94 (-3.29)	-2.00 (1.77) ^a	2.34 (1.69)
Clothing and footwear	1.39 (6.31)	1.56 (3.98) ^a	-0.30 (0.79)	1.24 (2.44)	0.76 (1.30) ^a	-0.51 (0.72)
Consumer expendables	1.09 (1.64)	0.16 (0.79)	-0.03 (0.14)	1.02 (0.22)	-0.32 (0.88)	-0.28 (0.62)
Housing	3.02 (10.44)	1.75 (2.05) ^a	-5.23 (6.25)	1.40 (0.85)	0.19 (1.60) ^a	-0.01 (0.07)
Transport	1.67 (6.46)	0.88 (4.30) ^a	-0.40 (2.00)	1.41 (1.62)	0.47 (1.19)	-0.91 (1.90)
Durables	3.35 (11.16)	1.69 (3.51) ^a	-2.49 (5.29)	1.25 (0.70)	-0.03 (0.08)	-0.32 (0.80)
Education and health	1.79 (7.50)	1.84 (5.67) ^a	-0.40 (1.26)	1.42 (3.04)	0.06 (0.46)	-0.31 (1.98)
Personal services and entertainment	1.59 (6.24)	0.17 (1.08)	-0.78 (5.14)	1.15 (0.61)	-0.02 (0.12)	-0.09 (0.38)
Social obligations	1.75 (10.79)	5.07 (5.86) ^a	-5.06 (5.98)	1.39 (2.74)	0.90 (3.27) ^a	0.09 (0.26)

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

^a The hypothesis that there are no economies of household size can be rejected at the 10 percent level.

6

EXPENDITURE BEHAVIOR BY INCOME GROUP

A key objective of this study is to analyze how the changes in income distribution that accompany growth affect the aggregate demand for different goods and services, and particularly how they affect the strength of the aggregate demand linkages to the local economy. In this respect results showing the effects of small changes in per capita income on the expenditures of the average household are of limited value. The results derived from an analysis of the expenditure behavior of households representing different income or farm size groups are more pertinent. Such results are more complex than Engel relations because household characteristics, such as family size and composition, also change. These differences in household characteristics must be allowed for in any analysis of policies or technologies that change the distribution of income among different types of households.

Expenditure Behavior by Per Capita Expenditure Decile

Per capita expenditure was chosen as the measure for dividing households into income groups. Tables 12 and 13 show the marginal budget shares for different commodity groups by per capita expenditure decile in the two study regions (the average budget shares are reported in Appendix 2). All the household characteristic variables were evaluated at their decile means in deriving these results; the means of selected variables are reported in the bottom section of the tables.

In both regions the average family size is strongly but inversely related to per capita expenditure. The size of the farm the house-

hold operates increases with per capita expenditure in Muda, but this relationship is less certain in Gusau. The sample correlation between farm size and per capita expenditure is 0.32 in Muda and only 0.07 in Gusau. Thus, households with low per capita expenditure are not necessarily the smaller farms, or vice versa.

In Muda, the marginal budget shares for all food groups decline sharply between the bottom and top per capita expenditure deciles. The marginal budget share for total food, alcohol, and tobacco declines from 67 percent for the bottom decile to 14 percent for the top decile. The decline is particularly sharp for cereals and cereal products, and hence for home-produced foods.

In contrast, the marginal budget share for total food, alcohol, and tobacco does not change significantly between expenditure deciles in Gusau.⁴⁵ There is a sharp drop in the share allocated to cereals and cereal products, but this is offset by increasing marginal budget shares for fruits, vegetables, and nuts; meat and fish; and eggs and dairy products. As in Muda, the marginal budget share for home-produced foods declines between the bottom and top expenditure deciles.

The insignificant decline in the marginal budget share for total food, alcohol, and tobacco in Gusau is quite unusual, though this finding is tempered by the decline in the average budget share reported in Appendix 2, Table 18. The average budget share for total food, alcohol, and tobacco declines from 84.7 percent for the bottom per capita expenditure decile to 80.0 percent for the top decile. Engel's Law that just such a decline occurs is upheld. But this decline in the average budget share is modest, in sharp contrast to the Muda results (Appendix 2, Table 19), to King and Byerlee's results from

⁴⁵ Significance tests for differences between the marginal budget shares of the second and ninth deciles are reported in Table 14.

Table 12—Marginal budget shares by per capita expenditure decile in Muda, 1972/73

Group	Per Capita Expenditure Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	67.39	57.94	51.98	49.61	45.57	41.88	37.63	35.27	27.71	13.89
Cereals and cereal products	21.88	18.42	15.64	15.34	13.41	12.27	10.39	9.43	6.22	0.53
Fruits, vegetables, and nuts	9.85	8.75	8.30	8.02	7.60	6.98	6.79	6.49	5.94	4.42
Meat and fish	12.19	10.54	9.52	9.11	8.52	8.17	7.24	7.16	5.73	3.46
Eggs and dairy products	2.61	2.38	2.14	2.01	1.85	1.76	1.57	1.52	1.42	0.96
Clothing and footwear	7.92	8.20	8.33	8.38	8.14	8.07	7.94	7.70	7.87	7.44
Consumer expendables	4.58	4.25	4.10	4.13	3.95	3.79	3.67	3.59	3.52	3.10
Housing	2.51	5.50	7.88	7.64	10.06	10.55	12.35	13.76	15.47	20.29
Transport	2.33	2.53	2.77	2.82	2.84	2.96	3.09	3.01	3.26	3.58
Durables	-1.01	1.70	2.83	4.05	4.95	5.94	6.85	8.00	9.82	13.22
Education and health	2.22	3.16	3.31	4.12	4.05	4.89	5.17	5.45	6.53	7.71
Personal services and entertainment	1.65	1.99	2.33	2.12	2.39	2.40	2.36	2.39	2.63	2.89
Social obligations	12.41	14.73	16.45	17.12	18.06	19.53	20.94	20.82	23.18	27.89
Locational group										
Food										
Home produced	22.47	18.36	15.44	15.54	13.52	12.54	10.22	9.71	5.34	-1.17
Locally produced	21.40	19.47	18.11	16.99	16.05	15.07	14.29	13.55	12.75	9.88
Imported	23.53	20.11	18.43	17.08	16.00	14.27	13.12	12.02	9.62	5.18
Nonfood										
Locally produced	17.87	23.50	27.70	28.74	32.06	34.21	37.36	38.91	43.06	52.79
Imported	14.74	18.56	20.31	21.64	22.37	23.90	25.01	25.82	29.23	33.32
Nontradables	23.72	28.64	32.42	33.35	36.30	38.12	41.07	42.47	46.18	54.92
Average farm size (acres) ^a	2.14	2.33	3.02	3.12	3.33	4.14	4.08	4.00	4.50	5.64
Average family size	7.07	6.64	6.42	5.90	5.45	5.43	5.27	4.66	4.65	3.89
Per capita expenditure (M\$)	150.00	197.00	225.00	255.00	289.00	327.00	369.00	419.00	514.00	820.00

Source: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73.

