LAND, LIVELIHOODS AND HUNGER: THE LONG-TERM DECLINE IN NUTRITIONAL LEVELS UNDER ZIMBABWE'S LAND REFORM PROGRAMME

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ABSTRACT

In 1980, recently independent Zimbabwe began a programme of land reform that was well-planned and implemented (in contrast to the experience since 2000). This original land reform was intended to do many things, among them increase agricultural productivity, enhance food security, and improve rural welfare.

Since 1982, the author has conducted the longest panel study ever undertaken in Africa, with 550 households, including both beneficiaries and non-beneficiaries of land reform. A key component of this study has been the use of multiple measures of the welfare of these rural households, among which were anthropometric measures of the nutritional well-being of both children and their parents. Some 12,000 observations on children have been collected to date.

An unexpected finding from this research is that the nutritional status of children included in the study for nearly 20 years—from 1983 to 2001—declined by an average of 1.4 percent per year over this entire period. In other words, children whose families benefited from land reform had nutritional levels 20 years later that were worse by more than 25 percent than when land reform began. This paper begins to explore some of the reasons for this decline.

The paper identifies in general terms important correlates between children's nutritional status and the setting of rural households in the research areas in Zimbabwe. For example, every measure indicative of the extent of cash-cropping is negatively correlated with child nutritional status, while the opposite is true for every measure relating to possession of livestock. Other indicators present a more complex picture.

To assist in unravelling the relationships between children's nutritional state and the world in which they live, it is planned to use a series of econometric models to investigate the determinants of child undernutrition. Space limitations, however, preclude the presentation of these results in this paper.

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Introduction

At the time Millennium Development Goals (MDGs) become a focal concern for development practitioners, per-capita income in Zimbabwe was only fractionally higher than at independence 20 years earlier. Thus, in income terms, Zimbabwe's first two decades were characterized by stagnation. The absence of changes in income was not however mirrored in other spheres. On the contrary, several developments initiated dramatic changes. This paper addresses several of these: a land redistribution programme launched only six months following independence; drought (in the 20 years following 1980, at least six droughts were experienced); and economic reform (an economic adjustment programme began in 1991). The paper does not however address the economic and social consequences of the turmoil that ushered in the millennium decade and has continued ever since. For each of these three factors the question is asked: what can be said about its impact on rural poverty as assessed through nutritional status?

In the attempt to untangle the various consequences of land redistribution, drought and economic reform, use is made of a unique data set comprising longitudinal information on two groups of households: those who benefited from the earliest phase of Zimbabwe's land reform programme and those who did not.[1] In attempting to understand the impact of change-stimulating factors, a distinction is made between these two groups. This distinction is of significant policy relevance because land reform was a key instrument in Zimbabwe's arsenal of anti-poverty measures for the first decade of independence. During the second decade of independence—1991 to 2000—political interest in both land reform and poverty alleviation waned. Beginning in 2000, the forced seizure of thousands of commercial farms—in the name of land reform—has been a major contributor to the dramatic worsening of poverty levels nationally. For several reasons, the paper focuses primarily on the middle decade. The first reason is that this period was supposed to have seen the earliest resettlement schemes, where the data for this paper have been collected, reach their full economic maturity. Second, severe droughts, including the worst of the century, punctuated this period. And, third, an IMF-World-Bank-inspired structural adjustment programme was launched in 1991.

The paper is an empirically based analysis of policy outcomes and employs several approaches. The analysis focuses on the use of non-monetary indicators of poverty, in this case simultaneous consideration of nutritional indicators for both children and adults within a household.

Because a paper of this scope cannot possibly address all the poverty-related issues in a data set spanning 28 years and covering 500+ households—with thousands of variables per household annually, an explicit purpose of the paper is to provide a flavour of what is possible in order to inform potential collaborators in future work.

Background

The investigation upon which this paper is based was launched to answer one 'simple' question: what are the effects of land redistribution on the welfare of rural families. Starting with a baseline data set established through interviews in 1983 and 1984, data have been collected over a 28-year period on some 400 households from 22 randomly selected communities in three of Zimbabwe's earliest resettlement schemes. These schemes were chosen so as to ensure representation of each of the three major agro-ecological zones in the country suited to cropping. The households were re-interviewed in detail in 1987, 1992, and every year from 1992 through 2001. Less-detailed data have also been collected in every year from 1984 to 2000, and also in 2002 and 2007-10. There has been remarkably little sample attrition. Some 82 per cent of households from 1983/84 were re-interviewed in 2001, and there is no systematic pattern to the few households that drop out.

[1] This data set—the longest panel study every undertaken in Africa—covers the same households over 28 years, 1982 to 2010. Some 550 rural households are covered, and fieldwork continues.

Beginning with the 1997 round of the survey, coverage was extended to include 150 additional households in villages in the communal areas (CAs) from which the resettled households originated in the early 1980s. This supplemental data permits explicit comparisons between the resettlement and communal experiences and between current living conditions in the communal and resettlement areas (CAs and RAs).

The original objectives of the resettlement programme were the enhancement of the socio-economic well-being of low-income households (that is, the reduction of rural poverty), including their ability to feed themselves adequately (that is, achievement of food security) while at the same time earning a reasonable income from the sale of crops and livestock. To achieve these objectives the amount of arable land allocated to beneficiary families was more than double the area of the average family's holding prior to resettlement, the land is generally of higher quality, and a whole range of supporting services and facilities—health, markets, agricultural credit, veterinarians, housing loans, schools, etc.—were provided. In contrast, the CAs are typified by small holdings on poor soils in remote areas with poor infrastructure and support services.

Analytical work has until now focused on three themes: *i*) the determinants of food supply and childhood nutritional status; *ii*) the processes governing livelihood changes, income generation and asset accumulation; and *iii*) the factors that determine households' ability to withstand income shocks, most notably those caused by drought and economic reforms.

The paper is organized as follows. Sections 2 and 3 begin the examination of poverty dynamics among resettled households with discussion of the data set available for analysis, after which nutritional welfare estimates are presented for the 1990s. Section 4 focuses on the validity of nutritional status as an indicator of poverty at the household level, while section 5 does the same using per-capita measures. Section 6 concludes.

Changes in Welfare over Time: the Dynamics of Child Nutrition

Money-metric indicators of welfare are employed throughout this paper. The panel data set however is rich in possibilities to construct nonmonetary-metric measures as well. This section reports on one such variable: changes in the nutritional status of children over time. From the outset, the Zimbabwe Rural Household Dynamics Study collected anthropometric data in order to be able to document objectively broader changes in household welfare. It is contended that, if child nutrition declines over time, there has likewise been a decline in household welfare even if money-metric indicators move in the opposite direction.

The nutrition data from the panel study can be best understood if it is appreciated that they come from what is a moving cohort sampled across many years. In 1983 and 1984, all children aged between six months and five years and resident in the household on the day of the visit were weighed and measured. The same procedure was followed in all subsequent years except that the age cut-off point was moved to six years in order to include as many children as possible from previous survey rounds.[2] Thus the pool of children included in any given year will contain new children who have attained an age of at least six months at the time of the visit to the household and will drop older children who are then above the age of six years. To the extent that there are secular influences from incomes or poverty on long-term child nutrition, these will be manifested as each year's recruits to the cohort grow to the age of six years and then exit the cohort.

Another feature of the nutritional data needs to be borne in mind as well. With a panel extending over 28 years, the supply of new entrants to the cohort comes less and less from the children of mothers who were bearing children in the early 1980s. Indeed, increasingly the panel includes the children of children who were themselves assessed in the early 1980s, or the grandchildren of the original heads of household. This fact means inevitably that genetic influences join environmental and economic influences as determinants of children's biometric indicators.

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[2] The number of valid assessments obtained in each year averaged 682, with a low of 205 in 1992 and a high of 910 in 1993. In the early 1990s, anthropometric data from adults began to be recorded to broaden the basis for analysis. Results from early analysis of the combined adult and child nutritional data sets are reported in Hoddinott and Kinsey (1998a & b) and Kinsey (1998a, b & c). See also Alderman, Hoddinott & Kinsey (2006).

With these comments, two of the conventional anthropometric indicators—height-for-age (HA) and weight-for-height (WH) are plotted as median *z*-scores (Dibley *et al.* 1987) in Figure 1 for each year in which anthropometric data have been collected.[3] Low HA is considered an indicator of chronic undernutrition (shortness or stunting), which is frequently associated with poor overall economic conditions or repeated exposure to adverse conditions, or both. Looking first at HA, there was an improvement from 1984 to 1987. Underlying this improvement was undoubtedly the provision of improved health services to resettled areas as well as recovery from the 3-year drought of the early 1980s. This improvement in HA was however reversed in the late 1980s or early 1990s, and by 1992 stunting was back at the level of eight years earlier, while the following year—1993—was the worst ever recorded. The 1993 outcomes were largely the result of the severe drought of the 1991/92 season, but they may embody also the early signs of the cutbacks in public health services. Following 1993, there was one year of marked improvement, but this was then succeeded by a resumption of the worsening trend. This trend may not be explained solely by variables related to food consumption, as it is likely that health-related factors—particularly the relentlessly spreading effects of HIV/AIDS—are likely to be involved also.[4]

Thus the linear trend shows that children in the three resettlement areas have tended to become more stunted, or chronically undernourished, over time, with the period 1995-2000 displaying consistently adverse outcomes. The worst outcome, in 1993, can in large measure be attributed to the severe drought in the 1992 season because children were assessed 6-9 months after the failure of the 1992 harvest and before the 1993 harvest.

Low weight-for-height is regarded as an indicator of acute undernutrition (thinness or wasting) and is usually associated with failure to gain weight or a loss of weight. Paradoxically, this indicator of acute undernutrition exhibits a slight improving trend over time, and it is a puzzle that this indication of dietary improvement is not reflected in a lagged improvement in HA. Instead, the much more positive *z*-scores for WH, and the upward trend, simply tell us that children's weight is proportional to their height, and increasingly so over time.

In summary, Figure 1 shows a somewhat mixed picture, but one in which chronic undernutrition as assessed by HA worsened over time. The resettlement experience has not, therefore, led to general improvements in food security sufficient to reduce this dimension of chronic undernutrition.

Figure 2 presents a different perspective. The plots in each case represent the proportion of the children assessed lying below two standard deviations below the mean—a level commonly defined as the threshold of undernutrition. HA, as noted above is an indicator of chronic nutritional status and underlying child health, and exhibits the most dramatic changes. In 1983/84 some 34 per cent of children were stunted. In the following assessment period—1987—the extent of stunting dropped by more than a third. This remarkable improvement was a consequence of several factors. Among them were cost-effective, community-based health interventions that resulted in rapidly improving access to health services and even more striking improvements in child immunization rates. And although the early 1980s experienced three consecutive years of drought, an effective drought relief programme meant that crop failures were not experienced in the form of pronounced checks to child growth.[5]

[3] The hashmarks across the data series in Figures 1 and 2 indicate that coverage before 1992 was not continuous and that there is imperfect consistency between observations prior to 1993 and those from 1993 onward. These inconsistencies arise from a change in the techniques of weighing and measuring children and obtaining their date of birth and some variation in the time of year assessments were made. A third common indicator, weight-for-age, is not used here as it is primarily a composite of the other two and fails to distinguish tall, thin children from short, well-proportioned ones.

