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Health and Nutrition

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Introduction

In most countries, citizens expect the government to improve their welfare. Indeed, Ronald Reagan's 1980 campaign for the US Presidency had as its theme, "Are you better off today than you were four years ago?" Reagan won in a landslide, in large part because most voters answered that question with a loud, "No!"

As we examine the impact of policy on rural development in the study communities in Kenya and Tanzania, welfare outcomes are of central importance. Income per capita and related measures of poverty and prosperity were examined in the previous chapter which showed that the best proxy for real income per capita is about 30% higher in the Kenyan community. Similarly, some 15% of the Tanzanian households have expenditures so low that providing an adequate diet seems impossible. Only 5% of the Kenyan households are in this category. On the other hand, income disparity appears to be greater in the Kenyan community.

Income, however, is not the only nor necessarily the most important welfare outcome. Indicators of health and nutrition are also of central -- and perhaps greater -- importance to a country's citizens. Although it is logical to assume that households with more income will invest more in health and nutrition, and thus have better nutrition and health outcomes, a considerable body of research casts doubts on this logical assumption (see Behrman & Deolalikar 1988, Kennedy & Cogill 1987, for example). When the differences in income are in communities in different countries, it is not at all clear that the community with higher income will also have better health and nutrition outcomes.

Since this study examines the impact of government policy on rural communities, evidence of health and nutrition outcomes at different points in time would be ideal, allowing us to see how and if changes in policy at the national level had impacts on the local level. Unfortunately, no earlier nutrition data are available for these communities.

In the absence of time series data, we examine, first, morbidity, mortality, and use of health care facilities in the two communities. These provide some summary indicators of well-being in the communities, along with evidence concerning the importance of government and non-governmental services in providing health care. Next we examine anthropometry data for children under six years of age, who, along with pregnant and lactating mothers, are those most prone to nutritional deficiencies. These data are examined carefully both in order to compare overall outcomes in the communities, and to compare differences in the determinants of those outcomes between communities. In particular, we are interested to see if there is a different relationship between income and health in the two communities.

To our surprise, health outcomes in the Tanzanian community are better or virtually no different than those in the Kenyan community on every measure. Furthermore, while there is a definite correspondence between income and nutritional status in the Kenyan community, there is little or no link in the Tanzanian community. Our conclusion, however, is that these differences are most likely not related to government policies, as the evidence suggests that government-provided health care services are no better in the Tanzanian community. Yet obvious possible alternative explanations, such as differences in water quality, water availability, housing, sanitation, diet, or preventive medicine, can all be ruled out. The source of the difference remains a puzzle.

Mortality, Morbidity & Health Care

We begin our examination of the survey by looking at infant and child mortality data for the two communities. Each woman who had given birth since independence was asked about the number of children she had born alive, and then (as sympathetically as possible) about deaths among those children. If deaths had occurred, the woman was asked for the year of birth and year of death. We then correlated these reported deaths with information collected earlier about all children born to women in the household, resulting in infant and child mortality statistics beginning in 1969/70.

Because infant deaths are relatively rare in both communities, our sample size is small; since independence there were 31 deaths among children under 6 in the Kenyan households and 16 in the Tanzanian households (27 and 15 of these were infants). However, in every time period, the implied infant mortality rate was smaller in the Tanzanian community than the Kenyan community. For example, during the 1980's, the infant mortality rate was 37 per thousand in the Kenyan community and 29 per thousand in the Tanzanian community. These numbers compare with national statistics of 67 and 112 per thousand in 1990 for Kenya and Tanzania, respectively. Given the access to safe water, good sanitation, superior housing, and (for Kirua) income per capita higher than the Tanzanian average, it is not surprising that both communities are better off than either nation as a whole; the Tanzanian community having lower mortality than the Kenyan community is a surprise, however.

Thus, the mortality data provide mild evidence that differences in income have not translated well into improvements in health. The morbidity data carry this theme somewhat further.