Note: All household characteristics variables are evaluated at decile means.

^a Farm area is the operated paddy area.

Sierra Leone, and even to the expenditure patterns of households in the Zaria villages analyzed by Simmons.⁴⁶

A distinguishing feature of the Gusau area that may account for the almost constant marginal budget share for food among income groups is the isolation of most of its villages from small towns or urban areas.⁴⁷ There may simply be little else to buy other than food without an arduous and time-consuming trip to the nearest town. Also, noncereal foods are considerably more ex-

pensive relative to cereals in Gusau than in Muda, and a large share of the budget is required simply to enable the richer households to diversify their diets. For example, the relative price of beef to sorghum or millet is about 10:1 in Gusau. In contrast, the relative price of fish (the main beef substitute) to rice is only 5:1 in Muda. One suspects, too, that the ratios of the prices of nonfoods to foods are also less favorable in Gusau than in Muda, though this is difficult to substantiate with the available data.

⁴⁶ King and Byerlee, *Income Distribution*; and Simmons, "Rural Household Expenditures," Figure 3.

⁴⁷ Another possible explanation may be an underreporting of food expenditures on gifts, feasts, and other ceremonies in the Gusau survey. Simmons reports a much higher average budget share for these items in her survey, and they do increase with total household expenditure. On the other hand, her results may simply reflect the higher income status of her households (Simmons, "Rural Household Expenditures").

Table 13— Marginal budget shares by per capita expenditure decile in Gusau, 1976/77

Group	Per Capita Expenditure Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	77.88	76.74	76.75	76.89	76.45	76.26	76.18	75.78	76.15	75.89
Cereals and cereal products	50.99	44.40	42.07	39.89	37.86	35.40	34.56	31.49	30.45	26.48
Fruits, vegetables, and nuts	4.57	5.94	6.71	7.61	8.18	8.59	9.56	9.68	10.41	11.72
Meat and fish	7.22	9.44	11.44	11.03	11.32	11.44	12.70	12.72	12.80	13.58
Eggs and dairy products	7.32	8.50	7.57	8.77	9.28	10.73	8.35	11.00	11.39	12.28
Clothing and footwear	8.87	9.08	9.31	8.94	8.98	8.96	8.85	8.92	8.56	8.31
Consumer expendables	4.23	4.33	4.44	4.45	4.47	4.39	4.72	4.49	4.57	4.66
Housing	0.45	0.48	0.45	0.41	0.43	0.46	0.34	0.42	0.37	0.32
Transport	1.49	1.98	2.04	2.27	2.52	2.77	2.62	2.88	2.95	3.16
Durables	0.77	1.21	1.36	1.33	1.33	1.37	1.54	1.65	1.71	1.91
Education and health	1.41	1.57	1.57	1.53	1.57	1.59	1.57	1.64	1.64	1.68
Personal services and entertainment	1.34	1.21	1.09	1.08	1.04	0.99	1.13	1.07	0.99	1.00
Social obligations	3.57	3.39	2.99	3.09	3.20	3.22	3.06	3.15	3.06	3.06
Locational group										
Food										
Home produced	59.15	53.55	50.05	50.82	50.00	50.08	46.16	46.60	46.18	43.82
Locally produced	14.49	18.62	21.73	20.63	20.92	20.47	23.62	23.01	23.59	25.22
Imported	4.23	4.57	4.97	5.44	5.53	5.70	6.39	6.18	6.39	6.85
Nonfood										
Locally produced	10.95	11.05	10.56	10.73	11.02	11.21	10.93	11.24	10.94	10.96
Imported	11.17	12.21	12.69	12.38	12.53	12.53	12.90	12.98	12.91	13.14
Nontradables	26.96	29.22	27.61	29.29	30.49	32.06	30.11	33.09	33.75	35.61
Average farm size (acres)*	8.52	10.98	9.03	7.94	10.08	8.21	7.63	9.02	10.23	9.82
Average family size	12.52	10.48	7.66	7.31	7.66	7.69	5.62	6.24	5.45	4.61
Per capita expenditure (N)	42.00	62.00	73.00	84.00	96.00	107.00	120.00	140.00	163.00	221.00

Source: Calculated from household survey data collected by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Note: All household characteristic variables are evaluated at decile means.

* This is the operated farm area.

There is no significant change in the marginal budget shares for clothing and footwear or consumer expendables between expenditure deciles in either region. But in Muda the marginal budget shares for all other nonfood's increase significantly between the bottom and top expenditure deciles, especially for housing, durables, social obligations, and the aggregate of locally produced nonfoods. These demand patterns are absent in Gusau, and there are no significant changes in the marginal budget shares for any nonfood category between per capita expenditure deciles.

If total expenditures were redistributed from the upper to the lower per capita expenditure deciles in Muda, this would in-

crease the aggregate regional demand for foods, particularly cereals, and reduce the aggregate demand for locally produced non-food goods and services. For example, the transfer of U.S. \$1.00 of total expenditure from the ninth to the second decile would increase the aggregate regional demand for food, alcohol, and tobacco by about 30 cents (see Table 14). It would also reduce the demand for locally produced nonfoods by about 20 cents, and reduce the demand for all nontradables by approximately 18 cents. The net result would be a weakening in the demand linkages to the local nonfarm economy.

This pattern holds quite generally across per capita expenditure deciles in Muda, as

Table 14—Effects of a transfer of U.S. \$1.00 of expenditure from the ninth to the second per capita expenditure decile on regional demand in Muda, 1972/73, and Gusau, 1976/77

Group	Muda		Gusau	
	Increase in Regional Demand	t-Statistic ^a	Increase in Regional Demand	t-Statistic ^a
	(cents)		(cents)	
Commodity group				
Food, alcohol, and tobacco	30.23	12.14	0.59	0.22
Cereals and cereal products	12.20	7.33	13.95	3.79
Fruits, vegetables, and nuts	2.81	4.15	-4.46	2.62
Meat and fish	4.81	5.44	-3.36	2.22
Eggs and dairy products	0.96	2.74	-2.89	1.23
Clothing and footwear	0.32	0.36	0.52	0.39
Consumer expendables	0.73	1.58	-0.24	0.28
Housing	-9.97	5.06	0.11	0.41
Transport	-0.73	1.54	-0.97	1.06
Durables	-8.12	7.33	-0.50	0.65
Education and health	-3.37	4.51	-0.07	0.24
Personal services and entertainment	-0.64	1.78	0.22	0.49
Social obligations	-8.45	4.24	0.33	0.51
Locational group				
Food				
Home produced	13.01	6.25	7.38	1.29
Locally produced	6.72	4.56	-4.97	1.30
Imported	10.49	7.56	-1.82	2.04
Nonfood				
Locally produced	-19.56	8.59	0.11	0.08
Imported	-10.66	5.88	-0.70	0.41
Nontradables	-17.53	7.98	-4.53	1.61

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

^a These are for the null hypothesis that there are no differences between the marginal budget shares for the ninth and second deciles.

shown graphically in Figure 4. Incremental expenditures on nontradables increase sharply and monotonically with increasing per capita expenditure deciles.

