

2. INCOME SOURCES OF THE RURAL POOR: THE CASE OF THE ZONA DA MATA, MINAS GERAIS, BRAZIL

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INTRODUCTION

As a result of recent studies documenting the low responsiveness of rural diets to short-term changes in incomes, increased household income is no longer considered either necessary or sufficient for augmenting food consumption among the rural poor. These results suggest that there is substantial variation in nutritional status among households with similar incomes, or, conversely, that malnourished households don't always appear among households with the lowest income levels. If this is true, and if we believe that no one would choose to be malnourished, then other factors, including perhaps income-related factors (aside from total income), must independently or jointly constrain families from achieving adequate food intake.

Sources of income could be one such factor, influencing the diets (and nutritional status) of rural inhabitants in three ways. First, the degree to which households depend on various income categories (that is, crops, livestock, off-farm labor, and unearned income) can affect the extent of household market interaction, access to capital markets, and dependence on farm-produced goods (especially family labor), all of which can affect, in turn, food availability.

Secondly, the composition of income within income source categories (for example, annual versus perennial crops, perishables versus products with long storage lives, etc.) can affect cash flow needed to maintain adequate diets.

Finally, instability in relative dependence on various income sources over time can influence food security in rural households. Such instability could reflect profit maximization behavior by farmers already doing well, and thereby represent a cushion to both income and consumption. On the other hand, such instability might reflect last resort reactions to pending crises by farmers struggling for subsistence, and therefore signal the onset of food-first survival strategies.

The purpose of this paper is to assess the influence of the amount and composition of total household income available to agricultural

households on their food consumption and short- to long-term nutritional status.

DATA SOURCES AND SAMPLE OVERVIEW

Data for this study were drawn from the final year of panel data covering 1979-84 from surveys conducted to monitor the progress of the Integrated Rural Development Project (PRODEMATA) in the impoverished Zona da Mata of Minas Gerais, Brazil. Detailed agricultural production, socioeconomic, and food consumption data were collected at the household level using an annual retrospective survey questionnaire. Information was solicited on inputs and outputs, market linkages, and the "transfer of knowledge" (via contact with agricultural extension agents, farmers' organizations, and the like) for a large set of agricultural products (by crop), and livestock (by type). Income from these and other on- and off-farm sources were noted.

Food intake was measured through 24-hour recall, and food consumption was converted into household-level caloric intake using the 1977 food composition table generated for the 1973/74 ENDEF National Nutrition Survey. Caloric requirements were based on the approximate age and gender composition of individuals present at meals during which the 24-hour recall data were collected.¹³

Unfortunately, households reported only aggregate, not individual, food consumption, precluding any intrahousehold analysis of caloric intake. Study of individual nutritional status was limited to anthropometric analysis of children aged 0-6 years present in the household at the time of interview: their weights, heights, and ages were recorded, then compared to international standards for children in similar age groups.¹⁴

The sample was skewed towards the smaller, poorer farms targeted by the PRODEMATA project, and included a representative number of

¹³ Using standard set forth in Energy and Protein Requirements, Technical Report Series #724, published in 1985 by the World Health Organization (WHO). For ages 10-18, estimated caloric requirements were scaled back from WHO estimates made in 1971. In addition, since individuals present during 24-hour recall meals were identified by age group, rather than specific age, average ages within each age group for males and females (calculated from specific ages given as part of household information) were used to determine energy requirements for anyone falling into that age (and gender) group, assuming a moderate work level. This calculation resulted in an adult equivalence of 2804 calories/day.

¹⁴ Standards taken from NCHS Growth Curves for children, Birth-18 Years, United States, Series 11-No.165, DHEW Publication No. 78-1650. (Using software developed by Michael Jordan and Norman Staehling of the Centers for Disease Control (CDC), version 3.0/1986.)

sharecroppers. Of the 384 rural households appearing continuously over the 1979-84 sample period,¹⁵ 84 contained children aged 0-6.

The descriptive statistics presented in Table 14 provide an overview of the entire sample, and measure a variety of indicators across subsamples of interest: households with children under 6 years of age are compared to households without children under 6, and female-headed households are compared to male-headed households. The subsamples do overlap: of the 34 female-headed households, six had children aged 0-6. Yet, as Table 14 shows, the subsamples were, in fact, quite different.

Average household incomes per capita varied substantially, depending on household composition. Households without small children earned significantly more per capita (on average) than did those with young children to support. Likewise, male-headed households netted significantly more per capita than did their female-headed counterparts. Note that, at an average per capita income of \$Cr1,106,000, female-headed households fared no worse than households with young children.

Over 50 percent of the households with small children appeared in the lowest per capita income tercile based on the entire sample (a highly disproportionate representation), and only 23.5 percent of the female-headed households came from the top tercile category.

The sample's farm size averaged approximately 35 hectares, and did not vary significantly between households with and without young children. Female-headed households, however, had significantly smaller farms (only 21.1 has.) than the rest of the sample.

On average, households in the sample ate enough during the 24-hour recall period to more than meet their daily caloric needs. In fact, none of our subsamples averaged less than 100 percent of its requirements. They did show, however, significant variations in caloric intake. Households without children under age 6 consumed a significantly higher percentage of daily requirements on average than did households with young children, mirroring differences in their per capita incomes. Interestingly, the best fed of our subsamples in terms of caloric intake was (on average) households headed by females, despite their relatively low average income per capita (on a par with the income of the worst-fed subsample!).

Our sole infrastructure variable, distance to the nearest large market town (the municipio seat), also varied across subsamples. Households without small children tended to live significantly closer to municipio seats than did households with them. Female-headed households tended to be closest of all.

¹⁵ The sample was restricted to these households because several variables used in the analysis take farm performance over the entire panel period into account.