All households were asked how many family members were seriously ill for at least one of the last seven days, with "serious" meaning "unable to attend school or work."[1] This survey questionnaire was administered in the third round, during April, the rainy season in both communities. In the Kenyan community, 6.7% of the individuals had been sick, while the corresponding number for Tanzania was 5.7%. Illnesses, however, were somewhat more severe in the Tanzanian community, since the duration of illness was on average 4.9 days, compared to 3.9 days in the Kenyan community. Although differences in survey design and the nature of questions makes comparisons difficult, these numbers are rather low compared to other data from

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[1] We ignore permanently ill or disabled persons in this analysis. The survey did ask about those who were permanently disabled. Six resident members of our Tanzanian households were permanently disabled, two of these by polio. None of the Kenyan sample was disabled. Unfortunately, we did not pursue this during the sampling period, to find out what had happened to any family members in the Kenyan sample who may have been disabled and left the community for care elsewhere.

less developed countries; for example, Kennedy (1989) finds morbidity rates about four times as high in her survey of women and children in South Nyanza, Kenya.[2]

We can examine these data by income tercile to see if, within communities, income makes a difference. Calculations are presented in Table 5.1. Illness does *not* appear to be associated with income in either community, as the percent ill by income tercile shows no consistent trend. On the other hand, in both countries the number of days incapacitated decreases with income; conceivably those who are better off can seek better care for illness than those who are worse off. So we turn now to an examination of health care.[3]

As shown in Table 5.2, arc expenditure elasticities for health care are well above one when moving from the first to the middle income tercile, then fall to about one when moving to the highest income tercile. Expenditures per capita, as a consequence, increase dramatically over the income groups. The highest income tercile in Tanzania, however, does not spend as much per capita on health care as the middle income tercile in Kenya.

Visits to clinics and hospitals increase substantially with income in the Kenyan community, while they increase much less in the Tanzanian community. These increases occur despite the fact that morbidity does not appear to be related to income. Those with more income apparently are more likely to receive professional health care of some sort. For Kenyans, this additional health care is almost entirely at public institutions. Attendance at private or mission institutions is not consistently related to income, with households of all income levels using non-public institutions for about one quarter of their visits. Those Kenyans who did attend private or mission

Table 5.1: Morbidity by Income Class

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[2] Recall that both of these villages have readily available clean water, relatively good sanitation, and relatively good housing. Ninety-seven percent of the Tanzanian households and all of the Kenyan households have a tin roof or better on the main house. All of these indicators are much better than those in Kennedy's South Nyanza sample,

[3] The survey form included an option of "used traditional medicine" for the response to an illness. An unbelievably small number of respondents admitted to such usage. Such underreporting of traditional medicine is widespread on formal surveys; this underreporting conceivably may have been even more prevalent on our survey because of the higher educational attainment of those conducting the enumeration (see the earlier chapter describing the enumeration). Respondents may have felt awkward admitting that they used traditional medicine in front of university professors and students. This underreporting should bias downward our estimates of expenditure on health care.

	Kenya			Tanzania		
	Number Sick	Percent Sick	Days Incapac-itated	Number Sick	Percent Sick	Days Incapac-itated
Income Tercile:						
Low	18	6.1	4.3	16	5.7	5.3
Middle	18	7.3	3.7	11	5.1	4.7
High	10	6.8	3.3	12	6.5	4.2
All Income Groups	46	6.7	3.9	39	5.7	4.9
Number of resident household members			688			679

Note: "Days Incapacitated" is the mean number of days an ill person was unable to work or attend school out of the previous 7 days.

Table 5.2 Use of Health Services by Income Class

	% of expenditure spent on health		Expenditure per capita per year on health (Kenya shillings)		Arc Expenditure Elasticity		% Who Attended Clinics/Hospitals in Last Two Months		Visits to private or mission clinics/hospitals as percent of all visits	
	Kenya	Tanz.	Kenya	Tanz.	Kenya	Tanz.	Kenya	Tanz.	Kenya	Tanz.
Income Tercile:										
Low	1.8	1.2	69	34	-	-	10.2	8.9	30.4	28.1
Middle	3.3	1.5	185	66	1.80	1.26	16.3	8.4	20.2	44.1
High	3.3	1.5	345	125	1.06	1.02	17.0	10.3	24.1	52.4
Total	2.9	1.4	169	67	-	-	13.8	9.1	24.2	40.3

clinics did so primarily (52%) because of an absence of drugs at the public clinics or hospitals. In Tanzania, on the other hand, attendance at non-public institutions clearly increases with income; for the two upper income terciles, the Tanzanian sample uses private or mission institutions a higher percentage of the time than the Kenyan sample. As with the Kenyans, many (45%) of those attending private clinics said they did so because of the absence of drugs in the government institutions; a much higher percentage of the Tanzanians, however, said the main reason to attend a private or mission institutions was to receive better care (30% to 13%).