The results for Gusau show similar but weaker patterns. If U.S. \$1.00 of total expenditure is transferred from the ninth to the second decile (see Table 14), then the aggregate regional demand for food, alcohol, and tobacco would only increase by about half a cent. But it would increase the aggregate demand for cereals and cereal products by about 14 cents and reduce the aggregate demand for meat and livestock products by about 6 cents. The aggregate regional demand for nonfoods would not change significantly. But there would be a

decline in the aggregate demand for nontradables of 5 cents, mostly because of reduced expenditure on meat and livestock products.

Figure 4 portrays the situation more generally. As in Muda, the marginal budget share for nontradables increases between the lower and upper per capita expenditure deciles. But the rate of increase is not as strong as in Muda, nor is it monotonic. Consequently, income distribution concerns will be less important for regional development in Gusau.

Kirby and Byrlee's study of rural household expenditure behavior in Sierra Leone provides a useful comparison to the Muda and Gusau results.⁴⁸ Figure 5 summarizes

⁴⁸ King and Byrlee, *Income Distribution*.

Figure 4—Marginal budget shares of locally produced goods and services, by per capita expenditure decile, Muda, 1972/73, and Gusau, 1976/77

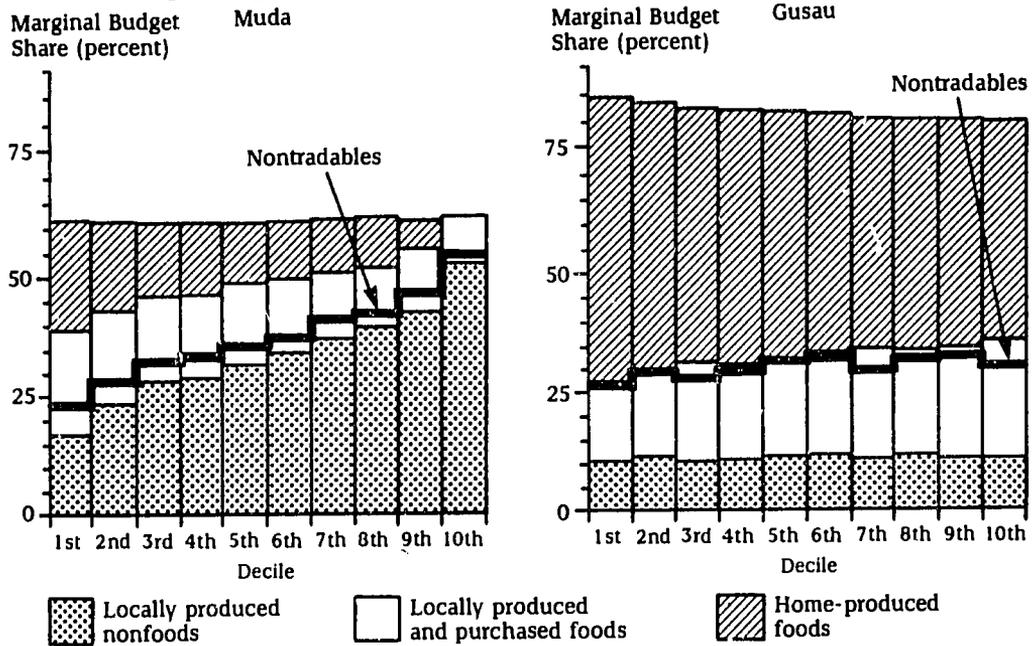
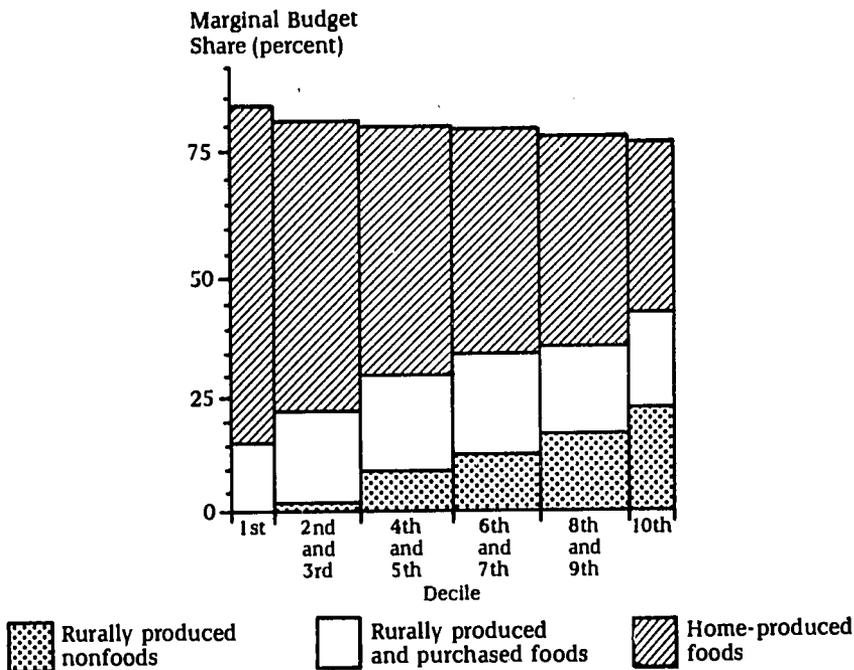


Figure 5—Marginal budget shares of locally produced goods and services, by per capita expenditure decile, Sierra Leone, 1974/75



Source: R. P. King and D. Byerlee, *Income Distribution, Consumption Patterns, and Consumption Linkages in Rural Sierra Leone*, African Rural Economy Paper 16 (East Lansing, Mich.: Michigan State University, 1977), Table 5.5.

their results on rural demand linkages by per capita expenditure decile. Unfortunately, they do not report separate results for all expenditure deciles, nor do they provide enough information to identify the marginal budget shares for nontradables.