Table 14--Descriptive statistics for total sample, households with children, and female-headed households, Zona da Mata, Brazil

Means (Standard Deviations)	Total Sample	Households With Children < 6 Years	t-Value ^a	Households Without Children < 6 Years	Female- Headed Households	t-Value ^b	Male-Headed Households
N	384	84		300	34		350
Total income (\$Cr000)	7,469.8 (9,011.6)	7,954.6 (10,461.8)	0.50	7,334.1 (8,563.1)	3,611.9 (3,430.8)	5.5***	7,844.6 (9,285.4)
Income per capita (\$Cr000)	1,592.4 (2,117.9)	1,108.8 (1,259.8)	-3.3+++	1,727.8 (2,285.0)	1,106.0 (978.2)	2.61**	1,639.7 (2,192.4)
Farm size (hectares)	34.7 (40.1)	31.0 (38.5)	-0.98	35.8 (40.6)	21.1 (26.5)	2.97***	36.1 (41.0)
Household size (persons)	5.5 (2.7)	7.6 (2.5)	8.8+++	4.9 (2.4)	3.8 (2.1)	4.56***	5.64 (41.0)
Adult equivalent ^c	5.2 (2.5)	6.2 (2.6)	4.3+++	4.9 (2.4)	4.0 (2.2)	2.98***	5.32 (2.53)
Percent of daily caloric requirement ^c	120.0 (40.5)	111.4 (32.7)	-2.6++	122.4 (42.4)	136.5 (53.9)	-1.92*	118.4 (38.7)
Distance to municipio (kilometers)	22.5 (13.6)	25.4 (15.1)	2.08++	21.6 (13.1)	18.6 (12.3)	1.73*	22.8 (13.7)
Illiterate household head (percent)	52.9	53.6		52.7	100.0		48.3
Landless (percent)	12.2	22.6		9.3	2.9		13.1
Households without unearned income (percent)	54.4	58.3		53.3	38.2		56.0
Terciles of income per capita:							
Bottom (percent)	33.3	52.4		28.0	38.2		31.1
Middle (percent)	33.3	21.4		36.7	38.2		34.0
Top (percent)	33.3	26.2		35.3	23.5		34.9

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG- "PRODEMATA" survey.

^a Results of t-test between households with children <6 years, and households without children <6 years, with +, ++, +++ denoting significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

^b Results of t-test between female-headed households and male-headed households with *, **, *** denoting significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

^c Adult equivalent based on energy requirements for adult male of mean age (44 years), height of 1.65 meters (2,804 calories/day).

Heads of households with and without small children had similar literacy rates (where 'literacy' required having all household heads literate), but 100 percent of females who headed households were illiterate.

Of the 84 families with small children, 22.6 percent were landless, compared with only 9.3 percent of the remaining households. Slightly less than 3 percent of female-headed households were landless, and a smaller percentage of them went without unearned income (that is, rent, interest, etc.) than did the sample as a whole (38.2 percent, compared with 54.4 percent).

In sum, the sample contains identifiable subsamples that differ, often dramatically, across several socioeconomic indicators. Where similarities exist, such as in income per capita of households with children under 6 and female-headed households, differences elsewhere belie them—in this case, income distribution, farm size, landlessness, illiteracy, distance to market, access to unearned income, and, importantly for this study, caloric intake.

CALORIC INTAKE OF SAMPLE HOUSEHOLDS

Farm households are classified into three categories, according to the percentage of household caloric requirements met: 1) those which met 80 percent or more of their daily caloric requirement, the 'healthiest' households; 2) those which met between 60-80 percent of their caloric needs; and 3) those that failed to reach even 60 percent of their caloric needs.

The Zona da Mata sample was fairly well fed in terms of caloric intake. Of the 384 households contained in the sample, 329 (85.7 percent) consumed 80 percent or more of their caloric requirements, 42 households (10.9 percent) fell into the 60-80 percent bracket, and only 13 households (3.4 percent) failed to meet at least 60 percent of their caloric needs (Table 15).

Small farms (0-10 hectares) were relatively underrepresented among the best fed households, with only 79 percent falling into that category. Only a small percentage of households in each farm size category consumed under 60 percent of their daily caloric requirements during the 24-hour recall period, and the proportional incidence of this sign of possible severe malnourishment was not significantly different among the farm-size groups and landless sharecroppers.

An interesting relationship surfaced between caloric intake and the percentage of income derived from off-farm sources. While a majority of households earned less than 10 percent of their income from off-farm sources (with the numbers of households steadily decreasing in categories with higher percentages of off-farm income), households earning higher percentages of income off farm fell more frequently into

Table 15--Prevalence of calorie deficiency in different groups, Zona da Mata, Brazil, 1984

Group	Total Sample (N)	Calorie Consumption		
		≥ 80 Percent (percent of households ^a)	60-80 Percent	< 60 Percent
Farm households by farm size				
Small (0-10 ha)	123	78.9	17.1	4.1
Medium (11-50 ha)	171	89.5	8.2	2.3
Large (51+ ha)	90	87.8	7.8	4.4
Landless sharecroppers	47	76.6	19.1	4.3
Female-headed households	34	88.2	8.8	2.9
Households by share of off-farm income in total income				
< 10 percent	204	87.3	9.8	2.9
10-30 percent	91	87.9	8.8	3.3
30-60 percent	56	80.4	16.1	3.6
>60 percent off-farm	33	78.8	15.2	6.1
N	384	329	42	13
Percent		(85.7)	(10.9)	(3.4)

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG-"PRODEMATA" survey.

^a Percent of households consuming given percentage of household energy requirement, based on an adult equivalency of 2,804 calories/day.

lower caloric categories than did the entire sample. Over 87 percent of households reporting less than 10 percent of total income from off-farm sources belonged to the best fed group, and only 3 percent of this income group fell below the 60 percent caloric intake cutoff. Households depending more on off-farm income fared worse nutritionally: of the 56 farms earning 30-60 percent of their income off-farm, over 16 percent fell into the 60-80 percent calorie column (nearly double the 8.8 percent of farms in the same nutritional category earning 10-30 percent of their income off-farm).