Breaking the expenditure information down into component parts provides further insights into the differences between health care in the two communities. In the Kenyan community, 28% of health care expenditures are for medicines, 46% for clinic or hospital fees, and 23% for transportation to and from the health care institutions. In the Tanzanian community, those shares are 60%, 30%, and 9% respectively (there is also a small "other" category also in both locations). These differences arise in part because of difficulties with public transportation in the Tanzanian village -- many Tanzanians walk across a valley to a clinic several miles away on another ridge; there is no public transportation available on that route -- and in part because of a difference in fee structure for both public and non-public institutions. In Tanzania, none of the public institutions charged a fee for visits, and the nearby mission clinic did not charge for short, one-time visits. In Kenya, cost-sharing had begun in a small, intermittent way during this period, and more respondents were charged, particularly at the nearest public hospital, in Thika. In addition, virtually all visits to private or mission clinics in Kenya resulted in a fee.

Once this different composition of charges is included in the analysis, we find that expenditures on medicines differ only slightly, at Ksh 47 per person per year for the Kenyan sample and Ksh 40 for the Tanzanian sample. This difference is well within the margin of error of our exchange rate adjustment (based on relative food prices). Although we did not survey drug cost in the two communities, one commonly used drug, chloroquine, was substantially less expensive in real terms in Tanzania. So the Tanzanians may be receiving at least as many drugs to treat illness as their Kenyan counterparts.

Another aspect of health care services is the monitoring of children. In both villages, clinics record the heights, weights, and vaccinations of children on yellow clinic cards, which are kept by the parents. Eighty-three percent of the children in Kenya had such cards, compared to 60% of the Tanzanian children. Prevalence of vaccinations was high in both communities, although slightly higher in Kenya, with 95% of the Kenyan children and 90% of the Tanzanian children having received the appropriate vaccinations for their age.[4]

The morbidity, mortality, and health care evidence, then, is mixed. The Kenyan sample is sick slightly more frequently than the Tanzanian sample, but the length of illness in the Kenyan sample is less. In both communities, the length of time ill decreases with income; evidently, the better off members of the communities treat illness more readily, and are more likely to use drugs to combat the illness. Tanzanians with more income are especially more likely to use non-public institutions for health care. Infant mortality rates, while not precise because of the sample size and the retrospective nature of the data, indicate that mortality rates are lower in the Tanzanian community. Health monitoring and vaccinations for children seem to be slightly better in the Kenyan community. Thus, despite the substantial differences in per capita incomes, and despite the slightly poorer health monitoring, the Tanzanian community appears to be at least as well off and possibly better off in terms of health outcomes. Further evidence on this score with a stronger statistical basis can be gathered from the anthropometry data on children in the sample. This is the topic of the next section.

Anthropometry

All children from 6 to 72 months of age were weighed and measured, and their birthdates recorded. In almost every case in Kenya and in about half the cases in Tanzania, the child's mother or guardian had a clinic card on which the birthdate and vaccinations were recorded. In these cases we could be confident of the birthdates. Mothers were not present for 29 children in Tanzania and 10 children in Kenya. Unfortunately, in many of these cases the guardian did not have a clinic card and did not know the child's birthdate. If the guardian knew the month but not the day of birth, we recorded the birthday as the 15th of the month. If, however, the guardian knew only the year, we recorded no birthdate and could not calculate statistics based on age. Consequently in the sample we have 19 children from Tanzania for whom we can calculate our measure of short-term malnutrition -- weight for height -- but for whom we cannot calculate our measure of long-term malnutrtion, height for age. There are three such children in the Kenyan sample.[5]

Table 5.3 presents statistics on height for age and weight for height for the two communities, both for the whole sample and divided by income (expenditure) tercile. Most

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[4] The survey checked for BCG, DPT, polio, and measles vaccinations.

[5] There is also one child in the Tanzanian sample for whom an invalid weight was recorded. This child thus appears in the height for age statistics, but not the weight for height statistics.