The size of the marginal budget share for rurally produced nonfoods is about the same in rural Sierra Leone as in Gusau—about 12 percent for the average household. But unlike Gusau, this marginal budget share increases sharply between the lower and upper expenditure deciles. In this respect the Sierra Leone results are more consistent with Muda, and assuming that most foods are tradables, then the richer deciles have the strongest demand links to the local economy.

Expenditure Behavior by Farm Size Decile

The analysis of expenditure behavior by per capita expenditure decile has shown some important relations that may be useful for regional development strategy, as will be seen in the next section. But these relations may be difficult to exploit in practice because of problems in measuring household expenditure. If similar results also hold for farm size deciles, then a more useful basis for policy prescription may emerge.

It has already been noted that the correlations between operated farm size and per capita expenditure are weak in both Muda and Gusau (0.32 and 0.07, respectively). As such, it does not follow that the expenditure behavior of the richer households, measured in per capita expenditure terms, will correspond to the expenditure behavior of the larger farms. A separate analysis was undertaken after reclassifying all the households. The resultant marginal

budget shares are reported in Tables 15 and 16, and in Figure 6. The average budget shares for different farm size deciles are reported in Appendix 2, Tables 20 and 21.

It turns out that there is a strong similarity between the changes in expenditure patterns across farm size and per capita expenditure deciles. In Muda the households with larger farms have lower marginal budget shares for foods, and larger marginal budget shares for nonfoods, especially those that are produced locally. The marginal budget share for nontradables also increases between the lower and upper farm size deciles. But the rate of increase in these marginal budget shares is lower than with per capita expenditure deciles (see Figures 4 and 6). Thus, although total expenditure increases among the larger farm households would create stronger demand links to the local economy than similar expenditure increases among the smaller farm households, the strength of the demand linkages would be less than if the total expenditure increase could be targeted to the top per capita expenditure decile instead.

The Gusau results show a significant decline in the marginal budget share for meat and fish between the lower and upper farm size deciles (Table 17), which did not exist between the lower and upper per capita expenditure deciles.⁴⁹ But there is still an increase in the marginal budget share for eggs and dairy products. The marginal budget share for all foods, alcohol, and tobacco does not vary significantly between farm size deciles. There is a modest increase in the marginal budget share for locally produced nonfoods and in the marginal budget share for all nontradables. Thus the larger farms in Gusau also have stronger links to the local economy. But, unlike Muda, these links are primarily through expenditures on nontradable foods—eggs and dairy products—rather than through expenditures on local nonfood goods and services.

⁴⁹ Significance tests for differences between the marginal budget shares of the second and ninth deciles are reported in Table 17.

Table 15—Marginal budget shares by farm size decile in Muda, 1972/73

Group	Farm Size Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	48.57	50.11	46.98	35.93	41.20	43.09	34.21	32.02	28.98	25.61
Cereals and cereal products	13.96	14.98	14.12	9.67	11.81	12.47	9.49	8.17	7.28	5.60
Fruits, vegetables, and nuts	8.84	8.37	7.87	6.79	7.20	7.19	6.24	5.97	5.51	5.06
Meat and fish	8.46	9.07	8.63	6.69	7.79	8.35	6.85	6.48	6.02	5.73
Eggs and dairy products	1.89	1.91	1.87	1.53	1.69	1.82	1.57	1.55	1.48	1.72
Clothing and footwear	8.74	8.41	8.55	8.50	8.18	7.98	7.92	7.91	7.65	7.28
Consumer expendables	4.34	4.00	4.03	3.68	3.80	3.79	3.54	3.50	3.48	3.48
Housing	9.44	9.18	9.33	13.48	11.59	10.68	13.43	14.19	14.85	14.69
Transport	2.98	2.62	2.88	3.17	2.98	2.90	3.10	3.18	3.27	3.35
Durables	6.30	4.34	5.32	8.02	6.19	5.43	7.90	7.86	8.40	8.52
Education and health	3.81	3.29	3.96	4.92	4.60	4.58	5.91	5.83	6.36	7.54
Personal services and entertainment	2.04	2.38	2.35	2.62	2.45	2.38	2.32	2.61	2.49	2.43
Social obligations	13.78	15.68	16.60	19.67	19.01	19.18	21.67	22.90	24.54	27.11
Locational group										
Food										
Home produced	13.78	15.15	14.57	9.53	12.00	12.50	9.48	7.34	6.53	3.27
Locally produced	17.11	17.23	16.08	13.69	14.84	15.70	13.39	13.58	12.64	13.76
Imported	17.68	17.74	16.33	12.71	14.36	14.89	11.33	11.10	9.81	8.57
Nonfood										
Locally produced	28.35	28.58	30.31	37.90	34.86	33.65	39.45	41.14	43.55	45.12
Imported	23.09	21.31	22.71	26.17	23.94	23.26	26.34	26.84	27.47	29.27
Nontradables	33.49	33.30	34.80	41.54	38.76	37.70	42.82	44.27	46.40	47.81
Average farm size (acres)	0.39	1.24	1.72	2.18	2.79	3.34	3.81	4.82	6.19	9.87
Average family size	4.71	5.63	5.16	4.51	5.64	6.08	5.30	5.55	6.48	6.36
Per capita expenditure (M\$)	265	258	300	355	328	330	394	406	398	529

Source: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73.

Notes: All household characteristic variables are evaluated at decile means. Farm size is determined by the amount of operated paddy area.