[4] A source of bias would exist if AIDS-affected children were dying between the annual rounds of the survey and thus were not being recorded as badly ill or undernourished, but there is no evidence that this is the case. There is instead evidence that the relatively isolated setting of many of the panel villages, together with the prohibition—effective until 1992—on men taking urban jobs, delayed the onset of the full range of AIDS-related miseries.

[5] The children in the panel households were also changing over this period. There had been a post-war baby boom, which increasingly saw children conceived, carried and born after independence replacing those who went through early childhood in the stressful war years of the late 1970s.

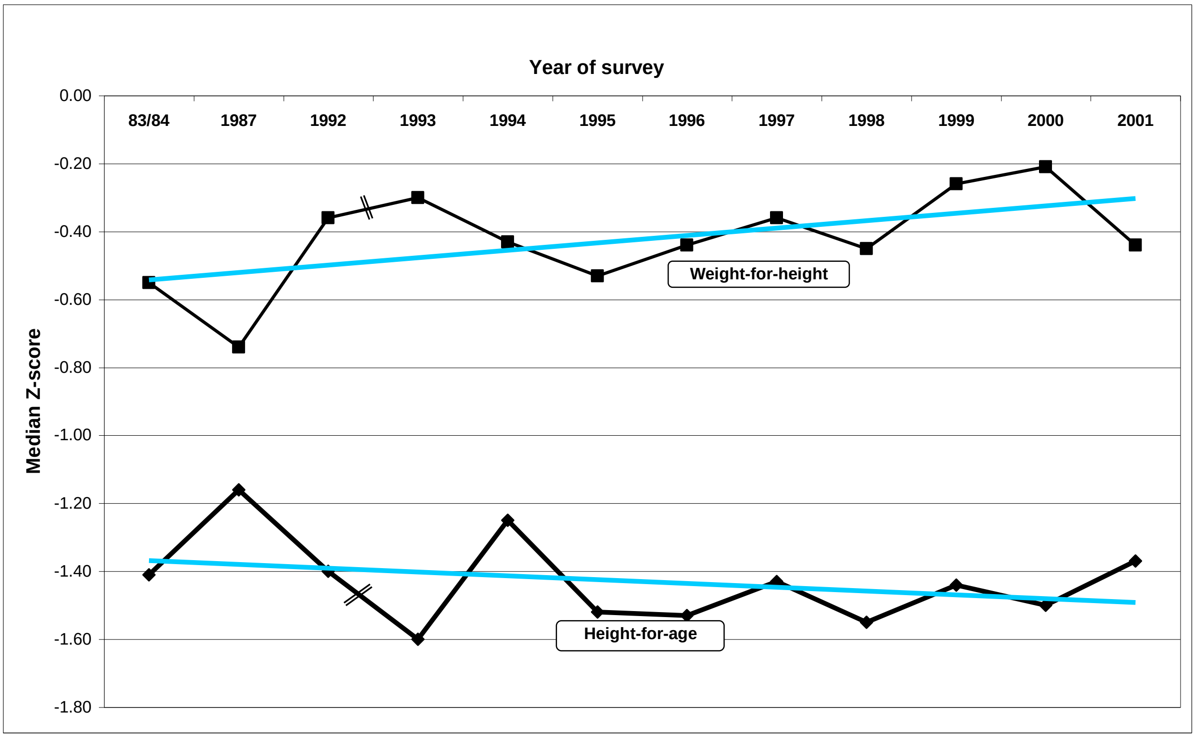

Figure 1. Changes in children's nutritional status as measured by z-scores, 1983/84 - 2001

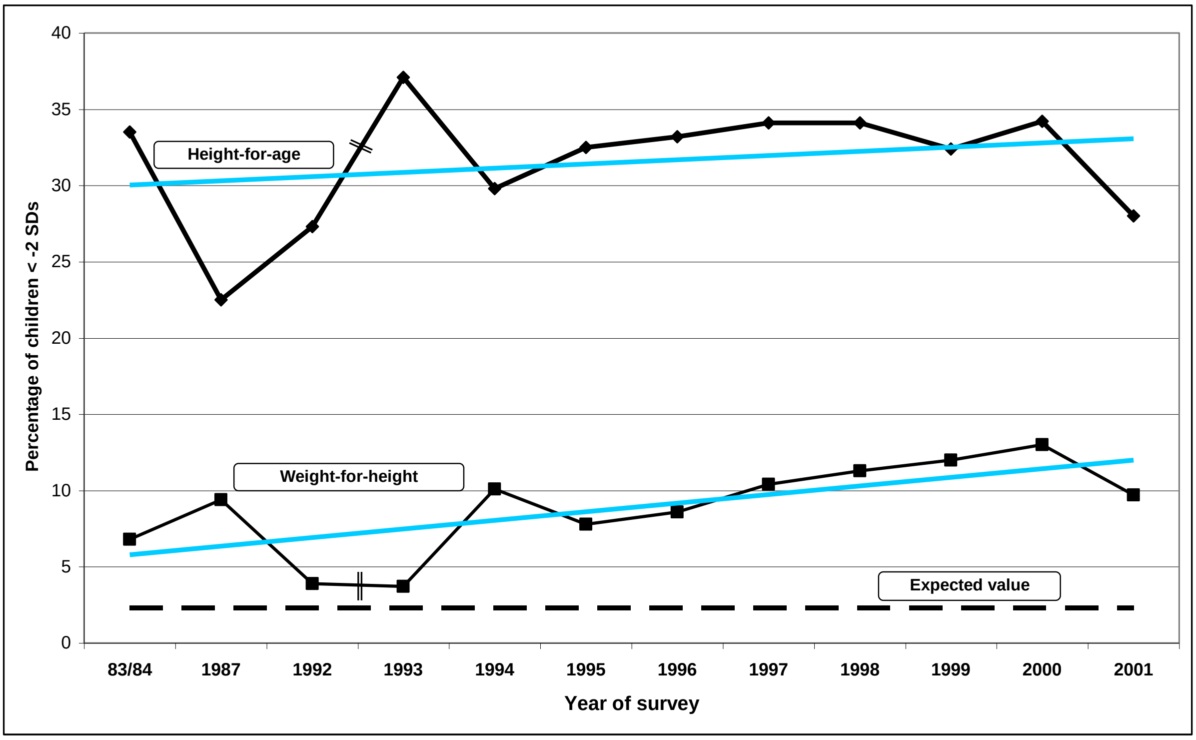

Figure 2. Changes in the proportion of children undernourished, 1983/84-2001

Over time, the proportion of children who are stunted has ranged from 23 to 37 per cent, but the trend is for a growing proportion to be stunted. Ten per cent more children were likely to be seriously stunted at the end of the period than at the beginning. The second indicator in Figure 2 also shows a worsening trend over time. WH, which consistently had levels of severity below 10 per cent of children prior to 1994, exhibits higher mean levels of undernutrition in the subperiod beginning in 1994, and the likelihood of a child being undernourished increases by 100 per cent over the entire period.

Taken together, Figures 1 and 2 suggest that two related processes are taking place together. The *z*-scores of Figure 1 are median values, so we know half the children assessed will have better scores than those plotted. And the other half will have worse scores. It is this latter group that generates the consistently worsening results shown in Figure 2. What appears to be happening is that serious child undernutrition is becoming increasingly concentrated in one group of households and, moreover, children in this particular group of households are becoming increasingly badly nourished.

While it is far from obvious what is driving the changes observed, they are consistent with two possible but very different explanations. First, they match well the timing of the reversal of other healthcare indicators—infant, child and maternal mortality—at the national level. This pattern is explained in part at least by the fact that real per-capita health spending—which increased more than 60 per cent between 1980 and 1990—was in the late 1990s marginally lower than at independence (GOZ 1998). A second factor that may help explain worsening nutritional outcomes during the 1990s is the fact that every growing season between 1988 and 1996—seven consecutive years—experienced below long-term-average annual rainfall, including the two serious drought years of 1992 and 1995. Then when heavy rains came, as they did in 1996 and 1999, they brought with them national epidemics of malaria, which is particularly serious in the case of already undernourished children.

Nutritional Status as an Indicator of Poverty

If policy-makers are to assist the poor and vulnerable efficiently, they must be able to differentiate them from others in society. In order to do so, they require particular criteria which are easily and inexpensively employed and which are not prone to the risk of moral hazard. In market economies, means-testing and categorical indicators of various sorts are commonly employed for this purpose. The use of such measures however requires a large amount of information. There are practical advantages therefore to defining poverty in ways that can be measured with small data sets which do not rely on income-based definitions of poverty. Particularly useful would be multi-dimensional concepts of poverty in which a relatively small set of indicators can encapsulate the much broader set of underlying concepts.

A basic question therefore is the extent to which households identified as being poor using conventional criteria, such as income and expenditure, are also identified as poor when nutritional criteria for children and adults are used as well.

At the inception of the research, a decision was made to use children's nutritional status as a key indicator of rural welfare. The research design thus made the use of anthropometric measurements for children a feature from the outset. The anthropometric data are complemented by data on food production and expenditure, child-feeding patterns, use of wild foods, drought relief, morbidity and mortality, and a wide range of additional data. From 1994, the data for children have been supplemented by measurements on adults. By taking weight and height measurements of adults, their body mass index (BMI) may be calculated and used as an indicator of chronic energy deficiency. A review of the application of the BMI (Shetty & James 1994) concludes that BMI in adults is a responsive index, sensitive to changes in nutritional status which are influenced by socio-economic status, seasonal fluctuations in food availability and level of physical activity. On this basis, BMI has been judged to be useful as an indicator for monitoring nutritional status. Further, it is argued that measures of the prevalence of adult undernutrition are "likely to be a better indicator of and reflect more truly the nutritional status of the community than estimates of childhood undernutrition alone" (Shetty & James 1994, *v*).

This section is based primarily on the analysis of a single year's data—1997—from the longitudinal survey including observations on the nutritional status of both children and adults, household resources, incomes and expenditures, and other socio-economic variables. The nutritional status of children is compared with that of adults in the same household using standard anthropometric measures of children and the BMI of adults.

How useful are nutritional indicators as potential tools of the analyst addressing food security and poverty issues in rural Zimbabwe? It would be useful to know, for example, how good the indicators of nutritional status are in agreeing with more traditional poverty indicators such as household resources, incomes and expenditures, and other socio-economic variables. In particular, what additional contribution does the collection of nutritional information on all household members—adults as well as on children—make in this regard? Do different distributions of adult and child nutritional status within households reflect fundamentally different socio-economic situations? And, finally, do the data available support the hypothesis that, when adults are thin, food insecurity rather than factors such as health or sanitation is more likely to be the dominant causative factor?