Table 5.3: Anthropometric Indicators of Child Health

			Indicators by Expenditure Tercile					
			Tanzania			Kenya		
	Tanzania	Kenya	1	2	3	1	2	3
Indicators of Chronic Malnutrition								
Median height for age z-score	-1.14	-1.56	-1.12	-1.15	-1.07	-1.76	-1.56	-1.28
Mean	-1.01	-1.52	-0.96	-1.08	-1.03	-1.70	-1.41	-1.31
Standard Deviation	1.27	1.37	1.55	1.06	0.92	1.63	1.13	1.16
% stunted, definition 1	23.4	33.7	27.0	16.7	22.7	35.7	37.8	18.8
% stunted, definition 2	13.0	23.2	18.9	11.1	4.5	31.0	18.9	12.5
Number of Observations.	77	95	37	18	22	42	37	16
Indicators of Short-term Malnutrition								
Median weight for ht. z-score	-0.42	-0.65	-0.18	-0.76	-0.25	-0.75	-0.61	-0.20
Mean	-0.38	-0.48	-0.18	-0.92	-0.22	-0.73	-0.37	-0.12
Standard Deviation	1.20	1.00	1.33	0.99	1.02	0.76	0.94	1.52
% wasted, definition 1	3.1	4.1	4.4	12.5	0	7.1	0	6.3
% wasted definition 2	22.9	24.5	20.0	33.3	25.9	26.2	22.5	25.0
Number of Observations.	96	98	45	24	27	42	40	16

Notes: Definition 1: z-score for child less than -2. Definition 2: Child's height for age or weight for height is less than 90% of the reference population's median. Tercile 1 is the lowest and Tercile 3 the higher tercile.

statistics are presented in terms of z-scores -- the number of standard deviations away from the reference population's mean score.[6] In terms of height for age, both samples are short, but the Kenyan sample is significantly shorter than the Tanzanian. The difference in means is statistically significant. This is so even though the mothers, whose heights were also measured, have almost identical mean heights: 158.7 cm for Tanzania and 158.4 for Kenya. Furthermore, both of the frequently-used definitions of "stunted" -- first, z-score less than -2.0 and, second, height-for-age less than 90% of the reference population's median -- suggest that about 10% more of the Kenyan population is stunted.[7] For Tanzania, income seems to be uncorrelated with long-run malnutrition

[6] Z-scores were calculated using software from the Center for Disease Control. The software calculates z-scores using the National Center for Health Statistics growth charts, based on a US reference population. This is the standard way for calculating z-scores for analysts in this field.

[7] The Kenya's 1987/88 Rural Nutrition Survey calculates national average figures for height-for-age remarkably similar to these results for the Kenyan community. The mean z-score nationally is -1.4, percent stunted according to definition 1 is 32%, and according to definition 2 is 20%. There are larger differences with national figures for weight-for-height: mean z-score nationally is -0.04, percent stunted definition 1 is

by most measures; neither the mean nor median height-for-age nor the first definition of "stunted" varies consistently with income. Only the second definition of stunted seems to be related to income, with the percentage falling from 19 to 5 percent. In Kenya, on the other hand, income seems to be more closely associated with height-for-age; the mean, median, and both definitions of "stunted" show large differences between the highest and lowest income terciles, and the middle tercile is between the upper and lower on three of the four measures. Thus, stunting seems to be a more serious problem in the Kenyan sample, and this measure appears to be closely correlated with income in that country

The weight-for-height statistics, as proxies for short-run malnutrition, tell a different story. Here the mean z-scores for the communities are only 0.1 apart, and the difference is not statistically significant. Both definitions of wasted show a slightly higher percentage in the Kenyan sample, but given our small sample size, this difference represents only one child. There is a greater difference in the medians, however, again favoring the Tanzanian sample. Once again, the Tanzanian statistics show no tendency to improve with income, while the Kenyan sample's mean and median are consistently related to income. Percent wasted, however, is not associated with income in either community.

Thus, the summary statistics for anthropometry confirm the mortality and morbidity data's indications that the Tanzanian sample is at least as well off and, according to many measures, somewhat better off on these indicators of physical well-being. Furthermore, it appears as if income does not affect these measures of well-being in the Tanzanian sample, while it does in Kenya.

In order to explore these issues further, we analyzed both height-for-age and weight-for-height z-scores with regression analysis. Here our purposes are threefold. First, we want to test the finding of the simple statistics that the Tanzanian sample is better off. Second, we want to examine other variables that the literature and our knowledge of the communities suggest may be

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4.5%, percent stunted definition 2 is 15.5%. Statistics for Murang'a District are closer to our community's than the national figures for weight for height, but better than our community or the national average for height for age.

important in influencing nutritional well-being. Third, we want to delve more deeply into the relationship between income and health.