Table 16—Marginal budget shares by farm size decile in Gusau, 1976/77

Group	Farm Size Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	77.88	76.46	76.26	76.09	75.93	75.96	75.94	76.12	75.95	75.54
Cereals and cereal products	37.20	37.26	33.09	35.46	34.32	34.44	34.92	37.33	35.58	35.62
Fruits, vegetables, and nuts	9.53	8.45	9.37	9.24	8.87	8.64	8.93	7.96	8.37	7.98
Meat and fish	11.58	12.58	13.58	12.29	12.35	12.66	11.99	10.74	10.57	9.32
Eggs and dairy products	8.41	7.76	9.36	8.21	9.88	10.02	9.78	10.53	11.78	13.69
Clothing and footwear	7.89	9.06	8.95	8.87	9.02	9.18	9.04	9.10	9.03	9.06
Consumer expendables	4.88	4.67	4.66	4.71	4.52	4.45	4.47	4.30	4.21	3.92
Housing	0.22	0.38	0.39	0.36	0.43	0.45	0.43	0.49	0.51	0.56
Transport	2.38	2.46	2.70	2.61	2.68	2.65	2.67	2.64	2.80	2.75
Durables	1.67	1.54	1.81	1.49	1.60	1.61	1.42	1.23	1.20	1.06
Education and health	1.44	1.56	1.62	1.57	1.62	1.64	1.61	1.60	1.62	1.69
Personal services and entertainment	1.02	1.05	0.95	1.16	1.10	1.03	1.12	1.07	1.07	1.23
Social obligations	2.61	2.84	2.66	3.14	3.11	3.02	3.30	3.46	3.62	4.18
Locational group										
Food										
Home produced	47.98	46.92	44.69	46.82	47.23	47.11	48.34	51.63	52.18	54.90
Locally produced	23.07	23.50	25.25	22.98	22.74	23.12	21.81	19.23	18.51	16.12
Imported	6.83	6.04	6.32	6.29	5.95	5.72	5.79	5.26	5.26	4.52
Nonfood										
Locally produced	9.80	10.60	10.45	11.08	11.12	10.99	11.31	11.50	11.78	12.49
Imported	12.32	12.95	13.29	12.84	12.95	13.06	12.74	12.38	12.27	11.97
Nontradables	28.99	28.35	30.27	30.04	31.49	31.30	31.72	32.12	33.89	37.08
Average farm size (acres)	1.67	3.05	3.95	4.95	6.20	7.37	9.40	12.11	15.35	28.05
Average family size	4.03	5.76	4.83	6.14	6.59	6.62	7.34	9.48	10.14	14.64
Per capita expenditure (₦)	110.00	96.00	126.00	111.00	115.00	114.00	115.00	96.00	108.00	114.00

Source: Calculated from household survey data collected by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Notes: All household characteristic variables are evaluated at decile means. Farm size is determined by the amount of operated area.

Figure 6— Marginal budget shares of locally produced goods and services, by farm size decile, Muda, 1972/73, and Gusau, 1976/77

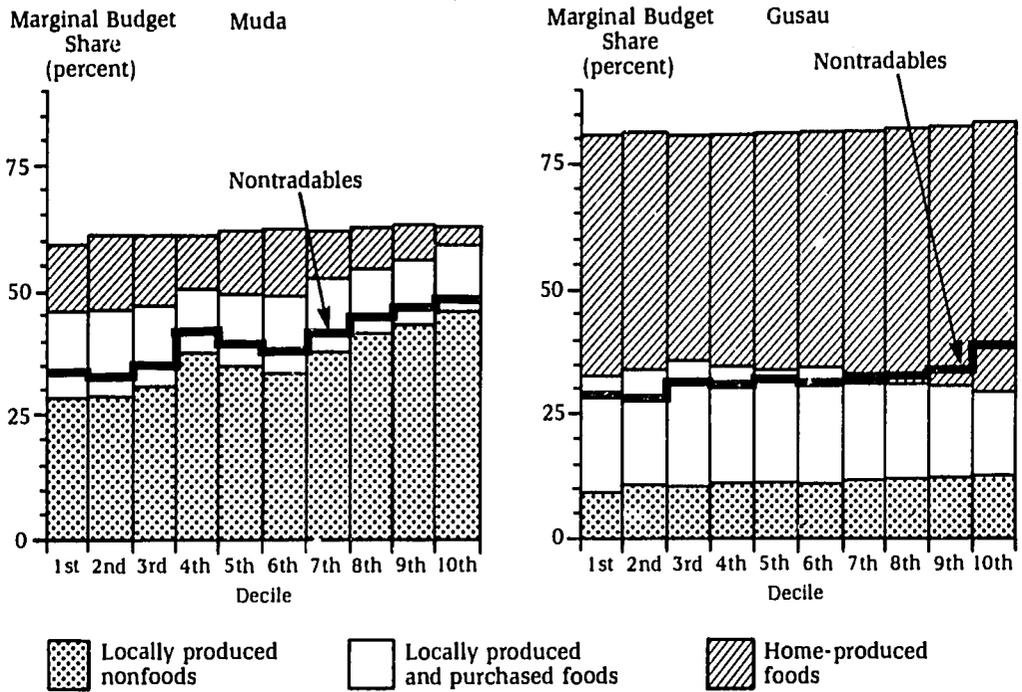


Table 17—Effects of a transfer of U.S. \$1.00 of expenditure from the ninth to the second farm-size decile on regional demand in Muda, 1972/73, and Gusau, 1976/77

Group	Muda		Gusau	
	Increase in Regional Demand	t-Statistic ^a	Increase in Regional Demand	t-Statistic ^a
	(cents)		(cents)	
Commodity group				
Food, alcohol, and tobacco	21.14	12.11	0.51	0.35
Cereals and cereal products	7.70	6.60	1.69	0.84
Fruits, vegetables, and nuts	2.86	6.03	0.08	0.08
Meat and fish	3.05	4.93	2.00	2.43
Eggs and dairy products	0.42	1.73	-4.02	3.14
Clothing and footwear	0.76	1.20	0.03	0.03
Consumer expendables	0.52	1.62	0.46	0.99
Housing	-5.67	4.10	-0.12	0.80
Transport	-0.65	1.96	-0.34	0.69
Durables	-4.06	5.23	0.34	0.82
Education and health	-3.07	5.85	-0.06	0.39
Personal services and entertainment	-0.11	0.43	-0.02	0.08
Social obligations	-8.86	6.34	-0.79	2.25
Locational group				
Food				
Home produced	8.62	5.90	-5.27	1.70
Locally produced	4.59	4.44	4.99	2.41
Imported	7.92	8.14	0.78	1.61
Nonfood				
Locally produced	-14.97	9.37	-1.18	1.44
Imported	-6.17	4.85	0.67	0.73
Nontradables	-13.09	8.50	-5.54	3.61

Sources: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73, and by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

^a These are for the null hypothesis that there are no differences between the marginal budget shares for the ninth and second deciles.

7

CONCLUSION

The analysis has shown that in both Muda and Gusau, the share of any increment to total household expenditures that is allocated to foodgrains is much lower for high income than low income households. At the same time, the share of incremental expenditure allocated to local nontradables is greater. In Muda the additional expenditure on nontradables goes mostly to nonfood goods and services, particularly those associated with housing, education, health, transport, personal services, entertainment, and social obligations and festivities. In contrast, additional expenditures on nontradables in Gusau are focused on higher quality foods, particularly fruits, vegetables, meat, and dairy products. The results are similar when the households are sorted according to the size of the farms; the larger farm households behave like the richer households and the smaller households behave like the poorer households, even though there is a surprisingly low correlation between farm size and per capita expenditure in both study areas.