By correlating adult BMI to child anthropometry and to the socio-economic data, the strength and validity of the use of body mass index of adults is assessed both as an indicator of nutritional status of a wider population and as a proxy for indicators that are more difficult to collect.

Preliminary analysis of the nutritional data revealed that, contrary to all expectations, children's' nutritional levels in RAs are lower than virtually anywhere else in the country. It was originally thought that this outcome might have been a consequence of the experience of relocating at a time of great environmental stress—the 3-year drought of the early 1980s. Subsequent analysis suggests however that the relatively poor nutritional status of children in RAs reflects persistent structural causes (Kinsey 1997). Not only has poor nutritional status been reflected in every round of research, but it has also been confirmed nationally by the Demographic and Health Surveys of 1988 and 1994 (GOZ 1989, 1995). The finding is also corroborated by the findings of the 1995 and 2003 poverty assessment studies (GOZ 1996, 1997, 2006).

Here an examination is made of the proposition that undernutrition is structural in the RAs by combining indicators of the nutritional status of children and comparing these with the BMIs of adults from the same household.

The point of departure is an assessment of the extent to which households identified as being poor using conventional criteria, such as income and expenditure, are also identified as poor using nutritional criteria. Although detailed explanatory analysis is impossible in a paper of this scope, hypotheses will then be suggested for cases where the outcomes diverge. These outcomes will be discussed according to *i*) the difference in mix between adult and childhood nutritional status and *ii*) location—differences between RAs and CAs and across agro-ecological zones.

Data. In the 1997 survey round, fieldwork took place between late January and early April. Anthropometric data were collected for all children resident in the household on the day of the interview and aged between six months and six years. If present, the parents of the children were also weighed and measured. A household is included in the analysis if data were collected for at least one child-parent pair and excluded if data exist only for children. A total of 357 households is included, just over 65 per cent of the total of 547 households covered in the 1997 survey round. Of the total number of households included, three-quarters reside in RAs and one-quarter in CAs.

The socio-economic data were collected at the same time as the anthropometric data and using the same format employed over many years. Although collected in early 1997, the data set captures the outcomes of the harvest from the 1995/96 season—a good harvest, livestock and nonfood consumption outcomes for the year preceding the interview, and food consumption and expenditure levels, as well as health indicators, for the month preceding the interview.

Procedure. The procedure used here attempts to identify those households where the phenomenon of undernutrition is present in adults, children, or both. Undernutrition is considered to exist among adults in a household if any one adult has a BMI below 18.5.[6]

[6] An upper limit for the diagnosis of chronic energy deficiency using BMI has been defined as less than 18.5 (Shetty & James 1994).

Similarly, undernutrition among children is considered to exist if any one of the three *z*-scores for any child in the household lies below two standard deviations below the mean.

Two new binary household-level variables—BMI and Z—were created and added to the set of socio-economic indicators. The variable BMI is set to 0 in cases where no adult in the household has a BMI score below the cut-off point and to 1 where any adult has a BMI score below 18.5. An identical procedure was followed in creating the second variable; Z is assigned a value of 0 if *all* of the children in the household have WA, HA and WH *z*-scores more than two standard deviations below the mean. If *any one* child has *any one* of the three *z*-scores below two standard deviations below the mean, Z is assigned a value of 1. Values of 0 for BMI and Z thus indicate an absence of undernutrition—asymptomatic households, while values of 1 indicate the presence of undernutrition—symptomatic households.

A simple way of assessing the potential usefulness of combining the nutritional status of adults with that of other family members in the household is to create a two-by-two matrix with undernourished and non-undernourished adults on one axis and undernourished and non-undernourished children from the same household on the other. The four cells of the matrix will contain: *i*) households with no undernourished children or adults (referred to below as 0/0 households); *ii*) households with both undernourished children and undernourished adults (referred to as 1/1 households); *iii*) households with one or more undernourished adults but no undernourished children (1/0 households); and, finally, *iv*) households with one or more undernourished children but no undernourished adults (0/1 households).

If this approach is valid, each cell of the resulting matrix may be thought of as representing households that differ in significant ways. The 0/0 households exhibit no adverse nutritional phenomena and are therefore not regarded as impoverished or vulnerable. If both adults and children from the same household are undernourished—the 1/1 households, then this suggests the same pathways are affecting nutrition among the young and the old and that food availability—perhaps as a result of poverty—is most likely to be a major contributing factor. This finding suggests that policy measures are needed to address poverty and food security directly.

The mixed cases present greater challenges to interpretation. If adults are well-nourished and children poorly nourished (the 0/1 households), one can conclude that the primary cause is not likely to be so much a lack of food—resulting from poverty—as poor intrahousehold distribution of food, poor child-feeding practices, or complications of nutritional status caused by child-specific, health-related factors. This finding would provide evidence that attention should be paid to education and health aspects in the family.

In the other mixed case, where adults are undernourished and children well-nourished (the 1/0 households), it may be concluded that the intrahousehold allocation of food is likely to be satisfactory but that adults are experiencing a situation in which physical activity levels are high in relation to the supply of food or the time available to prepare and eat nutritionally satisfactory meals is inadequate. An alternative or additional explanation is that adult-specific health-related factors, such as HIV/AIDS, are at work. Poverty, however, cannot be ruled out for these households.

Thus the 4-way array of nutritional data described above can suggest something about the relative influences of the three basic determining factors of nutritional status: food availability, health and care.

The crosstabulation procedure outlined above was applied first to the 1997 data set. To provide a comparison, the identical procedures were applied also to the 2001 data. The distribution of households in the two categories obtained by applying this approach to the data is summarized in Table 1. Households are regarded as *symptomatic* if undernutrition exists and *asymptomatic* if it does not. Some 36 per cent of households in 1997 exhibited no sign of undernutrition on the basis of the *z*-scores of the children in the household, while nearly 80 per cent of resident parents had BMIs in the normal range.[7] The significance level for the crosstabulation indicates that the hypothesis that intrahousehold child and adult nutrition levels are independent can be rejected.

Examining the crosstabulations, the most common outcome—48.5 per cent of all cases—is a household in which the *z*-score for at least one child is below the cut-off point while the BMI for all assessed parents is above the cut-off point. The rarest outcome is a household where an undernourished adult exists but no undernourished child does; there are only 15 such cases—4.2 per cent of the total—in this category. The "mixed cases" therefore represent over half of all outcomes in 1997.

Table 1.—Distribution of households by nutritional category, 1997 and 2001

1997	**Children's *z*-scores**		
	Symptomatic (1)	Asymptomatic (0)	Totals
Adults' BMIs	(*per cent (n)*)		
Symptomatic (1)	16.0 (57)	4.2 (15)	20.2 (72)
Asymptomatic (0)	48.5 (173)	31.4 (112)	79.8 (285)
Totals	64.4 (230)	35.6 (127)	100.0 (357)
2001	**Children's *z*-scores**		
	Symptomatic (1)	Asymptomatic (0)	Totals
Adults' BMIs	(*per cent (n)*)		
Symptomatic (1)	16.2 (48)	5.7 (17)	22.0 (65)
Asymptomatic (0)	44.3 (131)	33.8 (100)	78.0 (231)
Totals	60.5 (179)	39.5 (117)	100.0 (296)

1997: X^2 = 7.76 (df = 2; p = 0.0053); 2001: X^2 = 6.23 (df = 2; p = 0.0130)

Looking only at the "pure" outcomes, i.e. those where neither adults nor children are undernourished, or both are, in 16 per cent of households undernourishment exists in both groups while it exists in neither group in 31.4 per cent of all cases.

Comparing the distribution of households for 1997 with that for 2001 reveals striking similarities despite the lapse of four years. Even with a smaller sample in 2001[8] and thus somewhat lower significance levels, the patterns are almost identical. The fact that most of the children assessed in 2001 had not been born in 1997 lends support to the idea that patterns of undernutrition in RAs are structural in nature. And this point comparison provides no evidence of either dramatic worsening or improvement in families' nutritional status. While there is a small increase in the proportion of asymptomatic (0/0) households in 2001, there is also a slight increase in the proportion of symptomatic (1/1) households. The largest single change (down by 8.7 per cent) is the reduction in the proportion of 0/1 households, suggesting that the nutritional status of children relative to that of adults in these households had improved, or vice versa.

From this point the relationship between nutritional indicators and a set of poverty measures is examined for 1997 in two different ways. The first approach taken is to treat

[7] Many instances exist where children were assessed anthropometrically but where no parent was resident to be weighed and measured. These cases are excluded here. It should be recognized however that this exclusion may bias the results since children who are being fostered, as the result of the death of parents, because of a broken marriage, or as a family coping mechanism, may be particularly prone to failure to thrive.

[8] The smaller sample was caused in large part because many parents were away in early 2001 "occupying" commercial farms.

all the poverty measures as household-level means. Although analyses of poverty which treat the household as a single entity suffer from a number of theoretical and practical shortcomings, this approach is justified here because it provides comparability with most other studies of rural households conducted in Zimbabwe.[9] The second approach, which is more defensible theoretically, is to focus on the household but define those poverty measures that are based on continuously distributed variables in per-capita terms. This approach adjusts for the considerable heterogeneity in household size in the population.[10] Both approaches include comparisons between the set of poverty indicators and the combined nutritional indicators, and include as well a geo-tenurial stratification of households.

Nutritional Indicators and Poverty Measures: Household-level Outcomes

As noted earlier, the data available from the panel study allow construction of a wide range of indicators of poverty. Prior analysis, both of the panel data and of national-level data sets such as the 1990/91 Income, Consumption and Expenditure Survey (Zimbabwe 1994) and the Poverty Assessment Study Survey—PASS (Zimbabwe 1997) suggested that a set of variables highly likely to include valid indicators pointing to the extent of poverty in households should focus on consumption—both of food and nonfood items; food security; income—both from agricultural and nonagricultural sources; assets—land and livestock; the extent of cash-cropping; and health.[11]

The set of variables characterized in Table 2 was thus defined from the panel data. The indicators were calculated for the entire population of 357 households in 1997 and separately for each of the four nutritionally defined groups resulting from the crosstabulation in Table 1. The mean level of each variable is set out in Table 3 according to the status of the nutritional indicator, and the findings are summarized below. (Except where noted, the discussion points below refer only to instances where the differences in Table 3 are statistically significant.) It should be noted that the dummy variables in Table 3 can be read as incidence, e.g. the coefficient of 0.67 for illness means that 67 per cent of all households experienced an illness in the month before the survey.

Relative to the four nutritional categories, Table 3 provides findings that fall into two clusters:

Findings from that accord with expectations:

- The group with no undernutrition—0/0—has a significantly lower incidence of illness and a significantly higher income from the sale of livestock.