Our approach follows that of Sahn (1994) and Thomas, Strauss, and Henriques (1991a) in estimating reduced form equations conditioned on an instrument for expenditures per adult equivalent. Much of the debate in the literature has been concerned with whether or not increasing incomes will increase calorie consumption (Bouis & Haddad 1992, Behrman & Wolfe 1984, Kennedy & Cogill 1987). Here we circumvent that issue, acknowledging that income may affect nutrition and health either through improvements in the diet or by improvements in housing, sanitation, water, or other factors. However the improvement is mediated, it is still a function of income. An instrument for income is used rather than the variable itself, however, because the choice between work and leisure -- which clearly has an impact on income -- is not independent of a household head's decisions to care for his or her children's health and nutrition needs. A household head who is especially devoted to his or her children may work hard and earn more income to meet their needs at the same time that he or she improves the nutrition of the children in ways that do not depend on income. If we use income directly rather than an instrument for income we are likely to bias our estimate of the impact of income on health because of these considerations.

The instrument for income per adult equivalent is estimated in a regression with each household as an observation rather than each child as an observation. Thus, normal two-stage least squares estimating procedures could not be used, and the analysis had to be conducted truly in two stages. Estimating the equation by household allowed for the inclusion of data points from households that had no children in the relevant age range, thus improving efficiency. In addition, there is little rationale for weighting household with more than one young child more heavily in this regression, which would have occurred had we used two-staged least squares. Furthermore, the functional form made most sense when the dependent variable was total expenditure per household rather than expenditure per adult equivalent. Consequently, the fitted values from this equation were divided by the number of adult equivalents in the household prior to being used as instruments in the nutrition equations. This equation is presented in Table 5.6 at the end of the chapter. It is similar in many ways to the agricultural production equations estimated in Chapter 12 below.

There is no obvious functional form to use in estimating the impact of income on nutritional z-scores. One might argue that increases in income at low levels -- particular for those households below the food poverty line -- should have a much larger impact on nutrition than increases at higher levels.[8] Indeed, it seems likely that increases in income above some threshold would have no additional impact on nutritional status of children. Given the low absolute levels of income for all households in the sample -- the highest income per adult equivalent for any household in either country is less than US$800 -- it is plausible that this threshold is never reached in our sample. In the absence of firm theoretical guidelines, we estimated the equation first without including the instrument for income, then plotted the income instrument against the residuals. This indicated a sharp drop-off at the very low end, followed by an apparently random pattern. We chose to include two dummy variables for instrumented expenditures per adult equivalent: one when this instrument is less than the food poverty level, and another when the instrument is less than 50% above that level.

The nutrition equations include a number of other explanatory variables. Child's age is frequently found to have an influence on nutrition in other studies, possibly because stunting accrues gradually over time, or because of the marked nutritional problems many children suffer immediately after weaning. Children of high birth orders in less developed countries tend to be less well nourished than their older siblings, possibly because of competition for household resources, possibly because of negative impacts on the mother's health from multiple births. Here we found no significant difference between children with birth orders of 3 or higher, so include a dummy variable for all such children.

As mentioned above, the mothers of a number of children in the sample were non-resident. Many of these children were born out of wedlock; the mother, living alone and working elsewhere, is not in a position to care for the child and leaves him or her with grandparents. In other cases, the mother was deceased, or the mother was widowed and remarried and the second husband did not want to care for the first husband's children. Our hypothesis is that such children are likely to suffer in the intrahousehold allocation of goods, and thus be more prone at least to short-run malnutrition. Since we do not know how long the mothers have been absent, it is less likely that this variable will be significant in the long-run nutrition equation. We are unaware of such a variable being used in earlier research.[9]

In the short-run equation, we include a variable for the children for whom no age was recorded. Recall that these children could not be included in the long-run nutrition equation. We have no hypothesis concerning this variable; it was included simply to test to see if we need be concerned about this group being non-random, since we were constrained to leave them out of the other equation.

Household size is included in both equations. Some past studies have found a positive relationship between household size and nutritional indicators when controlling for per capita income, suggesting that there are economies of scale. Other studies have found a negative relationship, usually attributed to competition for resources and nurturing among a number of children in the household. Consequently, we do not have a strong hypothesis for the sign of this variable.

The gender of the child and of the head of household are included in the equations. Kennedy and Cogill (1987) found a positive effect of female heads on child's nutrition, which they attribute to a tendency for these women to allocate relatively more resources to the children. Some other studies have found no significant effect of this variable. The child's gender is also included to test for possible discrimination in intrahousehold allocations against one sex or the other.

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[8] Recall that the food poverty line is defined in Chapter 4 as the amount of income required for a household to purchase 2400 kcal of the local consumption basket per adult equivalent, assuming that 80% of income is spent on food.