In both regions aggregate income depends heavily on the production of agricultural crops, particularly foodgrains, the greater part of which are exported out of the region at given prices. The production of these crops is fixed by the land and technology available, and can only be increased through the kinds of public investments that were undertaken by the World Bank. In contrast, the output of most nontradables is essentially constrained by demand, and the underlying supply structure is elastic.

Within this simplifying framework, the households of the larger farms in Muda have the most desired expenditure patterns for stimulating secondary rounds of growth in the local economy. Furthermore, this growth would be focused on locally produced nonfood goods and services whose production is labor intensive. The larger farms are therefore suitable targets for technology or

for public investment that increases agricultural production.

A similar though more qualified conclusion holds for Gusau. Focusing agricultural growth on the larger farms would do more to stimulate the local economy, but the linkages would be mostly with other farmers who produce eggs and dairy products, such as the Fulani. The amount of secondary growth induced in the region is not likely to be nearly as large as in Muda, nor would it be as labor intensive.

It is tempting to conclude that the Muda results are typical of the labor-intensive agricultural systems of Asia, whereas the Gusau results typify the contrasting situation in Africa, where land/man ratios are high. But this thought is tempered by the Muda-like results obtained by King and Byerlee for rural Sierra Leone,⁵⁰ and by the similarity of the regional land/man ratios in Muda and Gusau. A more plausible explanation of the different results lies in the more poorly developed infrastructure in Gusau, and particularly the poor communication links between the villages and towns. These undoubtedly impede farm household access to nonfood goods and services and increase their cost relative to the price of foods. Within that setting, even the richer households will be discouraged from diversifying their expenditure into nonfoods.

The conclusion that large farms are desired targets for technology or public investments that increase agricultural production warrants a number of important qualifications.

First, the simplifying assumption about the supply structure of nontradables may be wrong. The secondary growth induced in a region by increases in agricultural productivity will be greater if the initial income gains accrue to households that spend the largest shares of their gain on nontradables that have elastic supplies. If some types of nontradables are found to have inelastic supplies, then the conclusion may have to

⁵⁰ Ibid.

be modified. More generally, one might expect the supply elasticities of nontradables to depend on how well developed the infrastructure of the region is and on government policies that assist or impede nonfarm businesses. If so, these are areas in which public policy can act to increase the supply elasticities and hence to enhance the regional multipliers arising from agricultural growth.

Second, increased consumption of foodgrains is only undesirable within the region if the demand for its exports is elastic. This is a fair characterization of the Muda and Gusau regions, but it may not be true for all poor rural regions. If the export demand is inelastic, then increased regional consumption of foodgrains would increase both export revenues and regional income. Since small farmers spend larger shares of incremental income on foodgrains, they would become much more attractive targets for increases in agricultural productivity.

Third, household savings have been ignored. Richer households generally save larger shares of incremental income, and unless these savings are invested locally in goods or services with a high content of nontradables, they could easily become a significant source of leakage from the regional economy. But savings are typically a small share of incremental income, so the bias against nontradables in investment expenditure would have to be large to offset the strong consumption links to nontradables exhibited by richer households.

Fourth, if larger farms are more mechanized, then the amount of extra employment they will generate directly in agriculture as a result of productivity increases will be less than if the same productivity increases were focused on small farms. This loss in direct employment must be offset by the greater amounts of indirect employment generated by the expenditures of large farm households. This concern was not particularly relevant in Muda or Gusau at the time of the surveys, but it is more relevant today in Muda as a result of widespread mechanization of land preparation and harvesting activities. However, since mechanization services are widely available on a contract basis, differences in technique are probably more related to field

topography and the physical possibilities for mechanization than to farm size.

Fifth, the conclusion presumes that regional growth is an end in itself, and it gives no regard to spillover effects that might be induced elsewhere in the national economy. For example, imports into the study regions are leakages as far as regional growth is concerned. But if these goods are produced in other poor rural areas, or if they create jobs for the urban poor, they will still be desirable from the national viewpoint. Similarly, savings that are invested outside the region represent a loss to regional growth, but they are nevertheless valuable in furthering national economic growth. This regional preoccupation was defended on the grounds that Muda and Gusau were relatively backward regions within their national economies, and were linked poorly to other rural areas. This argument will not be valid for all rural regions, nor will it suffice once a region has benefited substantially from public investments or agricultural technology.

Sixth, it must be stressed that the large farms in our samples are really medium-sized farms by most standards, particularly when the productivity of the land is considered. In Muda the average size of farms in the top decile is only 11 acres, and in Gusau it is 42 acres. It is possible that the marginal budget share for nontradables eventually peaks out when plotted against farm size and that large shares of incremental income received by really large farms are spent on regional (if not national) imports. But these hypotheses will have to be tested in less egalitarian societies than Muda or Gusau.

Despite these qualifications, this analysis highlights the potentially important role that "middle-sized" farms, such as the large farms of Muda and Gusau, may have to play in enhancing the downstream effects of agricultural growth. In this sense, the study provides additional empirical evidence to support Mellor's pioneering thinking on this subject.⁵¹

A less favorable aspect of these findings is that they do suggest a trade-off between growth and equity in rural growth. Targeting technologies or public investments on small farms leads to immediate equity and pro-

⁵¹ Mellor, *New Economics of Growth*.

duction gains, but the secondary growth in income and employment generated by that increased production may not be nearly as great as it would be if the initial increase in agricultural production were focused on middle-sized farms instead. Such trade-offs between growth and equity are accentuated by the fact that richer households probably benefit more from the secondary income growth than do the poor. Focusing produc-

tivity gains on middle-sized farms may accelerate regional growth, some of which will help alleviate absolute poverty and malnutrition. But this strategy might lead to a worsening of the relative distribution of incomes in rural areas. To the extent that these trade-offs exist, a suitable balance can be achieved by targeting agricultural technologies and public investments on a broad range of farm size groups.

APPENDIX 1: THE HOUSEHOLD SURVEYS

The Muda Household Survey

Because of the construction phasing of the irrigation project, a stratified sampling procedure was followed that distinguished between those farmers who had double cropped for the first time in 1970 (or earlier), 1971, 1972, 1973, and 1974, and those who had not begun to double crop at the time of the survey.

This basic stratification was augmented by taking into account the results of experimental data, which showed that the two basic soil types in the project area (acid and nonacid) significantly influenced crop yields. Thus the conceptual frame for sampling was a matrix with 10 cells—five phases, each with two soil types. For the purpose of field investigation, however, the design was reduced to 8 cells, owing to the impossibility of distinguishing *ex ante* between the 1973 and 1974 phases when the survey was designed early in 1972. The households in these two groups were all treated as single croppers.