Table 16 contains a more detailed stratification of household characteristics across the three caloric intake groups, revealing substantial differences among them. While farms in all three caloric intake categories derived roughly half their income from crops (on average), the other half came from sources that varied with nutritional status. Worse nutrition was correlated with greater dependence on off-farm agricultural, as opposed to nonagricultural, income. Only the best-fed group derived a higher share of its income from off-farm nonagricultural activities, than from off-farm agricultural, activities (4.7 percent versus 3.9 percent). Farm households getting 60-80 percent

Table 16--Income and employment sources of the poor, by calorie consumption indicators, Zona da Mata, Brazil, 1984

Indicator	Calorie Consumption			Total
	≥ 80 Percent ^a	60-80 Percent ^a	<60 Percent ^a	
N	329	42	13	384
Average percent of household total income from				
Crops	50.0	49.6	50.6	50.0
Livestock	32.3	26.3	27.8	31.5
Off-farm agricultural employment	3.9	10.7	9.6	4.8
Off-farm nonagricultural employment	4.7	4.7	0.6	4.5
Unearned income	9.0	8.7	11.4	9.1
Average household income per capita (\$C=000)	1,662.8	1,107.8	1,376.9	1,592.4
Average farm size (hectares)	35.3	26.9	44.7	34.7
Terciles based on total sample of 384:				
Percent in bottom income per capita tercile	31.3	47.6	38.5	33.3
Percent in middle income per capita tercile	33.7	28.6	38.5	33.3
Percent in top income per capita tercile	35.0	23.8	23.1	33.3
Average distance to municipio (kilometers)	22.0	24.8	26.7	22.5
Dependency ratio ^b	0.61	0.74	0.66	0.63
Percent of household head illiterate	52.6	47.6	76.9	52.9

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG--"PRODEMATA" survey.

^a Adult equivalent based on energy requirements for adult male of mean age (44 years), height of 1.65 meters (2,804 calories/day).

^b These ratios are based on 364 cases, the 20 missing households (all falling in the ≥80% calorie category) consisted of all seniors, and, in one case, seniors and children under the age of 15.

of their caloric needs, by contrast, depended on off-farm agricultural employment for nearly 11 percent of their income, and, like the best-fed group, got almost 5 percent of income from off-farm nonagricultural activities. Income from off-farm nonagricultural employment dropped to almost nothing for the poorest fed group, while off-farm agriculture continued to weigh in at nearly 10 percent of total income.

NUTRITIONAL STATUS OF CHILDREN AGED 0-6

In this section, the results of a descriptive analysis of the anthropometric data collected in 84 households containing children between the ages of 0 and 6 years are presented. Long-term nutritional status was measured by height-for-age, medium-term by weight-for-age, and short-term by weight-for-height. To eliminate potential double and triple counting of households having more than one child between the ages of 0 and 6, only the worst-off child in each household in terms of

each of the three anthropometric measures was studied in this section.¹⁶ Therefore, the same child from each household need not (but generally does) appear in the samples analyzed for long-, medium-, and short-term nutrition.

Anthropometric Indicators of Nutritional Status

Nutritional status was measured in standard Z-scores from the mean values for a standard population of children aged 0-6 (adjusted for age and gender—see footnote 14), and appears in three sets of columns per anthropometric measure in Table 17. The first set of columns represents the households whose worst-off child was above average in terms of the particular nutrition measure. The second set of columns includes children who were below average but fell within one standard deviation below the standard population mean, and the third contains children more than one standard deviation below the standard mean.

Table 17--Prevalence of malnutrition by anthropometric status of children in different groups, Zona da Mata, Brazil, 1984

Group	Percentage of Households with Z-Scores ^a of									N
	Height-for-Age			Weight-for-Age			Weight-for-Height			
	>0	-1 to 0	≤-1	>0	-1 to 0	≤-1	>0	-1 to 0	≤-1	
N	15	24	45	28	23	33	42	28	14	84
Percent	(17.9)	(28.6)	(53.6)	(33.3)	(27.4)	(39.3)	(50.0)	(33.3)	(16.7)	
Farm size										
Small (0-10 ha)	9.7	19.4	71.0	16.1	32.3	51.6	41.9	38.7	19.4	31
Medium (11-50 ha)	23.5	32.4	44.1	41.2	23.5	35.3	55.9	32.4	11.8	34
Large (51+ ha)	21.1	36.8	42.1	47.4	26.3	26.3	52.6	26.3	21.1	19
Landlessness	10.5	21.1	68.4	15.8	26.3	57.9	31.6	52.6	15.8	19
Share of off-farm income in total income										
< 10 percent	20.0	28.9	51.1	37.8	26.7	35.6	53.3	31.1	15.6	45
10-30 percent	15.0	25.0	60.0	25.0	20.0	55.0	45.0	20.0	35.0	20
30-60 percent	12.5	37.5	50.0	37.5	1.3	31.3	50.0	58.3	0.0	16
> 60 percent	33.3	0.0	66.7	0.0	66.7	33.3	33.3	66.7	0.0	3

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG—"PRODEMATA" survey.

^a Height-for-age, weight-for-age, and weight-for-height samples are of households with children <6 years old. Within each anthropometric measure, each household is identified by the lowest Z-score among its children.

¹⁶ Forty-seven of the households had only one child under age 6, 23 had two children under age 6, 10 had three, and 4 had four, for a total of 84 households with 139 children under age 6.

Unlike the fairly positive short-term picture described in the previous section regarding caloric intake by rural households, data analyzed in this section suggest that the growth of this sample's children aged 0-6 was stunted, but that nutrition improved over time. Over half of the 84 children fell below one standard deviation from the standard population mean in height-for-age, the long-term measure of nutritional status (Table 17). Although the children scored higher in terms of the medium-term measure, still, almost 40 percent of the children's weight-for-age fell more than one standard deviation below the standard population mean.

The second row in Table 17 provides the baseline percentages for all the Z-score categories against which other characteristics are compared. Note that, with this smaller sample, the number of cases in stratified categories at times dropped too low for meaningful statistical interpretation.

Farm Household Characteristics and Nutritional Status

A clear link surfaced between farm size and both height-for-age and weight-for-age. Children from relatively large farms (11-50 and 50+ hectares) had a much better chance of achieving above average height than those from small farms (0-10 hectares), of whom fully 71 percent were below one standard deviation from the standard healthy population mean height-for-age (Table 17). Children brought up on relatively large farms also appeared more frequently in the above average weight-for-age category. Coming from a larger farm did not translate, however, into improved weight-for-height. Small farms (0-10 hectares) still had proportionately the least children of any farm size group in the above average nutritional category.

Landlessness showed a stronger tie to low nutritional status of young children the more long term the nutrition proxy. Nearly 70 percent of the (19) children of landless sharecroppers sampled for long-term nutrition were in the lowest height-for-age category—a highly disproportionate presence.¹⁷ In the medium term, the pattern of poor nutrition in landless households held up, though the situation improved slightly, with children of landless sharecroppers comprising 58 of the lowest weight-for-age category. The weight-for-height distribution for landless sharecroppers more closely followed the u-shaped trend of their caloric intake distribution (Table 15).