[9] One partial exception is Haddad and Hoddinott (1994),who use data from the Ivory Coast to document that fewer resources are devoted to meeting the needs of non-offspring of the head of household.
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Several studies have found that mother's height is correlated with child's height for age (Kennedy & Cogill, Thomas, Strauss, & Henriques 1991a). This is explained both by genetics and, possibly, long-run malnutrition of the mother inhibiting her ability to effectively nurture the children.

Education of parents has been found in some studies to improve child nutrition, particularly education of the mother (Behrman and Wolfe 1984). As Sahn (1994) points out, in studies that do not control for income, this variable could be mediated through the impact of education on income or through education changing the preferences of the parent in favor of child nutrition, or through education giving the mother more weight in the allocation of household resources. In this study, as in Sahn's, only the latter two effects are included, since income is controlled.[10]

Furthermore, years of education is a noisy proxy for the amount of knowledge gained in school. We thus include also in these equations results from the test of cognitive skills administered to the agricultural decisionmaker. This test, discussed in Chapter 12 below, measures how much the decisionmaker learned in school. The impact of education on nutrition caused by changes in knowledge and ability to care for children should be more closely correlated with this variable than with the years of schooling variable. In the other chapter, we find threshold effects of this variable on agricultural productivity; these same thresholds are tested here for possible impacts on nutrition. In addition, this variable is interacted with the gender of the head of household, to see if this measure of educational attainment has gender-specific effects.

We interact the second of the income dummies with Kenya in order to explore the result from the summary statistics that income is less closely correlated with income in Tanzania.[11] The gender variables, child's age, and cognitive skills test scores are also interacted with the Kenyan dummy.

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[10] Thomas, Strauss, & Henriques (1991b) attempt to sort out the different indirect effects of education on long-run nutrition. Their results show that education is important not only because of the impact on income but also because of increased access to information.

[11] We did not interact the lowest income variable with Kenya because only two Kenyan children in the sample came from families with fitted expenditures below the food poverty level.

Table 5.4 : Anthropometry Z-Score Regression Results

Variable	Weight-for-Height	Standard Error	Height-for-Age	Standard Error
Constant	-0.23		1.47	
Fitted expenditures < food poverty level	0.192	0.376	-0.915***	0.347
Food poverty level < fitted expenditures < 1.5 times food poverty level	-0.405*	0.241	-0.290	0.318
Interacted with Kenya	0.081	0.318	0.026	0.510
Child's age in months	-0.0135*	0.00693	0.00390	0.00774
Interacted with Kenya	-0.00382	0.00852	-0.0185*	0.0110
Birth order equal to 2	-0.161	0.252	-0.133	0.283
Birth order greater than 2	-0.409*	0.236	-0.593**	0.261
Mother not resident in household	-0.699***	0.191	-0.232	0.351
No age was recorded for the child	0.264	0.315		
Household size	0.0228	0.0355	-0.0361	0.0416
Kenya	0.183	0.476	-0.735	0.522
Male	-0.0104	0.246	-0.640**	0.266
Interacted with Kenya	-0.463	0.298	1.06***	0.394
Female head of household	0.0979	0.287	-0.857**	0.375
Interacted with Kenya	-0.703	0.318	0.686*	0.414
Mother's years of schooling	0.0186	0.0312	-0.0501	0.0469
Cognitive skills test score >= 22	0.253	0.194	-0.805***	0.285
Interacted with female head of HH	0.0603	0.372	0.945**	0.432
Mother’s Height			-0.00277	0.0168
R-squared	0.200		0.203	
Adjusted R-squared	0.117		0.109	
F-Statistic	2.43***		2.16***	
White Chi-Squared Test	36.3** (22 df)		32.8* (23 df)	
Included observations:	194		172	

Notes: One, two, and three asterisks indicate statistical significance at the 10%, 5%, and 1% level, respectively. Standard errors are White-corrected because of significant heteroskedasticity.

Results

Table 5.4 presents regression results and standard errors for both regressions. The dependent variables are, for short-run malnutrition, the z-score for weight-for-height, and for long-run malnutrition, the z-score for height-for-age.[12] Consider first the short-run equation. Of most importance is the role of income. The regression results tell a different story here than the summary statistics: fitted income has no impact on short-run malnutrition in Kenya, but a significant impact on children from households between the food poverty level and 50% above that level. Surprisingly, children from households with predicted income below the food poverty level are significantly better off than those with slightly higher incomes. Given this puzzling result, and given that the coefficient of the second income variable is only barely significant, our view is that fitted income is having little if any discernible impact on short-run malnutrition.