Findings that confound expectations:

- Households in the worst-nourished category—1/1—had the lowest expenditure on grain despite no evidence of a purchasing power constraint.
- Households in the best-nourished category—0/0—have the lowest total food expenditure.
- There is no significant difference among nutrition categories arising from nonfood consumption expenditure with the single exception of the 1/0 cases.

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[9] See Kinsey, McQuie & Rukuni (1995).

[10] The number of resident household members has ranged from 2 to 76 in some years.

[11] The PASS (Zimbabwe 1997) reports incidence of diarrhoea, fever and respiratory illnesses three times higher in rural than in urban areas, with most cases occurring among the very poor in rural areas but among the non-poor in urban areas.

Table 2.—Poverty Indicators Constructed from the 1997 Data Set

Variable	Nature of variable
GrainPur$	Purchases of grain or maize meal in the month preceding the interview (January-March)—an indicator that own grain supplies are exhausted
FoodPur$	Total food purchases in the month preceding the interview—an ambiguous indicator since higher values may be associated with either poverty or wealth
FoodStrD	1 if the family had home-produced food in storage at the time of the visit; 0 otherwise—an indicator of household food security
GrainStr	Kilograms of grain in storage at the time of the interview—an indicator of household food security
LegumeStr	Kilograms of legumes in storage at the time of the interview—an indicator of both food security and dietary adequacy
GrainLoanD	1 if the family had a grain loan in 1995; 0 otherwise—an indicator of household food security two years previously
RepaidLnD	1 if the family repaid the 1995 grain loan in full; 0 if not; two if the family had no loan—an indicator of recovery from the 1995 drought
ConExEd$	Nonfood consumption: total annual household expenditure excluding education—an indicator of the household's level of living
ConInEd$	Nonfood consumption: total annual household expenditure including education—an indicator of the household's level of living
CropMktVl$	Market value of all crops harvested whether or not sold—a composite indicator of production levels
CropRev$	Total revenue from all crops grown and sold in the 1996/97 season—an indicator of disposable income
LSValue$	Market value of the household's total holdings of livestock—an indicator of wealth and—indirectly—of agricultural technology
LSPrdRev$	Total revenue from sale of livestock products and services—an indicator of disposable income
LSSaleRev$	Total revenue from the sale of animals—an indicator of disposable income
RemitCash$	Total cash remittances from nonresident household members or others—an indicator of disposable income and/or the inadequacy of household income
NonAgInc$	Total income from nonagricultural sources (excluding remittances)—an indicator of disposable income, the inadequacy of household income or the level of diversification
TotalInc$	Total household income from all sources—identical to disposable income
FemaleInc$	Total income earned/controlled exclusively by women in the household
AcrsCrpd	Total area cropped in the preceding season (1995/96)
CCrpAcrs	Total area planted to cash crops in the preceding season (1995/96)
CrpRatio	The ratio of cash-crop area to food-crop area (1995/96 season)
IllnessD	1 if any family member was ill in the month prior to the interview; 0 otherwise—an indicator of the health status of the family
IllWorkD	1 if any family member was too ill to work in the month prior to the interview; 0 otherwise—an indicator of the impact of ill health on family labour supply

Note: Variable names ending in D are zero-one dummies while those ending in a dollar sign represent a continuous monetary value.

- There are no significant differences among groups arising from the total market value of all crops grown.
- The highest-income group in terms of revenue from crop sales has the worst nutrition.
- All livestock-related outcomes for the 1/0 group differ significantly from the mean despite the fact that two of the three indicators are below the mean value and one (LsPrdRev$) is above—and the highest of the four groups.
- Above-average cash remittances exist for both groups containing undernourished adults.
- Higher levels of female-controlled income are associated with all undernourished households (although not significantly so) and significantly for the 1/0 case.
- The worst-nourished group of households (the 1/1 group) cultivates on average the largest acreage and the 1/0 group cultivates the smallest.
- The worst-nourished group and the 1/0 group cultivate the largest areas of cash crops, but only the latter is significant.
- There is no significant difference among any groups in terms of the ratio between areas planted to cash crops and food crops.
- Perhaps most surprisingly, neither total off-farm income nor total income is significantly associated with any nutritional category.
- Group 1/0 has significantly the highest incidence of illness overall but the lowest incidence of illness affecting work because illness is concentrated among children.

Table 3.—Mean levels of poverty measures with combined nutritional indicators

Variable	All cases (*n=357*)	BMI=0/Z=0 (*n=112*)	BMI=0/Z=1 (*n=173*)	BMI=1/Z=0 (*n=15*)	BMI=1/Z=1 (*n=57*)
			(*mean values*)		
GrainPur$	8.89	6.38	13.31	5.00	*1.40
FoodPur$	406.30	*360.27	425.61	433.93	430.89
FoodStrD	0.92	0.95	0.92	0.93	*0.89
GrainStr	640.69	608.14	679.46	*489.87	626.68
LegumeStr	2.66	2.77	0.32	0.13	*10.21
GrainLoanD	0.81	0.79	0.79	*0.67	*0.93
RepaidLnD	0.86	0.86	0.88	*1.07	*0.74
ConExEd$	5 669.24	5 901.71	5 398.63	5 309.00	6 128.58
ConInEd$	6 633.28	6 931.91	6 394.09	*5 881.73	6 970.25
CropMktVl$	12 710.75	12 701.26	12 308.48	12 115.67	14 106.93
CropRev$	9 755.86	9 481.99	9 465.89	9 753.07	*11 174.84
LSValue$	17 163.87	17 842.70	17 531.27	*13 289.00	15 734.65
LSPrdRev$	168.07	166.96	175.39	*250.67	126.30
LSSaleRev$	1 043.60	*1 374.33	956.75	*632.73	*765.44
RemitCash$	695.36	606.61	511.92	*1 700.00	*1 162.14
NonAgInc$	3 098.87	3 709.76	2 748.35	1 765.67	3 313.23
TotalInc$	17 715.67	18 558.92	16 700.49	16 464.74	19 469.13
FemaleInc$	637.13	582.76	635.91	*757.00	716.12
AcrsCrpd	7.84	7.51	7.98	*7.07	*8.26
CCrpAcrs	2.26	2.01	2.23	*2.73	2.73
CrpRatio	0.51	0.45	0.50	0.70	0.56
IllnessD	0.67	*0.60	0.70	*0.73	0.72
IllWorkD	0.44	0.43	0.46	*0.27	0.40

*Significantly different from the mean value at P=0.05.

One reason for the large number of apparently perverse findings noted above is the very high level of variability in almost all the indicators. In an attempt to go beyond a simple comparison of means, the variable for total income was broken down into quartiles and the distribution of households was plotted across the income quartiles on the basis of their nutritional group. The results are shown in Figure 3.

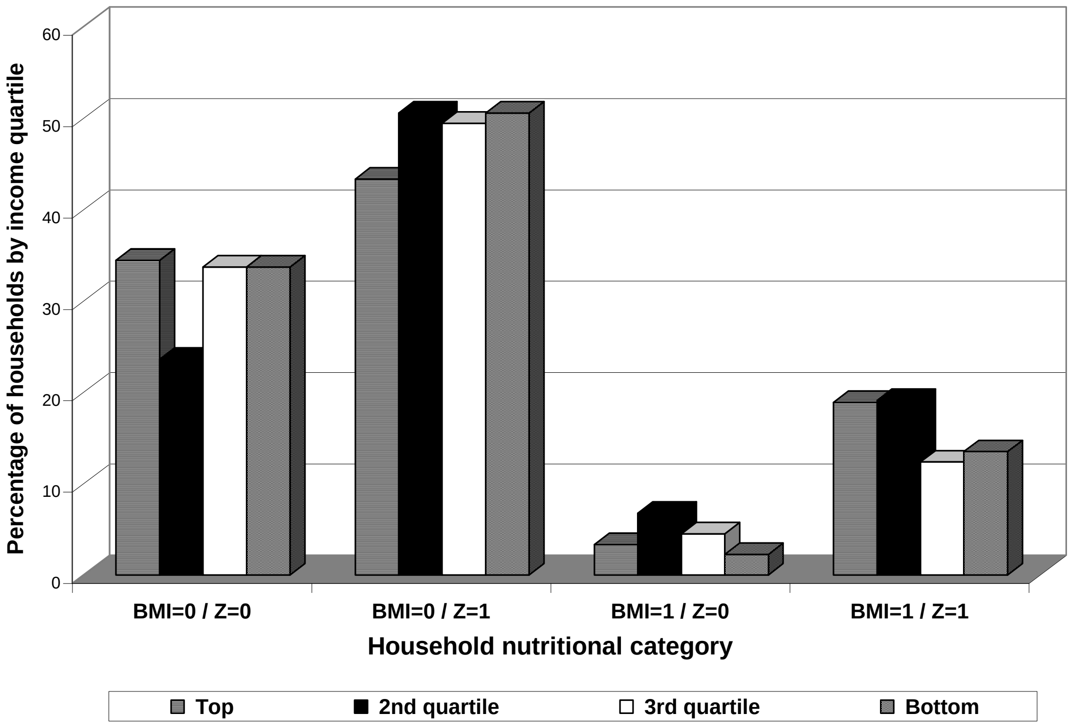

Figure 3. Distribution of household nutritional groupings by total income quartiles

Figure 3 shows few consistent patterns when nutrition-identified groups are arrayed against income-identified groups. If there were a consistent positive association between total income and the way households are classified nutritionally, one would expect the 0/0 and 1/1 groups respectively to look like a descending staircase and an ascending staircase from left to right. The appearance of the mixed cases is less predictable except that, because undernutrition is present in these households, there should be relatively fewer households in the higher quartiles.

In fact, the distribution of the 0/1 group of households is fairly uniform across all quartiles, suggesting—in conformity with Table 1—that the norm in rural Zimbabwe is a household with well-nourished adults but at least one poorly nourished child. Households with poorly nourished adults (where BMI = 1) are consistently more common in the second income quartile, while the lowest quartile actually does comparatively well and always contains fewer households than the top quartile for this group. The highest income quartile displays a slight advantage only for the 0/0 households, where there are no undernourished adults or children.

The results in Table 3 and Figures 1 and 2 suggest that, except in the 1/0 case—where the small sample size indicates the results could be entirely idiosyncratic, that the four nutritional categories are not particularly good proxies for traditional socio-economic indicators of poverty.

Before dismissing the 1/0 outcomes altogether, however, it is appropriate to recall the earlier comments regarding cases where adults are undernourished and children well-nourished. Since one of the more plausible explanations for this phenomenon is the effects of HIV/AIDS, it may be hopeful that relatively few—20 per cent—of households fall into this group, even when the anthropometry is done at a time of considerable labour stress, because the proportion of 20 per cent is less than the estimated mid-1990s prevalence rate of 30 per cent for HIV/AIDS among the sexually active population in Zimbabwe (World Bank 1996). If health is the underlying cause, it would weaken the argument that adults experience a situation in which work levels are high relative to food supply or the time available for meal preparation. But Table 3 does indicate that child rather than adult health is the major problem in this group.