Percentage of income earned from off-farm sources did not display the clear relationship with nutritional status of young children as it did with household caloric intake in the larger sample, and the decreased sample size hampered efforts to make useful comparisons across off-farm

¹⁷ Since only 19 of the 84 households containing children were landless, cell frequencies for anthropometric categories should be interpreted with care.

income categories. No dramatic patterns emerged between the percentage contribution of different types of income, on the one hand, and height-for-age, on the other (Table 18).

With weight-for-age, by contrast, an analysis of the types of income did yield interesting patterns. Households deriving an above average share of income from livestock were much more likely to have children in the highest weight-for-age Z-score category. Farms depending more heavily than average on off-farm labor (agricultural and nonagricultural) as an income source, on the other hand, tended to raise children with below average weight-for-age Z-scores, and, like households in the lower caloric intake categories, derived more of their income from agricultural than nonagricultural off-farm employment.

A more confused picture emerged in the relation between off-farm income and weight-for-height, though analysis of the components of household income did strengthen the impression from the weight-for-age data that reliance on livestock made a difference for child nutrition. Increased concentration in livestock went hand in hand with improved weight-for-height for the household's worst-off child. Markedly above average concentration on crops, on the other hand, characterized farms in the lowest weight-for-height category.

There was a positive correlation of absolute income per capita with both height-for-age and weight-for-age. Children with the best long- and medium-term nutrition came from families earning nearly twice as much per capita as the households with children making up the lowest height-for-age, and weight-for-age Z-score categories, respectively. Income distribution figures within Z-score categories reflect this inequity.

The dependency ratios suggest how burdened the productive household members in each of these samples were in caring for old and young. Across the three anthropometric measures, the dependency ratio for the lowest nutritional category was always substantially above the 84-household mean of 1.39.

PRODUCT-LEVEL OUTPUT MIX AND RURAL POVERTY

In this section, the importance of farm-level output mix to caloric intake and household nutritional status (measured by caloric intake for the whole sample, and by anthropometrics for the households with young children) is examined.

Five farm types were determined on the basis of relative product-specific concentration of the value of total farm output using cluster

Table 18--Income and employment sources of the poor, by anthropometric status indicators, Zona da Mata, Brazil, 1984

	Percentage of Households with Z-Scores ^a of									Total Average
	Height-for-Age			Weight-for-Age			Weight-for-Height			
	>0	-1 to 0	≤1	>0	-1 to 0	≤1	>0	-1 to 0	≤1	
N	15	24	45	28	23	33	42	28	14	84
Average percent of household total income from										
Crops	52.3	53.4	57.8	48.0	59.7	59.1	55.3	49.9	67.8	55.6
Livestock	30.2	33.1	24.8	38.0	21.6	24.4	30.3	27.8	22.4	28.2
Off-farm agricultural employment	5.2	4.7	6.6	3.9	7.3	6.5	3.8	10.4	2.9	5.8
Off-farm nonagricultural employment	4.4	3.7	4.3	2.9	4.0	5.4	3.8	6.1	1.4	4.2
Unearned income	7.7	5.1	6.4	7.3	7.4	4.7	6.8	5.8	5.7	6.3
Average household income per capita (\$Cr000)	1,552.4	1,379.4	816.7	1,648.6	1,092.2	662.5	1,228.1	751.4	1,466.1	1,108.8
Average farm size (hectares)	31.4	48.7	21.5	37.8	38.6	20.0	32.7	28.9	30.4	31.0
Income per capita tercile ^b :										
Percent in bottom	40.0	41.7	62.2	35.7	56.5	63.6	50.0	60.7	42.9	52.4
Percent in middle	20.0	25.0	20.0	21.4	17.4	24.2	16.7	25.0	28.6	21.4
Percent in top	40.0	33.3	17.8	42.9	26.1	12.1	33.3	14.3	28.6	26.2
Average distance to market (kilometers)	15.4	28.1	27.3	19.6	28.5	28.2	24.4	26.3	26.8	25.4
Average dependency ratio	1.20	1.08	1.62	1.09	1.19	1.79	1.12	1.68	1.60	1.39
Average percent of household illiteracy	46.7	50.0	57.8	42.9	65.2	54.5	52.4	71.4	21.4	53.7

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG-"PRODEMATA" survey.

^a Height-for-age, weight-for-age, and weight-for-height samples are of households with children <6 years old. Within each anthropometric measure, each household is identified by the lowest Z-score among its children.

^b Based on total sample of 384 households.

analysis.¹⁸ Farms focusing productive activities in coffee, corn, dairy products, rice, and off-farm labor formed distinct clusters. This cluster analysis was performed for the sample of 384 farms every year of the panel survey (1979-1984), creating the basis for an indicator of production stability over time: a dichotomous variable labeled "jumper" for farms that changed cluster assignments at least once during the sample period, and "stayer" for farms that remained in the same farm type cluster over the entire sample period.

The sample consisted primarily of producers concentrating on coffee or corn, with close to a third of the sample in each of these clusters (Table 19). Concentration in rice production was the most rare production activity (6 percent of farms). Nearly 65 percent of the sample "jumped" production clusters over the five-year period monitored. Their collective (low socioeconomic) profile hints that most jumped out of desperation, rather than from a secure base (or that the jump itself eroded that secure base).

Farm size varied dramatically across clusters, with dairy farms being the largest, and off-farm labor farms, the smallest (Table 19 and

Table 19--Prevalence of calorie deficiency in production clusters, Zona da Mata, Brazil, 1984

Group	(N)	Clusters					Jumper	Stayer
		1 Coffee	2 Corn	3 Dairy	4 Off-Farm	5 Rice		
		(percent of households)						
Farm households by farm size								
Small (0-10 hectares)	123	27.6	36.6	2.4	25.2	8.1	76.4	23.6
Medium (11-50 hectares)	171	33.9	32.2	20.5	7.6	5.8	63.7	36.3
Large (51+ hectares)	90	35.6	16.7	38.9	5.6	3.3	50.0	50.0
Landless sharecroppers	47	31.9	27.7	0.0	29.8	10.6	85.1	14.9
Female-headed households	34	17.6	29.4	20.6	23.5	8.8	73.5	26.5
Households by share of off-farm income in total income								
< 10 percent	204	46.1	26.5	21.1	1.0	5.4	57.8	42.2
10-30 percent	91	24.2	41.8	26.4	5.5	2.2	62.6	37.4
30-60 percent	56	10.7	32.1	8.9	33.9	14.3	78.6	21.4
> 60 percent	33	6.1	15.2	3.0	68.7	6.1	87.9	12.1
N	384	124	115	73	49	23	248	136
(Percent)		(32.3)	(29.9)	(19.0)	(12.8)	(6.0)	(64.6)	(35.4)

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG-"PRODEMATA" survey.