Because there was no adequate sampling frame, a two-stage procedure was adopted. In the first stage, the 700 rural population census enumeration blocks within the project area were randomly sampled using a pre-selected sampling fraction of about 23.2 percent. All families in the 162 selected blocks were canvassed, and preliminary details of occupation, type of farm soil, and total annual income were collected. These families (14,788 in all) were then sorted into paddy farming and nonpaddy farming categories, and the latter were eliminated from further sampling. The paddy farming households were arranged into the stratified sampling frame based on the two criteria of project phase and soil type, and a sample was selected in such a way that the sample size in each stratum was proportionate to the standard deviation of mean annual cash income in that stratum. The final sample size after eliminations due to the usual problems of fatigue and noncooperation, was 803 farm households, which gave a sampling fraction of about 1.5 percent for the project area as a

whole. In addition, a sample of 36 landless farm-worker households was also sampled on a random basis. There were about 4,300 landless households in the project area in 1972.

The survey was originally intended to span two complete crop seasons. The agricultural year in the Muda project area begins in September, when the land is prepared for the main season crop, and ends in August, when the off-season crop is harvested. Ideally, the household survey should have begun in late August or early September of 1972 and continued for 12 months, thereby spanning two complete crop cycles. Unfortunately, because of administrative delays, it was not possible to start the survey until November 1972. Although the survey continued for a full 12 months, neither the first part of the 1972/73 main season nor the latter part of the 1973/74 main season was covered. This weakness could be important for farm management analysis, but it does not place undue restrictions on the use of the data for the household expenditure analysis, particularly if total household expenditure rather than income is used as an explanatory variable.

The Gusau Household Survey

The Gusau households were surveyed for each of the three agricultural years 1976/77, 1977/78, and 1978/79, but only the data for the first two years are available to the authors. Furthermore, because 1977/78 was a rather severe drought year, only the data for 1976/77 are analyzed here.

In the absence of an adequate sampling frame, a two-stage sampling procedure was also followed. Thirty villages out of a total of 597 villages were selected at random, and all the households in these selected villages were listed. Information was obtained on the age and composition of the population, on family size and structure, on occupational patterns and the number of fields operated by each farm family. The total number of households listed was 2,736.

Based on the information obtained in the first stage, 16 of the 30 villages were selected for the second-stage sampling. The farm households in these villages were ranked by the number of fields they farmed (a proxy for farm size) and a line sample of 384 households was drawn. Of this initial sample, 44 subsequently were lost because of noncooperation, migration, death, and so forth, and 19 had to be rejected because of incomplete data records. The final sample size was 321, or about 0.5 percent of all the households dependent on agriculture in the region.

The Gusau survey should have begun at

the beginning of the 1976/77 agricultural year in early April, but it was delayed because of administrative difficulties. It also had to be terminated 6 weeks early (in late February 1977), so that preparations could begin for the 1977/78 survey. As a result the survey only operated for 42 weeks, rather than a full year. No attempt was made to adjust the data to compensate for this shortcoming, and this should be remembered in all dollar amount comparisons between the Muda and Gusau data. The missing weeks may be a problem for some items, such as house repairs, which tend to be undertaken at that time of year.

APPENDIX 2: SUPPLEMENTARY TABLES

Table 18— Average budget shares by per capita expenditure decile in Gusau, 1976/77

Group	Per Capita Expenditure Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	84.68	82.69	82.76	82.09	81.31	80.97	80.60	80.06	80.08	79.48
Cereals and cereal products	58.54	55.13	53.82	53.08	51.48	49.90	49.50	46.91	46.23	43.01
Fruits, vegetables, and nuts	7.41	7.19	7.72	7.27	7.50	7.35	7.97	7.82	8.18	8.95
Meat and fish	7.86	7.79	8.00	8.06	8.55	8.58	9.39	9.54	9.69	10.46
Eggs and dairy products	2.88	4.47	4.61	5.04	5.06	6.44	4.19	6.51	6.60	7.17
Clothing and footwear	6.04	6.50	6.53	6.80	7.00	7.21	7.16	7.37	7.16	7.13
Consumer expendables	4.24	4.22	4.16	4.28	4.34	4.29	4.58	4.39	4.49	4.61
Housing	0.12	0.27	0.28	0.26	0.30	0.31	0.24	0.31	0.29	0.26
Transport	0.55	1.36	1.62	1.55	1.87	1.81	1.85	2.02	2.20	2.37
Durables	1.34	1.22	0.96	1.02	1.05	1.10	1.13	1.28	1.33	1.51
Education and health	0.68	0.93	0.96	1.01	1.06	1.13	1.13	1.22	1.22	1.30
Personal services and entertainment	0.84	0.88	0.86	0.91	0.86	0.87	1.03	0.98	0.90	0.94
Social obligations	1.52	1.94	1.88	2.08	2.21	2.30	2.28	2.37	2.33	2.40
Locational group										
Food										
Home produced	59.30	57.98	56.99	57.28	56.68	56.53	53.62	53.98	53.91	51.84
Locally produced	20.43	19.73	20.36	19.45	19.25	19.17	21.06	20.47	20.41	21.60
Imported	4.94	4.98	5.41	5.36	5.38	5.23	5.92	5.62	5.76	6.05
Nonfood										
Locally produced	5.50	6.97	7.09	7.58	8.01	8.26	8.37	8.69	8.61	8.84
Imported	9.82	10.34	10.15	10.34	10.68	10.77	11.03	11.25	11.31	11.68
Nontradables	18.15	22.15	22.55	23.02	23.49	24.93	23.34	25.77	26.01	27.43

Source: Calculated from household survey data collected by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Note: All household characteristic variables are evaluated at decile means.