The Kenyan dummy, while insignificant, cannot be interpreted in isolation because of the inclusion of all the interaction terms. Simulations, however, show that the difference between the countries is never important. For example, a 12 month old Kenyan girl from a male-headed household in which the head is literate, with household income between 1.0 and 1.5 times the food poverty level, has a predicted z-score of 0.45; a Tanzanian girl from a similar household would have a predicted z-score of 0.24. For boys from the same households, the predicted z-scores would be -0.02 and 0.23 for Kenya and Tanzania, respectively. Other predictions give similarly close results. The regression, therefore, suggests that once other independent variables are controlled, there is no important difference between the communities in terms of short-run nutrition indicators.

Other significant variables include the absence of the mother, the child's age, and birth order. Of these, the absence of the mother is particularly large and significant, with a coefficient of -0.70, increasing the evidence that we need to examine issues of intrahousehold resource

[12] The reported standard errors are White-corrected because of the presence of significant heteroskedasticity, as indicated by the White Chi-Squared test.

allocation more carefully. Clearly other researchers need to consider collecting and including such a variable.[13]

Equally interesting are some of the variables that are *not* significant. The dummy for having no recorded age is insignificant and slightly positive. Thus, it does not appear that these children are systematically different from the rest of the sample. Household size is positive but nowhere near statistical significance, perhaps because of the offsetting ways that this variable is expected to influence income. The gender of the household head and education variables are all insignificant.

Let us now turn to the long-run nutrition regression in Table 5.5. Predicted income below the food poverty line in this case is significant and important, with children below the food poverty line having z-scores 0.9 less than those with incomes more than 1.5 times the food poverty line. Children from the next income category have z-scores 0.3 below the highest income category, although this coefficient is not statistically significant. The difference between Kenyans and Tanzanians here is quite small.

Once again, the presence of interaction terms clouds the interpretation of the Kenya dummy variable. Some of these interaction terms are significant and, when added together, produce important differences between groups of Kenyan and Tanzanian children. For example, a 36 month-old Tanzanian girl in a male-headed household has a predicted z-score 1.4 greater than a similar Kenyan girl; for boys, the difference is only 0.3, which is not large. This pattern holds for most comparisons, the difference becoming smaller at younger ages. Indeed, one of the surprises of this regression is the finding that the gender of the child has a different impact in the two communities; in Tanzania, the male children are significantly worse off than the female children.

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[13] This calls into question the practice of excluding observations from the analysis if a variable such as mother's height is missing. Missing mother's height is a good indication that the mother is non-resident; this analysis shows that children in such circumstances are likely to be at significantly greater risk of malnutrition.

This is not the case in Kenya, where boys have predicted z-scores about 0.4 greater than girls, with the difference not being statistically significant.[14]

The education and gender of the head of household variables produce some significant numbers with no obvious interpretation. The one clear result, buttressing that from the short-term regression, is that mother's years of schooling are unimportant. Other results are less clear. Children from female headed households in Tanzania are significantly less well off (z-score -0.86) than those from male-headed households, if the household head has low cognitive skills. If the household head is literate, however, gender of the head makes no difference. In Kenya, on the other hand, children from female-headed households have virtually the same predicted z-score as those from male-headed households if the head has low cognitive skills, but substantially better z-scores (by +0.82) if the head has high cognitive skills. These results show that the cognitive skills test shows promise of being a better proxy for education than years of schooling, although the complicated interactions here suggest the need for considerably more exploration of the underlying relationships.

The birth order variable once again is significant. Surprisingly, mother's height is minuscule in size and nowhere near statistical significance. Unlike the short-run equation, children of non-resident mothers are no worse off. This final result is in accord with our initial hypothesis.

Conclusions

Our investigations began with questions concerning the difference in outcomes between Kenyan and Tanzanian children, and the effect of income on nutritional status. In our samples, the Tanzanian children by most measures are better off than the Kenyan children. The regression results suggest that this holds for long-run malnutrition for girls, but that there is not a large difference for either sex in terms of short-run malnutrition, or for boys, particularly younger boys, in terms of long-run malnutrition. The overall picture is one in which all measures show the

[14] As Sahn, Van Frausum, and Shively (1994) point out, many anthropometric studies of children in Africa have found boys to be worse off than girls.