By examining the anthropometric categories for adults and children separately, it may be possible to shed more light on the rather enigmatic results of Table 3. Thus Table 4 sets out the mean values for the socio-economic indicators and, as before, indicates which of the group means differ significantly from the population mean. In this case however the discussion is structured according to the columns in Table 4 rather than along the lines as in Table 3. The major findings that emerge are set out below.

Relative to the four nutritional categories, the data in Table 4 indicate that:

Households with only well-nourished adults:

- Differ in no significant way from the population mean for any indicator.

Households with one or more poorly nourished adults:

- Are significantly more likely to contain poorly nourished children as well.
- Spend significantly less on grain—less than a quarter of the mean, have significantly more grain in storage and are more likely to have had a grain loan.
- Possess herds with significantly lower market values.
- Earn significantly less from sales of livestock.
- Receive significantly more remittances in cash—80 per cent more than the mean.
- Plant a significantly larger acreage to cash crops and have the highest ratio of cash crops to food crops.
- Report significantly lower rates of debilitating illnesses.

Households with only well-nourished children:

- Are significantly less likely to contain poorly nourished adults.
- Earn significantly more from sales of livestock.

Table 4.—Mean levels of poverty measures according to single nutrition indicators

Variable	All cases (*n=357*)	BMI = 0 (*n=285*)	BMI = 1 (*n=72*)	Z = 0 (*n=127*)	Z = 1 (*n=230*)
			(*mean values*)		
BMI	0.20	0.00	1.00	*0.12	*0.25
Z	0.64	0.61	*0.79	0.00	1.00
GrainPur$	8.89	10.59	*2.15	6.22	10.36
FoodPur$	406.30	399.93	431.53	368.97	*426.92
FoodStrD	0.92	0.93	0.90	0.91	0.94
GrainStr	640.69	651.43	598.18	666.38	594.17
LegumeStr	2.66	1.29	*8.11	2.77	2.46
GrainLoanD	0.81	0.79	*0.87	0.82	0.78
RepaidLnD	0.86	0.88	0.81	0.85	0.89
ConExEd$	5 669.24	5 596.33	5 957.83	5 831.71	5 579.53
ConInEd$	6 633.28	6 605.45	6 743.47	6 807.87	6 536.88
CropMktVl$	12 710.75	12 462.84	13 692.09	12 632.10	12 754.18
CropRev$	9 755.86	9 472.22	10 878.64	9 514.00	9 889.41
LSValue$	17 163.87	17 653.65	*15 225.14	17 304.86	17 086.02
LSPrdRev$	168.07	172.08	152.21	176.85	163.22
LSSaleRev$	1 043.60	1 120.85	*737.79	*1 286.74	909.34
RemitCash$	695.36	549.13	*1 274.19	735.75	673.07
NonAgInc$	3 098.87	3 126.16	2 990.82	3 480.14	2 888.34
TotalInc$	17 715.67	17 430.82	18 843.21	18 311.58	17 386.63
FemaleInc$	637.13	615.02	724.64	603.34	655.79
AcrsCrpd	7.84	7.80	8.01	7.46	8.05
CCrpAcrs	2.26	2.14	*2.73	2.10	2.35
CrpRatio	0.51	0.48	*0.59	0.48	0.52
IllnessD	0.67	0.66	0.72	0.70	*0.61
IllWorkD	0.44	0.45	*0.38	0.45	0.41

*Significantly different from the mean value for all cases at P=0.05.

Households with one or more poorly nourished children:

- Are significantly more likely to contain poorly nourished adults.
- Have significantly higher than average total food expenditure.
- Report significantly lower incidence of all illnesses.

Of the four groups based on nutritional status—two for adults and two for children, only the group for poorly nourished adults appears at all well-differentiated according to the set of indicators used, even though some of the differentiating factors are counterintuitive. The presence of a poorly nourished adult is a good predictor that there will also be a poorly nourished child; just under 80 per cent of households with a poorly nourished adult will also contain a poorly nourished child. These households also have very low expenditure on staple grain and possess low-valued livestock holdings from which they earn relatively little in sales. They do however plant the largest acreage of cash crops, both in absolute terms, and in relation to the area of food crops. These households also have mean total incomes more than eight per cent above those of households with only well-nourished adults and have the lowest incidence of incapacitating illness.

The findings discussed above raise the question as to whether the nutritional criteria do a bad job of identifying poor households or whether the socio-economic poverty indicators used here adequately differentiate households by level of poverty. Comparing Tables 3 and 4, it is possible to construct a simple test of explanatory power of each approach by counting the number of significant differences identified in each case. Combining indicators of adult and child nutrition, as in Table 3, yields 25 significant differences while treating the nutrition indicators separately, as in Table 4, yields only 15 for the same set of poverty indicators, an improvement of 66 per cent for the combined approach. Over half of the significantly different indicators in Table 3 however identify a relatively small group of households, but it may be that this group is one that would need to be targeted in poverty alleviation efforts.

The influence of ecology and tenurial regime. In order to test the proposition that the poverty indicators themselves are valid measures, the data have been restratified using two criteria for Zimbabwe which we already know a good deal about: land tenure regime—resettlement and communal areas—and by agro-ecological zone—Natural Regions. The results are set out in Table 5.

If the indicators used are generally valid, we would expect to find two strong patterns. First, since 84 per cent of households in communal areas (CAs) are poor in total consumption terms[12] (Zimbabwe 1997) and resettlement areas (RAs) have been provided access to a superior resource base, we would expect to find systematically stronger indicators of poverty in CAs than in RAs. Second, common sense suggests that rural households attempting to make a living from agriculture will achieve more positive results in areas physically better suited to farming. Thus it would be expected that poverty indicators, at least the agriculture-related ones, will generally indicate a progressive worsening as one moves from the better areas—NR 2—to areas of lower inherent potential—NR 3 and NR 4. And, since the RA-CA comparisons incorporate the NRs, and vice versa, the figures in Table 5 provide an even stronger test of the ability of the chosen indicators to identify distinctly different socio-economic groups.

How well do the indicators fit with these prior expectations?

In the case of the RA-CA comparison, all indicators with the exception of four have the expected relationship.[13] The first two exceptions are the nutritional indicators, which show that the probability of a household containing either an undernourished child or adult is less in the CAs than in the RAs. The second two exceptions are the indicators related to health, both of which show the CAs to be healthier places to live—especially for children—despite the fact that all the RAs were provided with new clinics in the early 1980s. The agriculture and livestock income variables and the consumption indicators show the advantage of living in a resettlement area, while the remittance and off-farm income variables are indicative of some of the disadvantages of living in CAs.

The different nutritional and health outcomes for RAs and CAs suggest sets of influences operating at different levels.

Why are nutritional and health status worse in RAs, where households have generous land holdings and preferential access to health and agricultural services? One possible explanation may lie in settlement patterns and the time allocations of women. Villages in RAs have been laid out in a consolidated pattern to facilitate provision of services. Travel time to fields is therefore long in RAs, as are the hours spent in the field. Busy mothers may leave young children at home in the care of older children or take them to the fields. In neither case are they likely to be well-fed. In contrast, in the CAs, the fields surround the homestead, travel times are short, and mid-day meals can be easily managed.

A further explanation may be that official exhortations to be productive have propelled RA households in the direction of cash cropping of non-consumable commodities such as cotton and tobacco, leading to high ratios between the area planted to cash crops and food crops and/or reductions in diversity in the mix of food crops grown. Because of their small land-holdings, CA households tend to market surplus food crops, if they have any, rather than growing crops for market which cannot be consumed by the household.[14] Incomes from agriculture and livestock are generally much higher in RAs than in CAs. Conventional wisdom on the effect of commercialization of agriculture on nutrition of farm families holds that there should be minimal if any adverse effects on nutrition because of the compensating effects of higher cash incomes. Why is this not the case here?

The study sites span zones of agricultural potential ranging from fairly high—NR 2—to quite low—NR 4. In the area of best potential, farming appears dynamic and cash incomes are high as a result of widespread cultivation of cash crops such as cotton and tobacco and novel crops such as paprika. Across all the years surveyed, however, this area has

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12 On the basis of the income required to purchase a basket of basic food needed by an average person per annum and meet non-food needs (clothing, housing, education, health, transport, etc.).

13 See Kinsey (1998b) for a more complete discussion of the nature of and reasons for the relationships.

14 But 40 per cent of CA households marketed nothing at all following the relatively good 1996 harvest.

consistently displayed the lowest nutritional outcomes. In the area of lowest natural potential, agriculture appears stagnant; and no farming system yet identified produces reliable incomes in this uncertain environment. Yet it is in this weakly commercialized area that the best nutritional outcomes for children have consistently been found.[15] The data in Table 5 do not illustrate this finding, but they do show that the probability of an undernourished adult in a household is three times higher in the best agro-ecological zone than in the intermediate and low-potential zones.

Table 5.—Mean levels of poverty measures according to tenure regime and natural region

Variable	All areas (*n=357*)	RAs (*n=269*)	CAs (*n=88*)	NR 2 (*n=212*)	NR 3 (*n=69*)	NR 4 (*n=74*)
			(*mean values*)			
BMI (0/1)	0.20	0.22	*0.16	*0.28	*0.08	*0.09
Z (0/1)	0.64	0.65	0.61	0.64	0.68	0.64
GrainPur$	8.89	5.86	*18.14	*2.65	*16.76	*19.19
FoodPur$	406.30	438.45	*308.03	*473.03	*357.27	*262.18
FoodStrD	0.92	0.94	0.86	0.96	0.90	0.84
GrainStr	640.69	*757.27	*284.33	*801.14	*315.59	*492.96
LegumeStr	2.66	1.81	5.28	0.61	*9.41	2.08
GrainLoanD	0.81	0.83	*0.74	0.84	*0.66	*0.85
RepaidLnD	0.86	0.88	0.79	0.91	*1.03	*0.58
ConExEd$	5 669	*6 409	*3 407	*6 521	*4 572	*4 280
ConInEd$	6 633	*7 494	*3 999	*7 459	*6 032	*4 842
CropMktVl$	12 710	*15 796	*3 278	*17 598	*4 309	*6 767
CropRev$	9 755	*12 300	*1 977	*14 395	*2 138	*3 771
LSValue$	17 163	*19 954	*8 632	17 868	18 588	*13 777
LSPrdRev$	168.07	202.14	*63.93	181.42	*103.37	191.89
LSSaleRev$	1 043	1 199	*567.56	972.40	*1 737	*581.89
RemitCash$	695.36	654.28	820.95	659.54	860.14	639.91
NonAgInc$	3 098	*2 265	*5 646	2 082	*7 169	2 105
TotalInc$	17 715	20 117	*10 373	*21 494	*14 179	*10 283
FemaleInc$	637.13	653.95	585.73	570.43	*874.72	600.26
AcrsCrpd	7.84	*8.98	*4.36	*8.45	*6.68	*7.19
CCrpAcrs	2.26	*2.76	*0.74	*3.53	*0.27	*0.54
CrpRatio	0.51	0.57	*0.30	*0.79	*0.05	*0.11
IllnessD	0.67	0.71	*0.57	0.71	*0.56	0.66
IllWorkD	0.44	0.45	0.40	0.40	0.48	*0.50

*Significantly different from the mean value for all areas at P=0.05.