Table 19—Average budget shares by per capita expenditure decile in Muda, 1972/73

Group	Per Capita Expenditure Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group:										
Food, alcohol, and tobacco	83.20	79.43	75.48	74.37	71.97	69.68	66.34	65.42	59.60	48.82
Cereals and cereal products	38.84	34.81	32.56	31.33	29.71	28.40	26.66	25.49	22.25	16.61
Fruits, vegetables, and nuts	8.51	8.78	8.81	8.93	8.96	8.82	8.61	8.71	8.35	7.48
Meat and fish	14.20	14.02	13.40	13.28	12.88	12.71	12.14	12.17	11.31	9.64
Eggs and dairy products	1.35	1.66	1.58	1.53	1.56	1.58	1.44	1.58	1.59	1.43
Clothing and footwear	3.92	4.58	5.20	5.30	5.45	5.58	5.71	5.62	6.05	6.00
Consumer expendables	3.00	3.23	3.30	3.38	3.37	3.34	3.37	3.39	3.51	3.38
Housing	0.32	1.11	1.73	2.06	3.04	3.18	4.09	4.79	5.73	8.88
Transport	0.79	1.08	1.30	1.51	1.54	1.71	1.89	1.86	2.14	2.48
Durables	0.31	0.31	0.77	0.99	1.32	1.67	2.06	2.49	3.36	5.28
Education and health	2.08	2.16	2.54	2.30	2.28	2.65	2.94	2.85	3.71	4.51
Personal services and entertainment	0.79	1.03	1.18	1.24	1.38	1.48	1.48	1.55	1.76	2.02
Social obligations	5.58	7.07	8.51	8.85	9.66	10.72	12.13	12.03	14.15	18.63
Locational group										
Food										
Home produced	37.99	35.01	32.92	31.94	30.33	29.42	27.56	26.54	22.85	16.83
Locally produced	21.55	21.06	20.30	20.21	19.95	19.46	18.80	18.96	18.37	16.47
Imported	23.66	23.36	22.17	22.22	21.68	20.80	19.98	19.92	18.37	15.52
Nonfood										
Locally produced	6.20	9.10	11.27	12.97	14.77	16.23	18.50	19.50	22.61	30.40
Imported	10.60	11.47	13.25	12.66	13.26	14.09	15.16	15.08	17.79	20.78
Nontradables	12.27	15.11	17.19	18.81	20.56	21.83	23.91	24.95	27.80	34.89

Source: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73.

Note: All household characteristic variables are evaluated at decile means.

Table 20—Average budget shares by farm size decile in Muda, 1972/73

Group	Farm Size Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	75.03	75.63	73.59	65.87	69.30	70.24	64.23	62.26	59.76	56.69
Cereals and cereal products	30.30	31.24	30.26	26.02	28.28	28.74	25.58	24.49	23.42	21.53
Fruits, vegetables, and nuts	8.99	8.97	8.98	8.57	8.74	8.85	8.40	8.30	8.13	7.89
Meat and fish	13.29	13.68	13.15	11.86	12.48	12.78	11.92	11.55	11.10	11.00
Eggs and dairy products	1.59	1.59	1.60	1.55	1.52	1.61	1.59	1.59	1.56	1.80
Clothing and footwear	5.37	5.09	5.41	6.02	5.61	5.53	5.83	6.00	5.97	5.97
Consumer expendables	3.71	3.37	3.45	3.48	3.38	3.34	3.38	3.33	3.34	3.39
Housing	2.61	2.28	2.65	4.69	3.74	3.15	4.67	5.07	5.65	5.32
Transport	1.60	1.32	1.51	1.87	1.68	1.65	1.94	2.00	2.11	2.28
Durables	1.33	0.91	1.22	2.42	1.69	1.52	2.46	2.54	2.83	2.90
Education and health	2.08	2.04	2.15	2.74	2.58	2.63	3.27	3.37	3.58	4.56
Personal services and entertainment	1.11	1.23	1.30	1.58	1.45	1.44	1.51	1.71	1.69	1.76
Social obligations	7.17	8.13	8.72	11.34	10.57	10.50	12.72	13.72	15.06	17.13
Locational group										
Food										
Home produced	28.56	31.90	30.49	26.41	28.92	29.59	26.58	25.36	24.41	22.02
Locally produced	22.59	20.71	20.63	19.08	19.47	19.69	18.43	18.18	17.49	17.91
Imported	23.87	23.02	22.47	20.38	20.91	20.96	19.21	18.72	17.86	16.76
Nonfood										
Locally produced	12.16	12.07	13.56	18.58	16.46	15.66	19.94	21.09	23.32	24.60
Imported	12.82	12.30	12.85	15.56	14.25	14.10	15.83	16.65	16.92	18.70
Nontradables	18.21	18.12	19.45	24.03	22.03	21.35	25.20	26.20	28.22	29.37

Source: Calculated from household survey data collected by the Cooperative Program of the Food and Agriculture Organization of the United Nations and the World Bank in the Muda region of Malaysia in 1972/73.

Notes: All household characteristic variables are evaluated at decile means. Farm size is determined by the amount of operated paddy area.

Table 21—Average budget shares by farm size decile in Gusau, 1976/77

Group	Farm Size Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	(percent)									
Commodity group										
Food, alcohol, and tobacco	82.14	81.71	80.99	80.64	80.61	80.78	80.43	80.93	80.38	79.46
Cereals and cereal products	53.06	51.78	48.65	50.24	49.15	48.99	49.17	50.68	49.24	48.16
Fruits, vegetables, and nuts	7.06	7.47	7.65	7.75	7.48	7.56	7.79	7.40	7.48	7.53
Meat and fish	7.96	8.65	9.53	9.12	9.08	9.22	9.18	8.51	8.62	8.59
Eggs and dairy products	4.72	4.70	5.87	4.10	5.82	6.10	5.22	5.84	6.55	7.10
Clothing and footwear	6.55	7.05	7.21	7.18	7.27	7.26	7.24	7.15	7.26	7.26
Consumer expendables	4.75	4.45	4.47	4.59	4.39	4.29	4.36	4.22	4.17	3.96
Housing	0.09	0.21	0.24	0.23	0.29	0.32	0.33	0.36	0.40	0.54
Transport	1.10	1.33	1.61	1.72	1.74	1.87	2.10	2.01	2.30	3.01
Durables	1.23	1.07	1.29	1.13	1.23	1.20	1.11	1.06	1.06	1.09
Education and health	1.10	1.11	1.21	1.13	1.18	1.17	1.12	1.07	1.09	1.06
Personal services and entertainment	1.04	1.01	0.95	1.06	1.01	0.92	0.94	0.84	0.82	0.80
Social obligations	2.01	2.07	2.01	2.32	2.28	2.19	2.37	2.35	2.51	2.83
Locational group										
Food										
Home produced	54.81	53.84	52.32	53.79	54.23	54.50	55.58	57.79	58.58	61.56
Locally produced	21.43	22.23	22.95	21.04	20.88	20.86	19.31	17.99	16.69	13.12
Imported	5.89	5.64	5.72	5.81	5.50	5.42	5.54	5.15	5.10	4.77
Nonfood										
Locally produced	7.41	7.66	7.88	8.36	8.34	8.19	8.56	8.32	8.77	9.51
Imported	10.46	10.63	11.13	10.99	11.05	11.03	11.01	10.74	10.86	11.04
Nontradables	23.03	23.24	24.58	23.29	24.80	24.84	24.23	24.27	25.22	26.22

Source: Calculated from household survey data collected by the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development, Nigeria, in the Gusau region of Nigeria in 1976/77.

Notes: All household characteristic variables are evaluated at decile means. Farm size is determined by the amount of operated area.

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