This paper is a draft submission to the

Inclusive Growth in Africa: Measurement, Causes, and Consequences

20–21 September 2013 Helsinki, Finland

This is a draft version of a conference paper submitted for presentation at UNU-WIDER’s conference, held in Helsinki on 20–21 September 2013. This is not a formal publication of UNU-WIDER and may reflect work-in-progress.

THIS DRAFT IS NOT TO BE CITED, QUOTED OR ATTRIBUTED WITHOUT PERMISSION FROM AUTHOR(S).
The Excluded Generations: Questioning a Leading Poverty Indicator

Inclusive Growth in Africa: Measurement, Causes, and Consequences
WIDER Conference, 20-21 September 2013

Bill H. Kinsey*

Abstract

Because poor nutritional outcomes in childhood are linked to a lifetime of negative economic and social consequences, nutritional assessments are commonly employed as a key poverty indicator. Chronic undernutrition however is persistent and relatively unaffected by household-level income and food security. This lack of association challenges conventional thinking and forces engagement with alternative explanations. Current research suggests that hygienic conditions at household level lead to a condition in which food consumed is unable to be fully utilized—and this condition is widespread throughout tropical Africa and elsewhere. Using a panel of rural Zimbabwean households as a case, the paper attempts to broaden the debate about ‘inclusive growth’ through an encounter between conventional economic wisdom on food security and broader medical understandings.

JEL Classifications: I15, O15, Q56, I38
Keywords: inclusive growth, chronic undernutrition, hygiene, food security

Contact details:
7a Belfast Close
Emerald Hill
Harare, Zimbabwe
Email: bkinsey@mango.zw

*Research Associate, Ruzivo Trust, Harare. The author expresses his grateful appreciation to the Dutch Ministry for Development Cooperation and the Royal Netherlands Embassy in Harare and to the American Anthropological Association for support in preparing some of the background materials for this paper and in soliciting critical comments.
The Excluded Generations: Questioning a Leading Poverty Indicator

1 Introduction

Of the millions of children living in Africa more than 38 percent suffer from stunting (WHO 2006), and globally stunting affected at least 165 million children in 2011 (Black et al. 2013). Among the short-term consequences of this pattern are that more than one fifth of all mortality for children aged under five is related to stunting. Among the longer term consequences are that stunted children suffer long-term cognitive defects and go through fewer years of schooling and exhibit poorer performance while in school; experience more severe consequences of common infections; and grow up to manifest lower economic productivity in their adult lives (Black 2012).

For decades development practitioners have believed the key to improving nutritional status in Africa lay in boosting food security so as to provide a nutritionally adequate diet. Observations about the millions of malnourished people living in Africa usually became a call for increasing food supply through more food aid to nations and families or for increasing agricultural productivity.

Development economists have tended to focus on undernutrition in one of two ways. In the first they have sought statistical evidence to examine the relationship between nutrition and income. Over some 30 years, a growing body of literature has examined the interaction between nutritional status in developing countries and nutritional intake and household income, and has made recommendations on how to improve nutrition based on parameters from empirical studies of food expenditure systems at the household level. The second focus has been to take nutritional status as a given—the outcome of behavioural decisions at the household level—and to examine the consequences of poor nutritional outcomes in childhood for the life trajectories of afflicted children.

Over time the perspectives adopted in empirical studies have broadened as it has been found that the policy recommendations derived from analyses depend both on the definition of nutrition and, more broadly, on the conceptual framework employed. For example, critical elements of the pathway from changes in income to its effect on nutritional status are still questioned. Moreover, by showing that nutrient intakes are unresponsive to changes in income even at very low income levels, some studies have questioned whether nutrition in low-income countries (LICs) will improve with income gains (for example, Behrman and Deolalikar 1987). There has thus been a trend away from identifying nutritional status exclusively with nutrient intake and a wider recognition that the policy implications might differ strikingly with more far-reaching conceptual frameworks (Schiff and Valdés 1990a & b).

The growing recognition among economists that undernutrition is a multifactorial problem has also strengthened an existing trend toward convergence between economics and medical researchers. It is now widely accepted that nutritional status depends not only on the intake of nutrients (calories, proteins, vitamins, etc.) but also upon non-nutrient food

---

1 Surveys of such studies include Alderman (1990), Behrman and Deolalikar (1988), Schiff and Valdés (1990a & b) and Shah (1983), among many others.