How good a job does the set of poverty indicators do in distinctly identifying population groups in Table 5? The following patterns emerge:

- Seven of the indicators appear useful for accurately identifying important differences among the five geo-tenurial groupings in that they show each group to be distinctly different from the population as a whole. These are: the amount of grain stored, the two measures of consumption, the values of crops grown and crops sold, total acreage planted, and the number of acres of cash crops planted.
- Another five indicators also do a reasonable job of differentiating the groups in that they show four of the five groups to be distinctly different from the population as a whole. These are: BMI, expenditures on both grain and total food, total income and the ratio of cash crops to food crops.
- The mean number of significant indicators in each subpopulation column in Table 5 is 14.4 compared to 6.3 in Table 3 and 3.8 in Table 4, suggesting that geography/tenurial status is more than two times as powerful as the combined nutritional indicators in identifying groups relevant for poverty analysis and that

[15] The higher potential areas have higher rainfall, and high levels of rain provide beneficial conditions for certain disease vectors. The relationship between nutritional status and disease will be investigated further in work underway.

combined nutritional indicators are more than twice as powerful as single nutritional indicators for this same purpose.

The weak explanatory power of the nutrition indicators suggests that the relationship between nutrition and traditional poverty indicators is not as straightforward as intuition might suggest.[16] Evidence for this contention can be found simply from correlating the entire set of poverty indicators with the separate nutritional indicators for adults and children. This is done in Table 6, which reveals some quite startling relationships.

Table 6.—Correlation between poverty indicators and nutritional outcomes (*n=357*)

An increase in [...] has the indicated effect on nutritional status	Nutritional outcomes of adults	Nutritional outcomes of children
Livestock-related indicators		
Market value of livestock	+	+
Revenue from livestock products/services	+	+
Revenue from sale of animals	+	+
Agriculture-related indicators		
Area cropped	−	−
Area planted to cash crops	−	−
Cash-food crop-area ratio	−	−
Market value of crops harvested	−	−
Total crop revenue	−	−
Consumption-related indicators		
Purchases of grain or maize meal	+	−
Foodstuffs in storage	+	+
Amount of grain in storage	+	−
Amount of legumes in storage	−	−
Total food purchases	−	−
Consumption excl education	−	+
Consumption incl education	−	+
Income-related indicators		
Remittances	−	+
Income from nonagricultural sources	+	+
Had a grain loan after the 1995 harvest	−	−
Repaid the 1995 grain loan in 1996	+	+
Total household income	−	+
Female-controlled income	−	−
Health-related indicators		
Any illness in the family in previous month	−	−
Serious adult illness in previous month	−	−
Tenurial regime and agro-ecology		
Live in a resettlement area	-	-
Live in a communal area	+	+
Live in NR 2	-	0
Live in NR 3	+	-
Live in NR 4	+	0

Turning first to the unambiguous results in Table 6, the crop- and livestock-related indicators are unequivocally correlated with nutritional outcomes of both adults and children. An increase in a crop-related indicator *always* worsens nutritional status, while an increase in a livestock-related indicator *always* enhances nutritional outcomes. Why should this pattern occur so clearly?

Answers to this question may come from a deeper appreciation of both the data and the farming systems from which they come. It should be borne in mind that the data are collected annually at, and immediately following, the period of peak labour stress and

[16] See Behrman & Deolilakar (1987) for an analysis of rural panel data which concludes that "increases in income will *not* result in substantial improvements in nutrient intakes" (p505).

when food supplies are at their lowest point in the season.[17] Collectively, an increase in the crop-related indicators can be interpreted as an increase in the seasonal demand for labour for field operations. This increase implies in turn two other associated shifts: an increase in the demand for caloric energy to sustain the labour inputs and a reduction in the amount of time available for women to care for children. Thus, greater commitments to cropping (and especially to cash-cropping) are associated with poorer nutritional outcomes. Nor do higher crop incomes from the previous harvest compensate during the current season.

Why do the livestock-related indicators have consistently the opposite effect? There are likely to be at least four effects at work. First, livestock are probably the best single indicator of wealth for rural households and of their ability to cope with cash shortfalls.[18] Second, the labour demands for livestock-keeping are nonseasonal in nature and do not require high levels of caloric expenditure; moreover, cheap, unskilled labour is often hired for herding during the busy period for cropping, and cattle are often herded collectively, thereby saving labour. Third, the value of the herd is positively associated with possession of draft oxen, which can significantly substitute for human labour in the demanding tasks of land preparation and weeding. Finally, revenue from sales of livestock products is indicative that households have surpluses of milk and eggs, suggesting that the family is consuming all of these valuable food sources it wishes to.

A more simplified explanation is also possible. Households with large livestock holdings are the wealthy; they have made it, and they have decreased their vulnerability to the vicissitudes of rainfed farming. Households with many positive crop-related indicators aspire to make it in a similar fashion and are working extremely hard to do so. Much of their income from crops may therefore be used to increase investment rather than improve consumption.

The two health-related indicators are also in accord for adults and children and display the expected relationships.

In contrast to the crop, livestock and health indicators, however, the 13 income and consumption indicators in Table 6 exhibit highly ambiguous outcomes. Seven of the 13 variables are positively associated with improvements in child nutritional status, but only 5 of 13 display the same association with adult nutritional status. Moreover, in almost half the cases (6 of the 13), the indicators exhibit opposite signs for adults and children, suggesting that the pathways to better *household nutrition* are more complex than is sometimes suspected.

The patterns for consumption indicators in Table 6 are difficult to explain satisfactorily. It feels intuitively correct that total household nonfood consumption would be positively associated with child nutrition, since there has to be a strong association with household income, but why should it be negatively associated with adult nutrition? And why should food purchases be negatively associated with nutrition for both children and adults, while grain purchases and the amount of grain in storage have positive effects for adults and negative ones for children? It is possible however to hazard a guess as to why the quantity of legumes in storage is negatively associated with nutrition. Legume-growing in Zimbabwe is usually a woman's activity, and the values in Table 6 are thought to arise because in this case legume-storage is a proxy for female-headedness.[19]

[17] Studies in Zimbabwe remarking on the seasonality of nutritional status draw contrasting conclusions on the period of maximum stress. Kizita (1982), Sanders (1982) and Unicef (1985) argue that the rainy season (November through March) is the most critical time. A more recent empirical study (Wright et al 1997) narrows the period of peak stress to January-March. Allart (1983), however, argues that the dry season is the period of greatest stress. Wilson (1990) notes that nutritional stress reflects not only seasonal changes in diet but also seasonal changes in the profile of disease risk; thus the peak period of stress will vary from one ecological zone to another.

[18] See Kinsey, Burger & Gunning (1998a).

[19] This explanation is supported by a strong positive correlation coefficient between storage of legumes and receipt of both remittance income and off-farm income. It is contradicted however by the strong positive correlation coefficient between storage of legumes and total income and the absence of a significant correlation with female-controlled income.

The income variables are, if anything, even more paradoxical. Why should all sources of cash income—aside from crop income and income controlled by women—be positively correlated with child nutrition and yet only one—nonagricultural income—correlates positively with adult nutrition? If grain loans are thought of as income in kind, then the effect associated with these indicators is at least what would be expected. Receipt of a grain loan in 1995 suggests that the household had inadequate savings, food in storage and/or other coping mechanisms to be able to cope with the failure of the 1995 harvest; repayment of a 1995 grain loan in 1996 is associated with a rapid recovery from the previous bad year and is positively associated with nutritional state in 1997.[20]

The following reasoning might be invoked to explain the outcomes for adults. Grain purchases will have supplemented the supply of starchy staples for households in the month prior to making the anthropometric measurements, however it will only be households that had a poor harvest the preceding year and whose supplies are exhausted that will be forced to purchase grain. If they in fact had a poor harvest, the implication is that income from crop sales was low, perhaps explaining why income from nonagricultural sources has a positive effect. And if poor harvests are structural for these households, they may not experience the effects (discussed above) that cause the negative correlations for the set of crop-related variables.

Finally, and unsurprisingly, both the health-associated indicators display the expected association with nutrition.

Nutritional Indicators and Poverty Measures: Per-capita Outcomes

Examination of the relationship between nutritional indicators and the mean of poverty measures at the household level revealed some puzzles and suggested that the ability of the combined nutritional indicators to proxy for poverty measures was generally weak. This section replicates the previous analysis but transforms the poverty measures to a per-capita basis. A number of the poverty measures are dropped at this point because they cannot be transformed; these include all the dummy variables from Table 2 and the variable for the ratio of cash crops to food crops. A new continuous variable—HHsize—is added to represent the number of persons resident in the household.[21] The outcomes using this approach are set out in Tables 7, 8 and 9, which compare with Tables 3, 4 and 5.

Comparing Tables 3 and 7 reveals clearly the greater validity of an approach based on poverty measures defined in per-capita terms. The reason why can most easily be seen from the results for the new variable representing household size. Households with no undernutrition (0/0) and no undernourished children (1/0) are significantly smaller than the average, whereas those with undernutrition among both adults and children (1/1) are significantly larger than the average. The most common group—households with undernourished children but well-nourished adults—are still the norm and differ in no significant way from the mean.

The changes observed are most striking for the entirely well-nourished (0/0) group. Whereas only 3 poverty measures are significantly differentiated in Table 3, 13 are in Table 7—a more than four-fold increase.[22] Expenditure on food is no longer significant in explaining the absence of undernutrition, but the measures that have become significant include: grain storage, nonfood consumption expenditure, all the crop-related measures (except area planted to cash crops), two additional livestock-related measures, and the two measures of nonagricultural income. Eight of the poverty measures that were below the mean values for this group in Table 3 are above the mean when treated in per-capita

[20] All failures to repay grain loans were not due to inability to repay however; in many cases, the responsible authorities simply failed to collect the grain that had been set aside for the loan. In many such cases, families either sold or consumed the maize; in other cases, the maize was ruined by weather while awaiting collection.

[21] The variable includes nuclear and extended family members as well as, in some cases, unrelated persons (some of whom work for the household) who live and eat with the family. Excluded are family members away at school, working elsewhere and absent looking for work elsewhere.

[22] The comparisons here include the significant dummy variables from Tables 3, 4 and 5 even though they are not reported again in Tables 7, 8 and 9.

terms as in Table 7, and no measure drops below the mean with the transformation to per-capita terms.