¹⁸ See Nerlove, Vosti, and Basel (1989) for a detailed description of methodologies adopted and cluster results.

Table 20). Corn farms tended to cover less than 50 hectares. Coffee farms were fairly uniformly distributed across farm size categories. Farms that "jumped" production clusters over time tended to be much smaller than "stayers."

Landless sharecroppers also tended to be unevenly distributed across clusters, as one would expect. The dairy cluster contained no landless sharecroppers. Landlessness was, however, over twice as prevalent in the off-farm labor cluster than in the sample as a whole. In addition, the landless switched production clusters much more often than did the sample at large (85.1 percent, compared with 64.6 percent).

Table 20--Income and employment sources of production clusters, Zona da Mata, Brazil, 1984

Indicator	Clusters					Jumper	Stayer	Total Average
	1 Coffee	2 Corn	3 Dairy	4 Off-Farm Labor	5 Rice			
N	124	115	73	49	23	248	136	384
Average percent of household total income from								
Crops	77.5	50.3	20.4	26.1	45.5	50.0	50.0	50.0
Livestock	14.9	32.1	68.8	17.5	29.1	27.9	38.0	31.5
Off-farm agricultural employment	1.4	3.4	1.0	21.4	7.5	6.6	1.7	4.8
Off-farm nonagricultural employment	1.4	1.5	3.0	23.5	1.3	5.6	2.6	4.5
Unearned income	4.7	12.8	6.8	11.5	16.5	10.0	7.5	9.1
Average farm size (hectares)	35.8	25.4	62.7	16.4	26.1	29.1	45.0	34.7
Average household income per capita (\$Cr000)	2,239.4	849.0	2,366.1	717.7	1,229.5	1,193.6	2,319.8	1,592.4
Income per capita tercile ^a								
Percent in bottom	20.2	47.0	11.0	59.2	52.2	41.9	17.6	33.3
Percent in middle	31.3	41.7	30.1	30.6	17.4	32.7	34.6	33.3
Percent in top	48.4	11.3	58.9	10.2	30.4	25.4	47.8	33.8
Average distance to municipio (kilometers)	26.7	19.3	21.7	22.1	18.1	22.1	23.1	22.5
Dependency ratio ^b	0.63	0.72	0.49	0.62	0.65	0.66	0.57	0.63
Percent of household head illiterate	46.8	63.5	38.4	59.2	65.2	60.1	39.7	52.9

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG-"PRODEMATA" survey.

^a Based on total sample of 384 households.

^b Based on 364 cases; the 20 missing households consisted of all seniors, and, in one case, seniors and children under the age of 15.

The 34 households headed by females were also disproportionately represented in the off-farm labor and "jumper" categories, and highly underrepresented in the coffee category.

The percentage of total income derived from off-farm sources gives some idea of which clusters' farms supplemented their income through off-farm employment. In clusters other than off-farm labor (which by definition depended heavily on off-farm employment), some trends emerged out of somewhat erratic patterns: farms earning more than 30 percent of their income off farm were far less likely to concentrate on coffee or dairy production than was the sample at large. The trend pertaining to production stability over time, by contrast, stood out clearly: farms more dependent on off-farm income belonged disproportionately to the "jumper" category.

The composition of total income by source (Table 20) confirms the appropriateness of cluster assignments, and highlights some differences across clusters. The coffee and dairy clusters led in highest concentrations of income source: the coffee cluster farms derived an average of 77.5 percent of their income from crop production; the dairy cluster, 68.8 percent of income from livestock. On average, the off-farm labor cluster split its primary income source almost evenly between our two types of off-farm employment: agricultural and nonagricultural. Finally, the "stayer" group was substantially more dedicated to livestock production and less dependent on off-farm income than were "jumpers."

Average household income per capita varied dramatically across cluster types and across "jumper/stayer" categories. Dairy and coffee farms registered the highest average per capita incomes. Farms in the corn, rice, and off-farm labor clusters came predominantly from the lowest income tercile, the latter reporting the lowest average per capita income. Moreover, the "stayers" earned nearly twice the income per capita of the "jumpers." Sixty percent of the "jumpers" had illiterate household heads, compared to only 40 percent of the "stayers."

Coffee households exhibited a steady representation (and, therefore, one close to the sample norm) in all Z-score categories for both height-for-age and weight-for-age, despite their high average household income per capita (Table 21). In weight-for-height, however, the children from coffee farms fell disproportionately into the lowest category. Corn-producing and off-farm labor households (both poorer on average than coffee farms) tended to be below average in every anthropometric measure. Only on dairy farms did high income accompany healthier children, according to all three anthropometric measures of nutritional status. Finally, and surprisingly given the low income profile of the average "jumper," "jumper" households' children appeared with nearly equal incidence across Z-score measures.