2 For examples, see Alderman, Behrman, and Menon (1987) and, for Zimbabwe, Alderman, Hoddinott and Kinsey (2006).
attributes that affect nutrition (such as cleanliness, freshness and storability of foodstuffs), publicly provided goods (sewerage, potable water, electricity, nutritional and health services and education\(^3\), and the like), and privately provided inputs (such as the time and care taken to prepare food and look after children). Although closely related, food security (as assessed by nutrient supply and intake) and nutritional status are not the same thing. A situation of food inadequacy thus may or may not reveal itself as a nutrition problem; and a nutrition problem may or may not be the result of an inadequate supply of food.

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: a land redistribution program launched only six months following independence; drought (in the 20 years following 1980, at least six droughts were experienced); economic reform (an economic adjustment program began in 1991); and arrival and rapid spread of HIV/AIDS.\(^4\)

In the attempt to untangle the various consequences of land redistribution, drought and economic reform, past work under the Zimbabwe Rural Household Dynamics Study (ZRHDS) has made use 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 program and those who did not.\(^5\) Because land reform was a key instrument in Zimbabwe’s arsenal of anti-poverty measures for the first decade of independence, attention is focused here largely on the group who benefited. 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. Because of these more recent changes mentioned above, the paper focuses primarily on the middle decade. Another reason for this focus 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.

In 1980, recently independent Zimbabwe began a program 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 a panel study of some 550 households, including both beneficiaries and non-beneficiaries of land reform. A component of this study has been the use of multiple measures of the welfare of these rural households, among which are anthropometric measures of the nutritional well-being of both children and their parents.

An unexpected finding is that the nutritional status of children included in the study for nearly 20 years declined by an average of 1.4 percent annually, i.e. children whose families benefited from land reform had nutritional levels two decades later that were worse by 25 percent than when land reform began. These declines mirror secular worsening elsewhere in Zimbabwe and occurred despite generally rising incomes, and farm productivity, a gradual accumulation of assets and improvements in social welfare. A growing body of research shows that poor nutritional outcomes in early childhood are strongly linked to a lifetime of negative economic and social consequences: impaired child development, compromised immunity, reduced energy levels, infection and disease, diminished educational performance, reduced productivity, and decreased prospects of moving out of poverty. For  

---

\(^3\) Black (2012) and others identify what they terms the ‘vicious cycle of undernutrition and infection’.

\(^4\) The paper does not address the economic and social consequences of the turmoil that ushered in the millennium decade and has continued ever since.

\(^5\) This data set—the longest panel study ever undertaken in Africa—covers the same households over 30 years, 1982 to 2012. Some 500-700 rural households are covered.
these reasons, nutritional status is commonly employed as a key poverty indicator. As noted earlier, however, nutritional status is only weakly associated with food crop production and household-level food security. This lack of association challenges conventional thinking of development practitioners and forces engagement with alternative medical explanations for chronically poor nutritional outcomes. While emergency feeding programs may help to alleviate acute undernutrition in crisis settings, evidence suggests that chronic undernutrition persists and is relatively unaffected by household-level food security. The underlying hypothesis of current medical research in Zimbabwe is that hygienic conditions at household level lead to a condition in which the food consumed by children is not able to be fully utilized—and and this condition is widespread throughout tropical Africa and elsewhere.

Undernutrition is a serious problem in Zimbabwe and is seen both as the result and as a driver of poverty. A third of all Zimbabwe’s children are stunted (GOZ 2012), and the prevalence of stunting has increased since 2009 and exceeds 35 percent in 24 of 64 districts (GOZ 2011). It is also estimated that less than 10 percent of children aged under two years receive an acceptable diet.

This paper explores the relationship between worsening child nutrition and a hygiene-related disorder—known as environmental enteropathy (EE)—among rural Zimbabwean households. The paper examines the reasons for the decline through identification of correlates between nutritional status—both of children and adults—and the setting of rural households. It then reviews environmental and demographic factors and their challenges to health and attempts to broaden the debate about ‘inclusive growth’ and improving nutritional status through an encounter between conventional economic wisdom on food security and broader medical understandings.