Table 7—Mean levels of poverty measures on a per capita basis according to combined nutritional indicators

Variable	All cases (*n=357*)	BMI=0/Z=0 (*n=112*)	BMI=0/Z=1 (*n=173*)	BMI=1/Z=0 (*n=15*)	BMI=1/Z=1 (*n=57*)
			(*mean values*)		
GrainPur$	1.18	0.93	1.68	0.63	*0.30
FoodPur$	43.16	45.81	42.53	*50.90	*37.86
GrainStr	65.15	*75.78	63.04	*55.15	*53.28
LegumeStr	0.27	0.45	0.03	0.02	*0.73
ConExEd$	593.24	*729.06	*516.21	*698.00	*532.59
ConInEd$	685.84	*842.24	*603.80	*763.95	*606.99
CropMktVl$	1 272	*1 510	1 132	*1 488	1 173
CropRev$	974.91	*1 146	859.12	*1 201	929.98
LSValue$	1 765	*1 994	1 715	1 732	*1 473
LSPrdRev$	16.18	*19.95	13.73	*35.34	*11.18
LSSaleRev$	112.31	*162.00	95.43	94.61	*70.57
RemitCash$	74.59	75.77	61.90	*168.61	86.06
NonAgInc$	348.87	*493.92	287.52	*203.77	288.25
TotalInc$	1 824	*2 261	*1 590	1 990	*1 629
FemaleInc$	68.89	76.18	66.15	78.38	60.39
AcrsCrpd	0.84	*0.92	0.81	0.81	*0.76
CCrpAcrs	0.23	0.25	0.21	*0.30	*0.25
HHsize	10.48	*8.91	11.01	*9.67	*12.21

*Significantly different from the mean value at P=0.05.

Turning to the worst-nourished (1/1) group of households, the number of poverty measures that is significant has risen from 9 to 16, a 78 per cent improvement. Nine of the poverty measures that were above the mean for this group in Table 3 are below the mean in Table 7, and no measure rises above the mean with the transformation to per-capita terms. The measures that lose their discriminatory power on a per-capita basis are crop sales and remittances. The measures that acquire power are: food purchases, grain storage, both consumption measures, value of livestock and sales of livestock products, total income, and the area planted to cash crops.

For the small mixed (1/0) group, there has been an increase in significant measures from 13 to 15, a 15 per cent improvement. No measure for this group that was above the mean on a household basis drops below the mean on a per-capita basis, but five measures rise above the mean with the transformation: both the nonfood consumption measures, both the crop value measures, and the total income measure.

The only poverty measures that successfully differentiate all four groups in Table 7 are the two nonfood consumption measures.

Overall, compared to Table 3, 38 per cent of the 72 poverty measures for the 4 groups in Table 7 reverse their position relative to the mean with the transformation of the measures to per-capita terms. With transformed values two groups—those with undernourished children—tend to drop below the population means of the poverty measures, while the two with well-nourished children tend to rise above the mean. Thus the procedure of transforming the values is picking up the same thing that inclusion of the household size variable does: larger households are far more likely to contain poorly nourished children.

Comparing the outcomes in Tables 4 and 8, in which only single nutritional indicators are used, there is again a dramatic improvement in the ability to discriminate among groups on the basis of the poverty measures. The biggest shifts are associated with the Z indicator. For households where Z equals 0, the number of significantly differentiated poverty measures rises from one to eleven and, where Z equals 1, the rise is from 2 to 5.

In the first of these cases, the transformation of poverty measures to a per-capita basis raises six of the group means from below to above the population mean; in the second case, the same transformation reduces the group means for the same six measures from above to below the population mean. Whatever the state of the Z indicator, food expenditures lose their significance while nonfood consumption and total income acquire significance. Further, all the crop- and livestock-related measures are significant for the group of households with well-nourished children.

It is worth noting in passing that the measure representing female-controlled income is not a significant poverty measure according to either grouped or individual nutritional indicators. This finding flies in the face of conventional wisdom and compels further research.

Turning finally to the comparison between Tables 5 and 9, the entire set of indicators displays relatively little change in discriminatory power. There is a sizeable decrease in the number of poverty measures that display significance for RAs, a marginal decrease for NRs 2 and 3, a marginal gain for CAs, and no change for NR 4. Of the 85 grouped outcomes in Table 9, only 8 reverse position relative to the population means with the per-capita transformation. This pattern of relative stability is a confirmation that geo-tenurial differences capture a good deal of the essence of poverty in Zimbabwe.

Table 8—Mean levels of poverty measures on a per-capita basis according to single nutrition indicators

Variable	Mean	BMI = 0 (*n=285*)	BMI = 1 (*n=72*)	Z = 0 (*n=127*)	Z = 1 (*n=230*)
			(*mean values*)		
GrainPur$	1.18	1.38	*0.37	0.89	1.34
FoodPur$	43.16	43.82	40.58	46.41	41.37
GrainStr	65.15	68.05	*53.67	*73.35	60.62
LegumeStr	0.27	0.19	*0.58	0.40	0.20
ConExEd$	593.24	599.86	*567.05	*725.39	*520.27
ConInEd$	685.84	697.50	639.69	*832.99	*604.59
CropMktVl$	1 272	1 280	1 238	*1 507	1 142
CropRev$	974.91	971.97	986.52	*1 153	876.68
LSValue$	1 765	1 825	*1 527	*1 963	1 655
LSPrdRev$	16.18	16.17	*16.22	*21.77	13.10
LSSaleRev$	112.31	121.59	*75.58	*154.04	89.27
RemitCash$	74.59	67.35	*103.26	86.74	67.89
NonAgInc$	348.87	368.63	270.65	459.65	287.70
TotalInc$	1 824	1 854	1 704	*2 229	*1 600
FemaleInc$	68.89	70.09	64.14	76.44	64.72
AcrsCrpd	0.84	0.85	*0.77	*0.91	0.79
CCrpAcrs	0.23	0.22	*0.26	0.25	0.22
HHsize	10.48	10.18	*11.68	*9.00	*11.30

*Significantly different from the mean value for all cases at P=0.05.

To summarize:

- Every poverty measure in Table 9 is useful for accurately identifying important differences for at least one of the five geo-tenurial groupings.
- Five of the measures in Table 9 are useful for showing each group to be distinctly different from the population as a whole. These are: the amount of grain stored, the value of crops grown and crop revenue, the area planted to cash crops, and household size. The two measures of consumption and the total area planted no longer universally discriminate.
- The mean number of significant indicators in each subpopulation column in Table 9 is 13.4 compared to 11.8 in Table 7 and 7.5 in Table 8. Whereas geography/tenurial status was previously more than twice as powerful as the combined nutritional indicators in identifying distinctly different groups, with a per-capita approach it is only 14 per cent better. Using per-capita measures, however, the combined

nutritional indicators perform somewhat less well vis-à-vis single nutritional indicators for this same purpose; the advantage with household measures was 110 per cent whereas with per-capita measures it is only 96 per cent.

As was the case for the poverty measures defined as household means, there is also a very high level of variability in the measures defined in per-capita terms.[23] To ascertain whether the per-capita treatment provides outcomes that accord better with the expectations suggested by theory—and better than the use of household means, the earlier treatment is replicated by dividing the variable for total income into quartiles and plotting the distribution of households across the income quartiles on the basis of their nutritional group. The results are shown in Figure 4.

Table 9—Mean levels of poverty measures on a per-capita basis according to tenure regime and natural region

Variable	All areas (*n=357*)	RAs (*n=269*)	CAs (*n=88*)	NR 2 (*n=212*)	NR 3 (*n=69*)	NR 4 (*n=74*)
			(*mean values*)			
GrainPur$	1.18	0.64	*2.81	0.32	*2.17	*2.68
FoodPur$	43.16	41.65	*47.78	*47.32	41.90	*32.46
GrainStr	65.15	71.24	*46.52	*78.20	*41.40	*50.53
LegumeStr	0.27	0.20	0.50	0.07	*1.05	0.09
ConExEd$	593.24	617.23	*519.92	*654.44	*530.97	*477.67
ConInEd$	685.84	715.01	*596.68	*740.89	675.77	*537.81
CropMktVl$	1 272	*1 516	*526.22	*1 695	*523.83	*778.29
CropRev$	974.91	*1 189	*321.49	*1 400	*255.15	*448.93
LSValue$	1 765	1 909	*1 325	1 732	*2 117	*1 520
LSPrdRev$	16.18	18.27	*9.80	18.85	14.47	*10.18
LSSaleRev$	112.31	122.77	*80.34	96.10	*213.12	*62.03
RemitCash$	74.59	60.32	*118.23	69.12	94.84	70.83
NonAgInc$	348.87	212.41	*765.99	211.46	*861.11	251.06
TotalInc$	1 824	1 930	*1 500	*2 090	1 707	*1 172
FemaleInc$	68.89	64.57	*82.10	59.32	*104.16	62.48
AcrsCrpd	0.84	*0.89	*0.68	0.85	0.82	0.82
CCrpAcrs	0.23	*0.27	*0.12	*0.35	*0.04	*0.06
HHsize	10.48	*11.61	*7.06	*11.32	*8.93	*9.58

*Significantly different from the mean value for all areas at P=0.05.

Compared with Figure 3, Figure 4 shows quite marked changes for the two groups with well-nourished adults but very little change for the two containing poorly nourished adults. The 0/0 group displays the expected "descending staircase" pattern for the top three income quartiles, but the percentage of well-nourished households in the bottom income quartile remains unchanged. Using a per-capita measure of total income has differentiated households that were formerly in the third quartile and relocated them in the top quartile. In the 0/1 group, the shift has been in two directions: households that were formerly in the top and bottom income quartiles have been relocated to the third quartile.

Households with poorly nourished adults (where BMI = 1) remain more common in the second income quartile, while the lowest quartile continues to do comparatively well in relation to the other three quartiles. The highest income quartile now displays an unambiguous advantage in households where there are no undernourished adults or children.

[23] It might be thought that transforming the poverty measures to a per-capita basis would reduce their statistical variability by correcting for household size. This is not the case because of the huge variability in household size: from 2 to 76 persons. While the transformation does reduce the coefficient of variation for 11 out of 17 continuous variables, it actually increases marginally the mean coefficient of variation across all variables.

With the earlier caveat about the small size of the 1/0 group, the results in Table 7 and Figure 4 suggest that the ability of the four nutritional categories to provide results consistent with prior expectations are improved when a set of commonly used socio-economic indicators of poverty is defined in per-capita terms.