Table 21--Prevalence of malnutrition in production clusters by anthropometric status of children, Zona da Mata, Brazil, 1984

Group	(N)	Clusters					Jumper	Stayer
		1 Coffee	2 Corn	3 Dairy	4 Off-Farm Labor	5 Rice		
		(percent of households)						
Height-for-Age Z-score ^a								
>0	15	40.0	20.0	26.7	13.3	0.0	66.7	33.3
-1 to 0	24	41.7	33.3	12.5	8.3	4.2	58.3	41.7
≤-1	45	40.0	26.7	8.9	20.0	4.4	62.2	37.8
Weight-for-Age Z-score ^a								
>0	28	39.3	25.0	25.0	3.6	7.1	60.7	39.3
-1 to 0	23	43.5	26.1	8.7	21.7	0.0	60.9	39.1
≤-1	33	39.4	30.3	6.1	21.2	3.0	63.6	36.4
Weight-for-Height Z-score ^a								
>0	42	40.5	23.8	19.0	11.9	4.8	59.5	40.5
-1 to 0	28	32.1	32.1	7.1	25.0	3.6	64.3	35.7
≤-1	14	57.1	28.6	7.1	7.1	0.0	64.3	35.5
N	84	34	23	11	13	3	52	32
(Percent)		(40.5)	(27.4)	(13.1)	(15.5)	(3.6)	(61.9)	(38.1)

Calorie consumption ^b								
≥80%	329	31.1	30.7	20.4	11.2	6.4	62.3	37.7
60-80%	42	33.3	26.2	9.5	26.2	4.8	71.4	28.6
<60%	13	53.8	23.1	15.4	7.7	0.0	100.0	0.0
N	384	124	115	73	49	23	248	136
(Percent)		(32.3)	(29.9)	(19.0)	(12.8)	(6.0)	(64.6)	(35.4)

Source: Universidade Federal de Viçosa, Programa de desenvolvimento rural integrado da Zona da Mata-MG-"PRODEMATA" survey.

^a Sample is of households with children <6 years old. Each household is identified by the Z-score of its worst-off child.

^b Adult equivalent based on energy requirements for adult male of mean age (44 years), height of 1.65 meters (2,804 calories/day).

The lower portion of Table 21 reports caloric intake information by cluster. Off-farm labor households, the poorest economically, were highly overrepresented in the 60-80 percent calorie group, but underrepresented in the <60 percent caloric group. The picture of the households belonging to the "jumper" category looks a lot grimmer when looking at the whole sample than when restricting the sample to households with young children: Although they were only slightly underrepresented in the best-fed caloric intake category, they were considerably overrepresented in the moderately underfed (60-80 percent calorie requirement) category, and made up 100 percent of all farms falling below 60 percent of caloric intake needs!

MULTIVARIATE ANALYSES OF DETERMINANTS OF CALORIC INTAKE AND NUTRITIONAL STATUS

Up to now, the descriptive statistics presented have illuminated some of the bivariate relationships that exist among a series of farm-level characteristics, on the one hand, and household caloric intake and child nutritional status, on the other. In this section, regression analysis is used to test simultaneously a series of hypotheses aimed at identifying factors that (other things remaining constant) influence the caloric intake of rural households and the nutritional status of children aged 0-6 years.

Caloric Intake Equation

Table 22 presents Ordinary Least Squares regression results, where the dependent variable is the percentage of household daily caloric requirement consumed over the 24-hour recall period. Explanatory variables (suggested by the descriptive tables) include such household characteristics as: distance to municipio, a household head illiteracy

Table 22--Determinants of household caloric intake

O.L.S. Regression Estimates—Dependent Variable = PREQ (Percentage of household daily caloric requirement consumed over 24-hour recall period ^a)			
Variable		Coefficient	t-ratio ^b
DIST	Distance (km) to nearest municipio seat (major market town)	0.15	0.97
ILLIT	Illiterate household head; male or female (1=yes, 0=no)	-1.46	0.31
FHHH	Female-headed household (1=yes, 0=no)	22.86	2.85**
DEPRIO	Household dependency ratio	-6.36	2.22*
JUMP	Household production cluster movement from 1979-84 (1=jump, 0=stay)	-11.85	2.55*
CROPVLS	Ratio of crop income to livestock income	0.15	0.66
PINCOFA	Percentage of total income from off-farm agricultural labor	-0.63	3.68**
PINCOFNA	Percentage of total income from off-farm <u>non</u> agricultural labor	0.06	0.34
PUNEARN	Percentage of total income from unearned income (rents, interest, etc.)	0.03	0.20
TOTINC	Total income (\$Cr)	-3.67×10^{-7}	1.44
Constant		132.09	20.13**
$\bar{R}^2 = 0.07$			
N = 352			

^a Household daily requirements based on individuals present at 24-hour recall.

^b Absolute value of t-ratios; *, ** indicate significance levels of 5 percent and 1 percent, respectively.

dummy variable, a female-headed household dummy variable, and a dependency ratio. Also included were income and income source measures: the percentage of income derived from off-farm agricultural activities, the percentage of income derived from off-farm nonagricultural activities, the percentage of income derived from unearned sources, and total household income, as well as a measure for stability of income sources (a "jumper" dummy variable), and, with the view that ready access to livestock products (showing up in substantial livestock income) boosts caloric intake, the ratio of crop to livestock income, and a constant term. The equation was estimated using 352 observations.

Results suggest that female-headed households, all other things remaining constant, were significantly better nourished than male-headed households. Increases in dependency ratios (either due to the presence of young children or the presence of older unproductive adults) led to a significant decrease in caloric intake relative to caloric needs. Farm households that substantially altered their production activities over time (that is, "jumpers") tended to consume significantly fewer of their needed calories. Finally, increases in the percent of income derived from off-farm agricultural activities tended to decrease slightly the percentage of household daily caloric requirements consumed. It is interesting to note that total income did not significantly influence caloric intake when controlling for the above factors.

Nutritional Status Equations

Regression analysis is used to identify the household- and individual-specific characteristics that influence the nutritional status of not just each household's worst-off child, but all children aged 0-6. A bootstrapping technique was employed to avoid the pitfalls associated with simultaneously including children from identical households as independent observations. This technique makes use of repeated random samples (in our case, 10) from multi-child households (only one child was drawn from each of the 84 households at a time) to estimate (and re-estimate) all coefficients for each of the samples drawn. Estimated coefficients and confidence intervals were then averaged and significance tests performed on these averages. Table 23 presents the results of the height-for-age Z-scores equation, with estimated coefficients and standard errors for each of the right-hand side variables appearing in the first two columns. In trying to explain long-term nutritional status, earlier years of the panel data were used to generate a long-term income value: in place of total 1984 income, the average value of total output in inflation-free corn units across all years of the panel period was used.¹⁹ Long-term income measured in this way was highly significant in determining height-for-age (once again, measured in terms of Z-scores). As expected, the ratio of crop

¹⁹ See Nerlove, Vosti, and Basel (1989) for details.