The paper is organized as follows. Section 2 provides an overview of recent trajectories of child nutrition in Zimbabwe. Section 3 reports on an examination of nutritional data as indicators of welfare. Section 4 presents evidence for the reasons why nutritional status is a poor indicator of welfare at a household and per-capita level, and Section 5 concludes with a discussion of the implications of chronic undernutrition for inclusion and exclusion.

## 2 Trajectories of Child Nutrition over Time

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 in the early 1980s, data have been collected over a 30-year period on some 400 households from 22 randomly selected communities in three of Zimbabwe’s earliest resettlement schemes. These schemes were chosen to ensure representation 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 were also collected in every year from 1984 to 2000, and also in 2002, 2007-10, and 2012. There has been remarkably little sample attrition in this part of the panel; some 82 percent of households from 1983/84 were re-interviewed in 2001.

Beginning in 1997, 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

---

6 A stunting prevalence of 20-29 percent is regarded as “medium”; 30-39 percent is “high”; and 40 percent is “very high” (A hunger map of Zimbabwe. http://www.politicsweb.co.za/politicsweb/view/politicsweb/en/page71619?oid=382206&sn=Detail&pid=71619 [Accessed 10 June 2013]).
communal experiences and between current living conditions in the communal and resettlement areas (CAs and RAs).

The original objectives of the resettlement program were the enhancement of the socio-economic well-being of low-income households (i.e., the improvement of rural welfare), including their ability to feed themselves adequately (i.e., 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, improved water supplies, 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, but with a typically greater depth of social networks and stronger links to nonrural areas.

While money-metric indicators of welfare are employed throughout the panel data set, the database is also 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 ZRHDS collected health and 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.7 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 interview and will drop older children who are then above the age of six years.8 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. With a panel extending over 30 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.

With these comments, the chief anthropometric indicator of interest here is height-for-age (HA), the indicator normally used to assess chronic undernutrition. HA is assessed using z-scores—the difference above and below the expected mean value (Dibley et al. 1987), with a z-score of -2 considered as the threshold of undernutrition. Rather than work directly with z-scores, Figure 1 below plots over time the percentage of children falling below -2 standard deviations. As noted, 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. The figure also plots comparable data from the periodic Zimbabwe Demographic and Health Survey (ZDHS 2012).

---

7 The number of valid assessments obtained in each year averaged some 800. 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 and Kinsey (2006).

8 In practice, data were recorded for children aged less than 6 months and greater than 6 years, and these data are also used here.
Two important differences between the data series in the figure should be noted. ZRHDS is a panel study that involves the same households in three areas every year, whereas for the ZDHS a new random sample is drawn nationally for every round. Thus the ZRHDS allows a true assessment of annual changes, or changes over short intervals, while the ZDHS presents a more representative national picture over longer intervals.

The perspective in the plots represents the proportion of the children assessed lying below 2 standard deviations below the mean—the threshold of undernutrition. HA exhibits dramatic changes. In 1983/84 nearly 34 percent 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 program meant that crop failures were not experienced in the form of pronounced checks to child growth.

This improvement in HA was however reversed in the late 1980s or early 1990s, and by 1992 stunting was back close to the level of eight years earlier, while the following year—1993—was the second worst ever recorded. The 1993 outcomes reflect the severe drought of the 1991/92 season, but they may embody also the early signs of the cutbacks in public health services as part of the structural adjustment program. Following 1993, there was one year of marked improvement, but this was then succeeded by a continuation of poor outcomes. The linear trend is clearly for a growing proportion of children in resettlement areas to be stunted. In addition to the worsening of average nutritional status, twelve percent more children were likely to be stunted at the end of the period than at the beginning.
The data plotted from the ZDHS represent only rural families from the national data set, and thus provide a useful comparison with the panel data set. Looking at the two trend lines, the figure strongly suggests that nutritional outcomes have worsened over time for all rural areas of Zimbabwe. Moreover, the recent assessment of progress toward the MDG targets for eradicating extreme poverty and hunger concludes the targets are unlikely to be met (UNDP 2012).

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 percent 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.

In summary, the ZRHDS data in Figure 1 show a somewhat mixed picture, but the worsening of chronic undernutrition over time tells us that the resettlement experience has not led to general improvements—either in food security or in other underlying conditions—sufficient to reduce this dimension of undernutrition.

The analysis underlying the figure suggests that two related processes are taking place together. Using median values for z-scores, we know half the children assessed will have better scores than the values used. And the other half will have worse scores. It is this latter group that generates the consistently worsening results shown in the figure. 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.