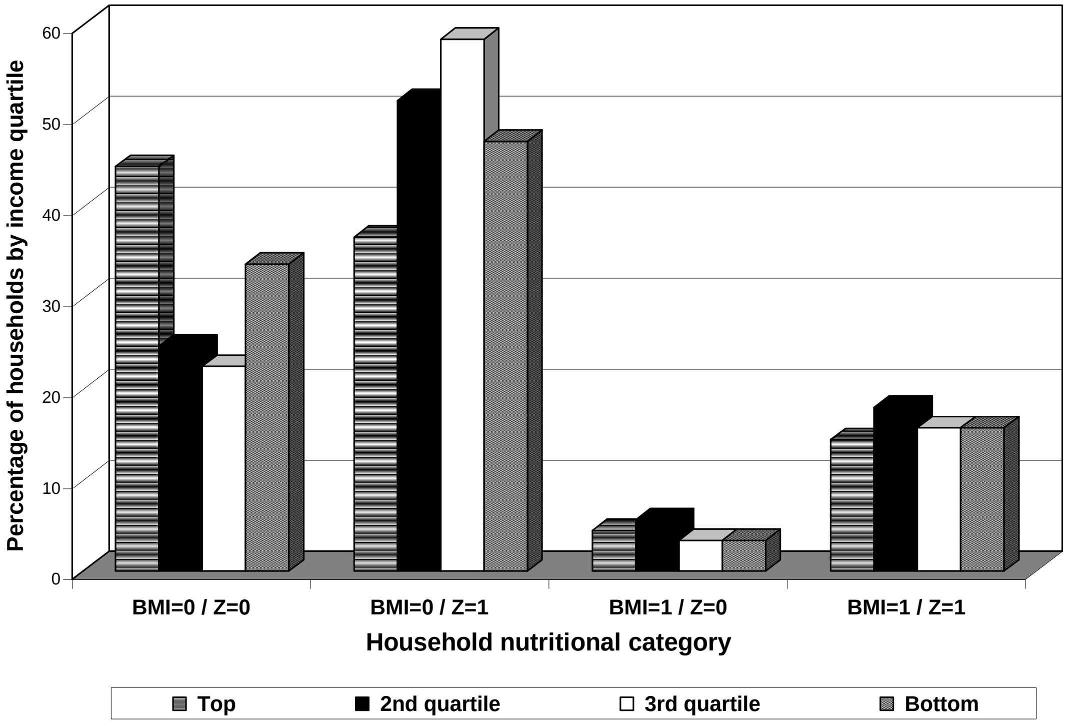

Figure 4. Distribution of household nutritional groupings by per-capita income quartiles

Discussion. This section set out to examine how indicators of nutritional status agree with other socio-economic indicators commonly used to identify poverty at the level of the household. With the approach taken and the data used, the conclusion has to be that agreement is relatively weak. This conclusion is most valid when mean values are reported only at the level of the household, as is so common in Zimbabwe, and less true when values for poverty measures are reported in per-capita terms.

While there are clearly fundamentally different socio-economic situations represented in the data set, these are not well delineated by the distribution of the nutritional indicators. Although the binary BMI and Z variables are positively correlated in a statistically significant way, the correlation coefficient is small (0.15), indicating only a weak linear association. Nor is there any consistent evidence that households with adults identified as being thin by the BMI are any worse off in terms of food security or health status than households without thin adults. Moreover, the combined nutritional indicators lack discriminatory power when a group in which undernutrition exists is the norm, as is the case in the population used here, where households with undernourished children and well-nourished adults are the expected outcome.

Several factors could help to explain this weakness in discriminatory power. First, much has been lost by converting the anthropometric scales to simple 0-1 dummy variables depending upon the position of an observation relative to a defined cut-off point. This procedure fails to differentiate between degrees of undernutrition, and it may be the severity of undernutrition that accords better with the socio-economic indicators. Moreover, the indicators test simply for the presence or absence of undernutrition in households, while it could be that the extent of undernutrition is more significant.

A basic problem however is that, because BMI does not correlate well with the anthropometric indicators for children, many of the most promising cause-and-effect variables operate in opposite directions for children and for adults. This makes generalizations about the household unit extremely difficult.

Of the three limitations noted by Nubé, Asenso-Okyere and van den Boom (1997) to the use of BMI as an indicator of levels of living, one seems particularly pertinent here. This limitation is that seasonal fluctuations in food availability or labour demands may affect BMI. The adults assessed for this study were all examined during or immediately following periods of peak labour demands and at a time when food supplies from the previous harvest would normally have been running low.[24] The outcomes suggest that, in this setting, the BMIs may be better at identifying stress in terms of arduous farm labour than at differentiating poor rural households from other rural households.

The assertion by Shetty and James (1994) that "The BMI is sensitive to socio-economic status and to seasonal fluctuations in food consumption relative to the level of physical activity" (p*vii*) seems somewhat paradoxical in the context of the results discussed here. Socio-economic status is a phenomenon which can normally be expected to change only relatively gradually over time, whereas seasonal changes in food consumption and physical activity are likely to be very pronounced for rural households. Precisely because of its sensitivity to *both* sets of factors, identical outcomes can arise with the approach used here because a wealthy household experiences labour stress, a poor household has inadequate food or a moderately well-off household has experienced one case of illness. The analysis here indicates that much more needs to be known about changes in BMI in environments where multiple causal agents operate.

Finally, while structuring analysis on the basis of per-capita rather than household values clearly yields results more indicative of underlying poverty relationships, improvements can still be made. The difficulty with a per-capita approach is that it weights adults and children equally and thus masks significant differences in household composition. A logical next step therefore is to repeat and extend the analysis while weighting household members in equivalent consumption terms.

Concluding Remarks and Discussion

One clear result is that the incidence of poverty among land reform beneficiaries is as high as that among non-beneficiaries. But this outcome is not a consequence of the failure of early land reform to be economically successful; rather it is a reflection of redistribution within extended families. Redistribution takes place, not by transferring resources from well-off households to poorer ones—as village insurance models in the vein of Townsend (1994) suggest, but via the movement of individuals from poor to better-off households.[25] Mobility is thus critical, and the implication is that improvement of rural welfare hinges upon improvements in the economy as a whole. Product price increases or improved off-farm, income-generating opportunities are also shown to have potential to assist in reducing rural poverty, but the most significant reduction in poverty is brought about by reductions in household size, an outcome that could be achieved through income-earning opportunities elsewhere in the economy so that rural households no longer have to act as safety nets.

Increases in crop prices associated with the economic adjustment programme of the first half of the 1990s helped initially to reduce rural poverty, while rural poverty at the time was relatively insensitive to the formal sector contraction that accompanied the same programme. Variation in rainfall, of course, has an enormous impact on rural poverty.

Poverty is generally measured by per-capita consumption, which is not easily possible with the panel data set discussed here. Income has therefore been employed instead. A disadvantage of this approach may be that income is used for purposes other than just consumption. In the case here, this does not cause too much bias as investments in agricultural capital have declined over the years and do not amount to much[26] The

[24] The 1996 harvest was a relatively good one; indeed it was one of the best observed over the 28 years of the study.

[25] See Dekker and Kinsey (2011) for discussion of the relationship between mobility and livelihoods.

[26] One possible caveat to this conclusion arises among the small but growing number of RA farmers who are beginning to grow flue-cured tobacco. This group is making very substantial investments in curing barns and equipment.

accumulation of cattle over time is regarded here as a capital gain rather than investment out of income. Income is also much more volatile than consumption. The major cause of income volatility is the erratic rainfall experienced over the period reviewed, coupled with a correlation coefficient between the annual means of rainfall and income of 0.77. Price changes also help offset potential income shortfalls to some extent, as prices are higher in years with low production. Receipt of food aid has also helped compensate for reduced incomes, but the political handling of food aid may have helped to create a dependency syndrome.

The large majority of the households—even after the maturity of a major public programme aimed at alleviating rural poverty—still live below a nationally defined poverty line (which is believed to overstate the extent of poverty). The positive trend can be ascribed to more land being taken into cultivation, acquisition of more cattle, and slightly higher yields.[27] Agricultural terms of trade however deteriorated after 1992/93, as consumer prices rose by more than producer prices. And it is alarming that underlying the modest average gains in income appears to be persistent and worsening inequalities.

At the individual level, incomes per capita show some slow improvement over time. Households cultivating more than one acre per capita manage, in general, to achieve incomes above the poverty line. Yet, the number of household members can and does change drastically from one year to the next (Kinsey 2010). Demographic changes at the household level—driven by retrenchments in the formal sector, HIV/AIDS morbidity and mortality, and household cycle stages—may be influencing measures of per-capita income as much as, if not more than, underlying economic realities. The longer term trend in the size of rural households was also upward, lending support to the conclusion that—despite worsening rural-urban terms of trade—former urban dwellers were returning to their previous rural homes.[28]

Based on the analysis reported here and the contents of the data set, several possible extensions to the analysis are possible. Most importantly would be to calculate the components of income from the 1998 to 2001 rounds and incorporate these into an analysis covering a longer period. A related step would be to examine more carefully the relationships over time among poverty measured in terms of nutritional status, income and in terms of assets. This would require further detailed work on the way in which assets are utilized—both in coping with stressful events and in more ordinary times. In addition to data on livestock, the panel study data set contains a high level of detail on the stock of housing and other fixed capital, agricultural capital equipment, and consumer durables.

One of the richest parts of the panel data set is that relating nutritional status and health to a wide range of socioeconomic variables. Preliminary work has been done to ascertain the extent to which nutritional status—as measured by the anthropometric status of both adults and children—can proxy for more-difficult-to-obtain measures of poverty (Kinsey 1998b & c). Additional work could usefully extend the work reported in Alderman, Hoddinott and Kinsey (2006) by focusing on the long-term human capital costs of episodes of poor nutrition in childhood and on the delineation of the relationship between poor nutritional status and poverty in other dimensions.

Second, a more systematic analysis could be undertaken of the abrupt shifts in household size to ascertain their nature, causes and permanence. It is clear from a long-term study such as that utilized here that shifts in demographic characteristics drive much of what is observed about poverty from survey work. It would be well worth analysing therefore whether household size and composition are altered deliberately—as a response to economic pressures—or whether economic pressures arise as the consequence of unanticipated alterations in household size or composition.

Finally, the data set contains detailed food consumption data decomposed by source—own production, purchases and transfers—for comparable periods of food stress each year for

[27] The sources of higher yields need further investigation. One of the effects of adjustment was the removal of the subsidy on fertilizer, resulting in a decline in its use in the communal areas (Oni 1997). The same is true for the resettlement areas as well. During the mid-1990s, fertilizer prices went up several times during each season; and supplies of the right type of fertilizer at the right time of the season have been irregular also. After 2000, fertilizer became virtually unavailable.

[28] The survey work in 2010 showed that this trend was strikingly reversed over the preceding decade.

most of the 1990s. While analysis of this data could not be extrapolated to give annual consumption, investigation would be worthwhile in terms of indicating differentials among socioeconomic groups and changes in the patterns of seasonal stress in food consumption.

The final word must be that land redistribution as a blanket policy for reducing rural poverty is a failure. To be sure, the average household appears to have benefited, but there is no such thing as the average household. Even after so many years, poverty remains a lived experience for the majority of the households studied, and nutritional well-being continues to decline. And there are disturbing indications that the poverty gap is widening as inequalities in outcomes become more extensive. It would appear that improving the effectiveness of land reform as a poverty-reducing instrument now hinges critically upon delineating more carefully the demographic, social and economic profiles of rural households and abandoning blanket policies in favour of far more carefully tailored programmes catering more explicitly to the needs and abilities of multiple categories of households.

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