Tanzanian children being either no worse off or considerably better off than the Kenyan children, despite income differences.[15]

Why has the Tanzanian community done so well? Consider the following hypotheses:

- (1) *Is government-provided health care of higher quality in the Tanzanian village?*

Residents of both communities complain that the local government health care centers lack drugs. Those Tanzanian respondents using private or mission clinics said they did so in order to receive better care. This last rationale was given much less frequently in Kenya. Furthermore, some indicators of the efficiency of government services is provided by the immunization coverage and percent of children whose growth is being monitored. On both these counts, the Kenyan community is better off, as noted above. Thus, while we do not have conclusive evidence, it does not appear that differences in the quality of government services have led to better child nutrition in the Tanzanian village.

- (2) *Does the lower cost of government health care in Tanzania induce more use, and thus provide more (if not better) care?*

It is indeed the case that fees are lower in Tanzania, allowing these households to spend a higher proportion of their total health bill on medicines. Yet Table 5.2 above shows that Tanzanian households visit clinics *less* frequently than their Kenyan counterparts. And given that the number of days sick per illness (Table 5.1) is greater in Tanzania, it does not appear that the Tanzanians are seeking out this less expensive medical care more quickly. So the lower fees may very well be inducing more use than higher fees, but the difference, if it exists, does not explain why the Tanzanians are relatively healthier than the Kenyans.

- (3) *Are the private and mission clinics of better quality in Tanzania?*

This is difficult to gauge, although we can say that they are cheaper. However, this hypothesis does not explain the difference between the communities either. Recall from Table 5.2 that richer households are more likely to use private/mission clinics in Tanzania. If the quality of

[15] Note that although we control for income to some extent in our equation, the majority of households in each community are aggregated into the highest income category. The Kenyan households in this income

care was superior in these clinics, the richer households who use such clinics should be better off. But our statistics do not bear this out.

Thus, the difference does not seem to be explainable by policy differences between the country, or provision of services by private agents. The following questions consider some non-policy issues:

- (4) *Are the Wachagga simply taller than the Kikuyu, holding food intake constant?*

Since the average heights of mothers in the two communities are virtually identical, this does not appear to be the case.

- (5) *Is the state of nutrition knowledge, or are feeding customs, better in Tanzania?*

This is a possible explanation, which our data do not address directly. It is possible that weaning techniques are different in the communities. The significance of age for Kenyans but not for Tanzanians in the height-for-age regression lends some credence to this hypothesis. But the prediction of superior height-for-age for girls in Tanzania holds even for 12-month-olds, prior to weaning. While this explanation may be part of the story, it seems unlikely to be the major reason for the difference.

- (6) *Was there a period of stress in the last few years that stunted many Kenyan children and did not occur in Tanzania?*

Once again, the significance of the age variable for Kenya gives some plausibility to this hypothesis. But our discussions with households did not turn up any evidence of a time of food crisis in the years since the drought of 1984, and this last was too early to affect children in our sample. Certainly the Kenyan households had seen declines in their real incomes since the fall of coffee prices in 1989, during a time period when the Tanzanian households may have seen an increase, but given that the real incomes of the Kenyan households are still substantially higher, it does not seem plausible that this income decline is the reason for the difference.

- (7) *Are the Tanzanian households receiving more effective traditional medicine?*

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category have considerably higher incomes -- about 25% -- on average than their Tanzanian counterparts. These differences are not controlled in the regression.

We have no way of addressing this question directly, given our lack of success in picking up use of such medicine in our survey. However, it seems unlikely that would the use of better traditional medicine would lead to better long-run nutrition in Tanzania but not to better short-run nutrition.

Thus, we are left with a puzzle. There is no obvious explanation for the better nutritional status of the Tanzanian girls. Nevertheless, the evidence does suggest that differences in government policy are not the explanation. This study then corroborates the findings of others which suggest considerable differences between nutritional status among communities remain after controlling for income and the presence of health interventions. One possible hypothesis is that Tanzanian households learned in the past how to manage their scarce resources to maintain nutritional levels. We return to this discussion in Chapter 14, the conclusion.

Finally, this study lends some evidence to the claim that incomes do have a positive impact on long-run nutritional status within communities. It is clear, however, that the determinants of nutrition vary across communities and countries, and that we need to take care in generalizing about results concerning gender of the head of household, education, and income across countries. The fact that two villages have different nutritional status may be explained by factors other then differential access to health services.

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