3 Nutritional Indicators and Welfare Measures

In earlier work to assess the usefulness of nutritional status as an indicator of welfare (Kinsey 2010b), anthropometric data were collected for both children and their parents and households were identified where the phenomenon of undernutrition was present in adults, children, or both. Undernutrition exists among adults in a household if any one adult has a Body Mass Index (BMI) below 18.5. Similarly, undernutrition among children is considered to exist if any one of the three z-scores (height-for-age, weight-for-age, and weight-for-height) for any child in the household lies below two standard deviations below the mean.

Preliminary analysis of the nutritional data revealed that, contrary to all expectations, children’s’ nutritional levels in resettlement areas (RAs) are lower than virtually anywhere else in the country. It was originally thought that this outcome might have been a

---

9 Urban families almost consistently exhibit much lower levels of undernutrition.
10 An upper limit for the diagnosis of chronic energy deficiency using BMI has been defined as less than 18.5 (Settee and James 1994).
11 Including all three anthropometric indicators along with BMI for adults means that both chronic and acute undernutrition are being considered here.
12 See also Jenkins and Prinsloo (1995).
consequence of the experience of relocating at a time of great environmental stress—the 3-year drought of the early 1980s. Subsequent reporting suggests however that the relatively poor nutritional status of children in RAs appears to reflect persistent structural causes (Kinsey 1997; GOZ 1989, 1995, 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 with the BMIs of adults from the same household. As a first step, households were divided into four groups: those with no undernutrition, those with both undernourished children and adults, and those where either children or adults were undernourished—but not both. Then a set of 90 more-or-less conventional “welfare indicators” was constructed comprising multiple measures assessing income, health, crop production and livestock ownership, among others. Although detailed explanatory analysis is impossible in a paper of this scope, the significant outcomes serve to point out the frequent mismatch between nutritional status and indicators of economic wellbeing.

**Household-level outcomes.**—Because the number of resident household members is such an important variable in assessing outcomes, the treatment here merely summarizes major findings from the aggregated analysis without detailing the results. Relative to the expected findings, the outcomes fall into two clusters:

**Findings from that accord with expectations:**
- Households with no undernutrition have 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 have the lowest expenditure on grain (despite no evidence of a purchasing power constraint) and cultivate on average the largest area.
- Households in the best-nourished category have the lowest total food expenditure.
- The highest-income group in terms of revenue from crop sales has the worst nutrition.
- Above-average cash remittances exist for both groups containing undernourished adults.
- The group with just poorly nourished adults cultivates the smallest mean area and has significantly the highest incidence of illness overall but the lowest incidence of illness affecting work because illness is concentrated among children.
- Perhaps most surprisingly, neither total off-farm income nor total income is significantly associated with any nutritional category.

One reason for the large number of apparently perverse findings noted above is the very high level of variability in almost all the indicators. The results suggest however that nutritional categories are not particularly good proxies for traditional socio-economic indicators of household welfare. By examining the anthropometric categories for adults and children separately, it may be possible to shed more light on these rather enigmatic results. Thus the mean values for the socio-economic indicators have been calculated and, as before, an assessment made of where the group means differ significantly from the population mean. The major findings of significance that emerge are set out below:

**Households with one or more poorly nourished adults:**
- Are more likely to contain poorly nourished children as well.
- Spend less on grain and have significantly more grain in storage.
- Possess cattle herds with lower market values.
- Earn less from sales of livestock.
- Receive more remittances in cash—80 percent more than the mean.
- Plant larger areas to cash crops and have the highest ratio of cash crops to food crops.
- Report lower rates of debilitating illnesses.

**Households with only well-nourished children:**

---

13 Full details of the calculations can be found in Kinsey 2010a and 2010b.
• Are less likely to contain poorly nourished adults.
• Earn more from sales of livestock.

Of the four groups based on nutritional status, 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 percent 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 area 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 percent above those of households with only well-nourished adults and have the lowest incidence of incapacitating illness.

The influence of ecology and tenurial regime. In order to test the proposition that the welfare indicators themselves are valid measures, the data were 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 (NRs).