Table 23--Determinants of height-for-age for all young children

Variable	Avg. β	Avg. SE	t-ratio ^a	Range β		Range SE	
				Low	High	Low	High
<u>Income</u>							
VTOAV	0.0004	0.0001	2.70+++	0.0003	0.0004	0.0001	0.0001
<u>Income Sources</u>							
CROPVLS	-0.03	0.01	2.12++	-0.03	-0.02	0.01	0.01
PINCOFA	0.004	0.01	0.31	-0.003	0.01	0.01	0.01
PINCOFNA	0.005	0.01	0.46	-0.001	0.01	0.01	0.01
PUNEARN	-0.01	0.01	0.84	-0.01	-0.005	0.01	0.01
<u>Household Characteristics</u>							
DEPRATIO	-0.28	0.16	1.73+	-0.35	-0.18	0.14	0.17
DIST	-0.001	0.008	0.12	-0.005	0.003	0.008	0.009
FHHH	-0.04	0.53	0.08	-0.21	0.18	0.48	0.57
HHSIZE	-0.07	0.05	1.27	-0.10	-0.01	0.05	0.06
ILLIT	0.29	0.30	0.95	0.02	0.56	0.28	0.32
JUMP	-0.10	0.26	0.40	-0.29	0.07	0.24	0.29
PREQ	0.01	0.004	2.43++	0.009	0.01	0.004	0.004
<u>Individual Characteristics</u>							
AGECH	-0.02	0.03	0.81	-0.06	0.002	0.02	0.03
AGECH2	0.0002	0.0003	0.73	-0.00001	0.0006	0.0003	0.0004
SEXCH	0.07	0.25	0.29	-0.14	0.21	0.23	0.27
WHZSCORE	0.19	0.15	1.25	0.12	0.26	0.13	0.17
Constant	-0.95	0.90	1.05	-1.42	-0.51	0.80	1.02
\bar{R}^2	Average	0.16	Range: (Low)	0.08	(High)	0.29	
N		84 ^b					

^a Absolute value of ratio of avg. estimated β to avg. SE calculated from 10 randomly-drawn samples (in each sample, each household containing children <6 years old was represented by a randomly selected child), with +, ++, +++ denoting significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

^b Composition of sample varied each round.

Notes:

AGECH	Age of child (months)
AGECH2	AGECH x AGECH
CROPVLS	Ratio of 1984 crop income to livestock income
DEPRATIO	Household dependency ratio
DIST	Distance (km) to nearest municipio
FHHH	Female-headed household (1=yes, 0=no)
HAZSCORE	Child's height-for-age Z-score (standard deviations away from a standard population's mean)
HHSIZE	Household size
ILLIT	Illiterate household head; male or female (1=yes, 0=no)
JUMP	Household production cluster movement from 1979-84 (1=jump, 0=stay)
PINCOFA	Percentage of 1984 total income from off-farm agricultural labor
PINCOFNA	Percentage of 1984 total income from off-farm nonagricultural labor
PREQ	Percentage of household daily caloric requirement consumed over 24-hour recall period (based on individuals present at 24-hour recall).
PUNEARN	Percentage of 1984 total income from unearned income (rents, interest, etc.)
SEXCH	Gender of child (1=male, 0=female)
TOTINC	Total 1984 income (\$Cr)
VTOAV	Average annual value of total real agriculture output (1979-84)
WAZSCORE	Child's weight-for-age Z-score (standard deviations away from a standard population's mean)
WHZSCORE	Child's weight-for-height A-score (standard deviations away from a standard population's mean)

to livestock income was correlated with children's growth, with decreases in that ratio (that is, increases in the relative importance of livestock income) significantly associated with improved height-for-age. More dependents relative to productive household members showed up significantly related to decreases in children's height-for-age. Finally, the percentage of caloric requirement consumed by the household as a whole was positively and significantly linked to height-for-age for young children.

Table 24 presents regression results for the weight-for-age Z-scores equation. Here, average value of total output was dropped in favor of total 1984 income due to the shorter-term nature of the nutritional measure being explained. Only one included variable registered a significant influence. Predictably, height-for-age was strongly (and positively) correlated with weight-for-age (that is, long-

Table 24--Determinants of weight-for-age for all young children

Variable	Avg. β	Avg. SE	t-ratio ^a	Range β		Range SE	
				Low	High	Low	High
Income							
TOTINC	8×10^{-9}	9.1×10^{-9}	0.88	-6.0×10^{-10}	1.5×10^{-8}	8.3×10^{-9}	1.0×10^{-8}
Income Sources							
CROPVLS	0.004	0.007	0.60	-0.006	0.01	0.007	0.008
PINCOFA	-0.007	0.008	0.86	0.01	-0.002	0.007	0.009
PINCOFNA	-0.004	0.007	0.67	-0.01	-0.001	0.007	0.008
PUNEARN	0.005	0.007	0.69	0.002	0.009	0.007	0.008
Household Characteristics							
DEPRIO	-0.02	0.10	0.18	-0.08	-0.04	0.09	0.11
DIST	-0.007	0.005	1.27	-0.01	-0.003	0.005	0.006
FHHH	-0.09	0.33	0.26	-0.19	0.07	0.31	0.37
HHSIZE	-0.01	0.03	0.42	-0.05	0.009	0.03	0.04
ILLIT	0.20	0.19	1.06	0.12	0.29	0.17	0.21
JUMP	0.06	0.17	0.35	-0.06	0.17	0.16	0.19
PREQ	-0.004	0.002	1.55	-0.006	-0.002	0.003	0.003
Individual Characteristics							
AGECH	-0.007	0.02	0.42	-0.02	0.003	0.02	0.02
AGECH2	0.0003	0.0002	0.15	-0.00008	0.0002	0.0002	0.0002
SEXCH	-0.12	0.16	0.74	-0.23	0.07	0.15	0.18
WHZSCORE	0.69	0.07	9.45+++	0.63	0.75	0.06	0.08
Constant	1.04	0.54	1.92+	0.54	1.46	0.50	0.61
\bar{R}^2	Average	0.58		Range: (Low) 0.49 (High) 0.67			
N		84 ^b					

^a Absolute value of ratio of avg. estimated β to avg. SE calculated from 10 randomly-drawn samples (in each sample, each household containing children <6 years old was represented by a randomly selected child), with +, ++, +++ denoting significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

^b Composition of sample varied each round.

Note: For variable description, see Table 23.

term nutrition strongly affects nutrition in the medium term—its inclusion in the equation boosted average R-square to 0.58).