If the indicators used are valid, we would expect to find two strong patterns. First, since 84 percent of households in communal areas (CAs) are poor in total consumption terms 14 (GOZ 1997) and resettlement areas (RAs) have been provided access to a superior resource base, we would expect to find systematically stronger indicators of welfare in RAs than in CAs. Second, 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 the agriculture-related welfare indicators 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.

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. 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. Agriculture and livestock income variables and consumption indicators show the advantage of living in a resettlement area, while 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 thus 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 explanation may lie in settlement patterns and the time allocations of women. Villages in RAs have been laid out in a nucleated pattern. Thus neighbours, and their small livestock, live in close proximity. Moreover travel time to fields is 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 or well cared for. 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 producing non-consumable commodities such as cotton and

---

14 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.).
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 landholdings, 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. 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 to quite low. 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 and soya. Across all the years surveyed, however, this area has consistently displayed the lowest nutritional outcomes. In the area of lowest natural potential, agriculture appears stagnant; and no unirrigated farming system produces reliable incomes in this environment. Yet it is in this weakly commercialized area that the best nutritional outcomes for children have consistently been found. Furthermore, the probability of finding an undernourished adult in a household is three times higher in the best agro-ecological zone than in the intermediate and low-potential zones.

Other approaches. The weak explanatory power of the nutrition indicators thus far suggests that the relationship between nutrition and traditional welfare indicators is not as straightforward as intuition might suggest. Evidence for this contention can be found by correlating the entire set of welfare indicators with the separate nutritional indicators for adults and children, a procedure which reveals some quite startling relationships.

Unambiguous results emerge from the unequivocal correlations between crop- and livestock-related indicators and the 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. The data are collected annually at a period of peak labour stress and when food supplies are at their lowest point in the season. 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. Second, the labour demands for livestock-keeping are nonseasonal in nature and require little 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

---

15 The higher potential areas have higher rainfall, which provides beneficial conditions for certain disease vectors.
16 See Behrman and 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).
have surpluses of milk and eggs, suggesting that the family is consuming all of these 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 income and consumption indicators exhibit ambiguous outcomes. For example, in almost half the cases, 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 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?

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?

The following reasoning might explain the outcomes for adults. Grain purchases will have supplemented the supply of food 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 that cause the negative correlations for the set of crop-related variables.

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

Per-capita outcomes.--Examination of the relationship between nutritional indicators and the mean of welfare measures at the household level revealed some puzzles and suggested that the ability of the combined nutritional indicators to proxy for welfare measures was generally weak. This section replicates the previous analysis but transforms the welfare measures to a per-capita basis.

Table 1 presents selected welfare measures defined in per-capita terms and adds a new variable representing household size. Households with no undernutrition and those with no undernourished children are significantly smaller than the average, whereas those with undernutrition among both adults and children are significantly larger than the average. The most common group—households with undernourished children but well-nourished adults—is still the norm.

Overall, the undernutrition-free group and the all-undernourished group differ significantly according to some 70 percent of the indicators included here, and in the manner expected.
Expenditure on food differentiates the all-undernourished group as expected, but its significance for the undernourished-adults group is hard to explain. Other variables that differentiate the worst-nourished group of households include grain storage, both consumption measures, value of livestock and sales of livestock products, total income, and the area planted to cash crops.

**Table 1.—Mean levels of welfare measures on a per-capita basis according to combined nutritional indicators for the household**

<table>
<thead>
<tr>
<th>Variable</th>
<th>All households</th>
<th>No undernutrition</th>
<th>Undernourished children</th>
<th>Undernourished adults</th>
<th>All undernourished</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mean values)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain Purchases $</td>
<td>1.18</td>
<td>0.93</td>
<td>1.68</td>
<td>0.63</td>
<td>*0.30</td>
</tr>
<tr>
<td>Food Purchases $</td>
<td>43</td>
<td>46</td>
<td>43</td>
<td>*51</td>
<td>*38</td>
</tr>
<tr>
<td>Grain in Storage</td>
<td>65</td>
<td>*76</td>
<td>63</td>
<td>*55</td>
<td>*53</td>
</tr>
<tr>
<td>Legume Storage</td>
<td>0.27</td>
<td>0.45</td>
<td>0.03</td>
<td>0.02</td>
<td>*0.73</td>
</tr>
<tr>
<td>Consumption $a</td>
<td>593</td>
<td>*729</td>
<td>*516</td>
<td>*698</td>
<td>*533</td>
</tr>
<tr>
<td>Consumption $b</td>
<td>686</td>
<td>*842</td>
<td>*604</td>
<td>*764</td>
<td>*607</td>
</tr>
<tr>
<td>Crops Value $c</td>
<td>1,272</td>
<td>*1,510</td>
<td>1,132</td>
<td>*1,488</td>
<td>1,173</td>
</tr>
<tr>
<td>Crop Revenue $d</td>
<td>975</td>
<td>*1,146</td>
<td>859</td>
<td>*1,201</td>
<td>930</td>
</tr>
<tr>
<td>Livestock Value $e</td>
<td>1,765</td>
<td>*1,994</td>
<td>1,715</td>
<td>1,732</td>
<td>*1,473</td>
</tr>
<tr>
<td>Livestock Sales $f</td>
<td>16</td>
<td>*20</td>
<td>14</td>
<td>*35</td>
<td>*11</td>
</tr>
<tr>
<td>Livestock Sales $g</td>
<td>112</td>
<td>*162</td>
<td>95</td>
<td>95</td>
<td>*71</td>
</tr>
<tr>
<td>Remittances $h</td>
<td>75</td>
<td>76</td>
<td>62</td>
<td>*169</td>
<td>86</td>
</tr>
<tr>
<td>Non-ag Income $</td>
<td>349</td>
<td>*494</td>
<td>288</td>
<td>*204</td>
<td>288</td>
</tr>
<tr>
<td>Total Income $</td>
<td>1,824</td>
<td>*2,261</td>
<td>*1,590</td>
<td>1,990</td>
<td>*1,629</td>
</tr>
<tr>
<td>Female Income $</td>
<td>69</td>
<td>76</td>
<td>66</td>
<td>78</td>
<td>60</td>
</tr>
<tr>
<td>Acres Cropped</td>
<td>0.84</td>
<td>*0.92</td>
<td>0.81</td>
<td>0.81</td>
<td>*0.76</td>
</tr>
<tr>
<td>Cash-crop Acres</td>
<td>0.23</td>
<td>0.25</td>
<td>0.21</td>
<td>*0.30</td>
<td>*0.25</td>
</tr>
<tr>
<td>Household size</td>
<td>10</td>
<td>*9</td>
<td>11</td>
<td>*10</td>
<td>*12</td>
</tr>
</tbody>
</table>

*Significantly different from the mean value at P=0.05.  
Consumption excluding educational expenditure.  
Consumption including educational expenditure.  
Market value of all crops grown.  
Value of crop sales.  
Market value of all livestock holdings.  
Revenue from sale of livestock products.  
Revenue from sale of livestock.  
Excludes in-kind remittances.

The only welfare measures that successfully differentiate all four groups in Table 1 are the two nonfood consumption measures, but paradoxically the worst-nourished group does not have the lowest mean levels of consumption.

Overall, with the transformation of the measures to per-capita terms, the two groups with undernourished children tend to drop below the population means of the welfare 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.

Table 2 presents outcomes in which single rather than household nutritional indicators are used for a reduced set of variables. For households with well-nourished children, all the indicators differ in the direction expected and most are significantly different from the means. The indicators in the case of poorly nourished children are again in the direction expected, but only the low levels of consumption expenditure and total income are significant. Further, all the crop- and livestock-related measures are significant for the group of households with well-nourished children.
Table 2—Mean levels of welfare measures on a per-capita basis according to single nutrition indicators**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Adult nutritional status</th>
<th>Child nutritional status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Well-nourished</td>
<td>Poorly nourished</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(mean values)</td>
<td></td>
</tr>
<tr>
<td>Grain in Storage</td>
<td>65.15</td>
<td>68.05</td>
<td>*53.67</td>
</tr>
<tr>
<td>Consumption$</td>
<td>593.24</td>
<td>599.86</td>
<td>*567.05</td>
</tr>
<tr>
<td>Consumption $</td>
<td>685.84</td>
<td>697.50</td>
<td>639.69</td>
</tr>
<tr>
<td>Crop Value $</td>
<td>1 272</td>
<td>1 280</td>
<td>1 238</td>
</tr>
<tr>
<td>Crop Revenue $</td>
<td>975</td>
<td>972</td>
<td>987</td>
</tr>
<tr>
<td>Livestock Value $</td>
<td>1 765</td>
<td>1 825</td>
<td>*1 527</td>
</tr>
<tr>
<td>Livestock sales $</td>
<td>16.18</td>
<td>16.17</td>
<td>*16.22</td>
</tr>
<tr>
<td>Livestock sales $</td>
<td>112.31</td>
<td>121.59</td>
<td>*75.58</td>
</tr>
<tr>
<td>Remittances $</td>
<td>74.59</td>
<td>67.35</td>
<td>*103.26</td>
</tr>
<tr>
<td>Nonag Income $</td>
<td>348.87</td>
<td>368.63</td>
<td>270.65</td>
</tr>
<tr>
<td>Total Income $</td>
<td>1 824</td>
<td>1 854</td>
<td>1 704</td>
</tr>
<tr>
<td>Acres Cropped</td>
<td>0.84</td>
<td>0.85</td>
<td>*0.77</td>
</tr>
<tr>
<td>Household size</td>
<td>10.48</td>
<td>10.18</td>
<td>*11.68</td>
</tr>
</tbody>
</table>