Table 25 presents the results for the short-term measure of nutritional status, weight-for-height. This was the weakest of all regression equations, with an average R-square of only 0.02, with only the constant registering as significant. Interestingly, long-term nutrition (height-for-age Z-score) did not display any significant link to nutrition in the shortest run (weight-for-height).

CONCLUSIONS

The sample population drawn from the Zona da Mata of Minas Gerais, Brazil, for this analysis was not poorly nourished in terms of meeting

Table 25--Determinants of weight-for-height for all young children

Variable	Avg. β	Avg. SE	t-ratio ^a	Range β		Range SE	
				Low	High	Low	High
Income							
TOTINC	1.0×10^{-8}	1.2×10^{-8}	0.86	1.5×10^{-9}	1.9×10^{-8}	1.1×10^{-8}	1.3×10^{-8}
Income Sources							
CROPVLS	0.008	0.01	0.80	-0.008	0.02	0.009	0.01
PINCOFA	-0.01	0.01	1.02	-0.02	-0.005	0.009	0.01
PINCOFNA	-0.005	0.003	0.55	-0.01	-0.0005	0.009	0.01
PUNEARN	0.009	0.01	0.88	0.003	0.01	0.009	0.01
Household Characteristics							
DEPTIO	-0.05	0.13	0.35	-0.13	0.03	0.12	0.14
DIST	-0.009	0.007	1.24	-0.01	-0.004	0.006	0.007
FHHH	0.005	0.43	0.01	-0.13	0.18	0.40	0.47
HHSIZE	-0.02	0.05	0.39	-0.06	0.02	0.04	0.05
ILLIT	0.27	0.25	1.10	0.15	0.40	0.23	0.27
JUMP	0.09	0.22	0.39	-0.09	0.28	0.21	0.23
PREQ	-0.005	0.003	1.54	-0.007	-0.003	0.003	0.004
Individual Characteristics							
AGECH	-0.003	0.02	0.13	-0.02	0.01	0.02	0.03
AGECH2	0.00004	0.0003	0.15	-0.0002	0.0002	0.0003	0.0003
SEXCH	-0.11	0.21	0.54	-0.29	0.15	0.19	0.23
WHZSCORE	0.12	0.10	0.19	0.06	0.16	0.08	0.11
Constant	1.29	0.71	1.80+	0.68	1.89	0.66	0.78
\bar{R}^2	Average	0.02	Range:	(Low) -0.06	(High) 0.12		
N		84 ^a					

^a Absolute value of ratio of avg. estimated β to avg. SE calculated from 10 randomly-drawn samples (in each sample, each household containing children <6 years old was represented by a randomly selected child), with +, ++, +++ denoting significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

^b Composition of sample varied each round.

Note: For variable description, see Table 23.

caloric requirements based on household adult equivalents, nor were the children present in 84 of the 384 households particularly malnourished with regard to international standards for children aged 0-6. Our analysis focused on total household caloric intake and the nutritional status of the worst-off child in every household (better-off children were excluded from the analysis in the 36 households having multiple children until the multiple regression stage). To the extent that our focus on aggregate caloric intake and worst-off children biased potentially nonlinear interrelationships examined in this paper, the results should be interpreted with some caution.

Nevertheless, several important interrelationships between food consumption, nutritional status, and a series of household and individual characteristics were revealed by the analysis.

Several strong interrelationships surfaced between farm characteristics and nutrition in the descriptive analysis. Farm size was positively correlated with the long-term and medium-term measures of children's nutritional status, while a U-shaped relationship existed between farm size and the short-term measure of nutritional status (weight-for-height). A strong and consistently negative relationship was detected between distance to nearest major market and both caloric intake and nutritional status of young children. Landlessness was found to be directly linked to poor nutrition of children in rural households but was not conclusively linked to caloric intake. Female-headed households were consistently better fed.

Several important links were established between the income sources and their nutritional status and caloric intake. Degree of reliance on income sources did make a difference: households deriving above average percentage of total income from livestock tended to be both better fed and had better-nourished children, and families that depended more heavily on off-farm employment as a source of income tended to fare worse, both in terms of caloric intake and nutritional status. Composition of income within income source categories also made a difference for the one category we examined, off-farm labor: evidence suggests that off-farm agricultural employment was more directly linked with poor caloric intake than was off-farm nonagricultural employment.

Finally, agricultural output mix, and its changes over time, made a difference for caloric intake and children's nutrition, and highlighted the lack of a direct correlation between higher incomes and better nutritional status. Dairy farms, possibly due to the available source of high quality protein and calorie in dairy products, tended to have the most well-nourished children. Coffee farmers, which, on average, had the second highest income levels, failed to lever this income into either improved caloric intake or improved nutritional status of young children. The off-farm labor cluster (with the absolute lowest income level) did not fare nearly as badly as one would expect in either the caloric intake or the nutritional status measures. Finally, farms with inconsistent production activities over time (that is, those who jumped

from one production cluster to another at least once during the sample period) tended to have less well-nourished children, and made up 100 percent of the poorest fed households in the sample.

Several policy implications and implications for further research can be derived from the results. First, since income sources were seen to influence caloric intake and nutritional status, they could serve as valuable targeting instruments. While some measures of income sources may not be quickly ascertainable, others (for example, households' dependencies on off-farm agricultural income) can aid in the detection of poverty-prone households in this setting. Farm types (defined in terms of output mix) were also shown to affect household caloric intake and measures of nutritional status in children. Since these farm types are readily recognizable by agricultural extension agents and others, their identification could serve as an ideal instrument for rapid field-level poverty assessment.

Secondly, female-headed households were better nourished despite significantly lower purchasing power and access to land, but their children were not above average in terms of our nutritional measures. Clearly there is room for further research to understand how female-headed households generate above average caloric intake from below average entitlements, and why their children don't show any improvement in growth, despite their apparent access to more calories.

Thirdly, the important link between production stability and the performance of children in the height-for-age and weight-for-age nutrition measures suggests that "permanent income" plays a critical role in raising rural families above the poverty line. Families with inter-temporally erratic production patterns were the worst fed, indicating a strong correlation between being at the margin in terms of agricultural production and being at the margin in terms of nutritional status. Policies aimed at stabilizing production patterns might be called for.