* Significantly different from the mean value for all cases at P=0.05. **See notes to Table 1.

With the approach taken and the data used, the examination of how indicators of nutritional status agree with other socio-economic indicators commonly used to identify poverty and welfare at the level of the household leads to the conclusion that agreement is relatively weak. This conclusion is most valid when mean values are reported only at the level of the household and less true when values for welfare 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. 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—rather than a simple threshold—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 for adults 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, 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 periods of peak labour demands and at a time when food supplies from
the previous harvest would normally have been running low. 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.

Finally, while structuring analysis on the basis of per-capita rather than household values clearly yields results more indicative of underlying welfare 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 arising from household composition.

4 The Physiology of Deprivation:
An Overview

The contradictory evidence examined in the previous section suggests that nutritional status reflects things other than a straightforward causal chain linking economic wellbeing to food availability and food availability to nutritional outcomes. Nutritional status is an outcome not only of the quantity and quality of food consumed but is also determined by the body’s ability to extract and utilize the nutrients contained in the food.

The body's food-processing plant—the gastro-intestinal tract—is a muscular tube some nine metres in length that starts at the oesophagus and ends at the anus (Gray, Pick and Howden 1987). While some sugars are absorbed in the stomach, and small amounts of proteins in the large intestine, it is the 6-7m long small intestine where most nutrient absorption takes place. Food is chemically decomposed and compounds split into other compounds by reacting with water in the small intestine with the help of secretions from the liver, pancreas, and intestinal glands. Folds and finger-like projections called villi line the walls of the small intestine and enormously increase the surface for absorption. (See Figure 2.) Because of the folds and villi, the small intestine has a surface area some ten times greater than the human skin surface (Van De Graaf 2002).

Digestion begins at the mouth, where food is chewed. The chewed food travels down the oesophagus into the stomach, where acidic juices further aid in the digestion of the food mass. After the stomach carries out its role, the food is now in a liquid state and passes into the small intestine, first into the duodenum. This is where most of the digestion occurs because different enzymes, released by the pancreas and by glands in the intestinal wall, affect the food molecules. At the end of this process, each complex molecule has been broken down into simpler states. For example, carbohydrates are broken down into simple sugars, proteins into amino acids, and fats into glycerol and fatty acids. These substances are absorbed through the intestinal wall and utilized by cells and systems throughout the body. In addition to its role in absorbing nutrients, the intestinal wall also serves an important role as a barrier to prevent toxins from the intestinal ecosystem from reaching the sterile bloodstream.

EE has been known for almost 50 years when it was recognized that most people in LICs had an abnormality of the small intestine (Prendergast and Kelly 2012). This disorder was hypothesized to arise from unhygienic conditions because among sufferers who relocated to high-income countries the condition slowly resolved. Essentially EE has two basic effects: it causes the villi to atrophy and creates excessive cell growth, thus impeding absorption of nutrients, and it impairs the intestinal barrier function, allowing virulent organisms to stimulate an immune response and wasting nutrients in fighting the resulting inflammation.
Figure 2.—A. The folded interior of the jejunum; B. Villi arranged on the circular folds of the jejunum; C. Healthy villi and glands in the duodenum (Hamilton 1956)
Medical anthropologists have used the term “invisible illnesses” to refer to groups of illnesses that share similarities of being real to those experiencing them but being invisible to others for a variety of reasons (Masana 2011). EE does not fit comfortably into this schema for several reasons. Most importantly, it is normally asymptomatic, and the sufferer does not experience any symptoms. Thus it is invisible even to those experiencing it. There are no pains to complain about. It is also both socially and medically invisibilized. It falls into that category that Masana characterizes as chronic illnesses that “do not necessarily involve, at least not permanently, an evident change or physical deterioration that makes others think that somebody is sick” (Masana 2011, 130). Since between 60 and 65 percent of the children in the panel study are stunted in any given year, socially acceptable ideas about what constitutes a healthy body are likely to be strongly influenced by this norm. If everyone is sick, then sick is the normal. Thus neither the parents nor the community detects anything unusual when stunted, underweight children are observed. Further evidence supporting this argument is that parents in the panel feel more shame about whether their children wear decent clothes, have shoes and attend school than about whether they are visibly undernourished and stunted.

Stunting has a major impact on child health and development. Chronic undernutrition is thought to contribute to one-third of mortality in children under five years of age and—as noted earlier—leads to late school entry, fewer years spent at school and worse academic outcomes, reduced adult productivity, and an increased risk of stunting in subsequent generations (Black et al. 2008). Thus the continuance of chronic undernutrition on existing scales precludes inclusive growth in Africa.

The first two years of life are a critical time for linear growth and particularly for brain growth and development of complex neural networks. Stunting develops during what have been termed the vital first thousand days—9 months of foetal life and the second birthday, and its effects are irreversible. Figure 3 shows clearly the pattern of the onset of stunting in Zimbabwe. At the age of only six months children’s HAZ begins a rapid decline that continues to just before the second birthday. At that point there is some catch-up growth, but it never becomes complete.

Despite the prevalence of chronic undernutrition and attempts to address it, past experience with nutritional interventions have had only a marginal impact (Prendergast and Kelly 2012).

5 Discussion: We Are Not What We Eat

This paper takes some steps toward severing the assumed link between consumption of a nutritionally adequate diet and the positive outcome of improved nutritional status. Under the unhygienic conditions where EE arises, the body of the child is simply unable to utilize whatever nutrients may be fed to it. This fact suggests that a major rethink is needed about ways to address undernutrition among future generations.

Much more work is needed in order to support this reconceptualization. Many of the interventions aimed at improving nutritional status in the past have been designed or implemented in ways that precluded effective evaluation of their effects. Studies of complementary feeding programmes, for example, with nutrition education in food secure populations showed a significant increase in HAZ whereas the effect on stunting was not statistically significant. Studies of nutrition education in food insecure populations showed significant effects on HAZ in one study. Overall, the provision of complementary foods in food insecure populations was associated with significant gains in HAZ, whereas the effect on stunting did not reach statistical significance.
Although the theoretical benefits of strategies to improve diet quality and micronutrient density of foods consumed by small children are well-recognized, few LICs have clear policies in support of integrated strategies to control micronutrient deficiencies in young children. A comprehensive review of the effects of multiple micronutrients showed small benefits on linear growth but with little evidence of effect on morbidity outcomes as suggested by individual studies. Another review of the effect of multiple micronutrient supplementations on improvement of cognitive performance in children concluded that multiple micronutrient supplementations might be associated with a marginal increase in reasoning abilities but not with acquired skills and knowledge. In her review of ‘single-target’ interventions, Humphrey (2009) shows that the best observed outcomes appear capable of addressing only about one-third of the magnitude of the stunting problem.

In summary, then, the reviews of wider experience display the same contradictory patterns as does this interrogation of the Zimbabwean experience.

Suggestively, Spears (2013) has shown that there is a quantitatively important gradient between child height and sanitation that can statistically explain a large fraction of international height differences. This association between sanitation and human capital is robustly stable and appears to possess more explanatory power than the relationship between GDP and child height.

Figure 3.—Timing of Growth Faltering Among Rural Zimbabwean Children, 1993-2001 (n=7235)

References


_____ (2010b). Poverty dynamics in rural Zimbabwe: The 30 years (lost) 'war against poverty'. Paper for the conference 'Ten Years of War against Poverty - What Have We Learned since 2000?' at the Chronic Poverty Research Centre/Brooks World Poverty Institute at the University of Manchester, 8-10 September 2010


