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MAPPING THE LINKAGES BETWEEN AGRICULTURE, FOOD SECURITY & NUTRITION IN MALAWI

Edited by Noora-Lisa Aberman, Janice Meerman, and Todd Benson

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2015

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AGRICULTURE, FOOD SECURITY & NUTRITION

IN MALAWI

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Table of Contents

Figures

Tables

Text Boxes

CHAPTER 1 : INTRODUCTION TO CONCEPTUAL ISSUES RELATED TO AGRICULTURE, FOOD SECURITY, AND NUTRITION

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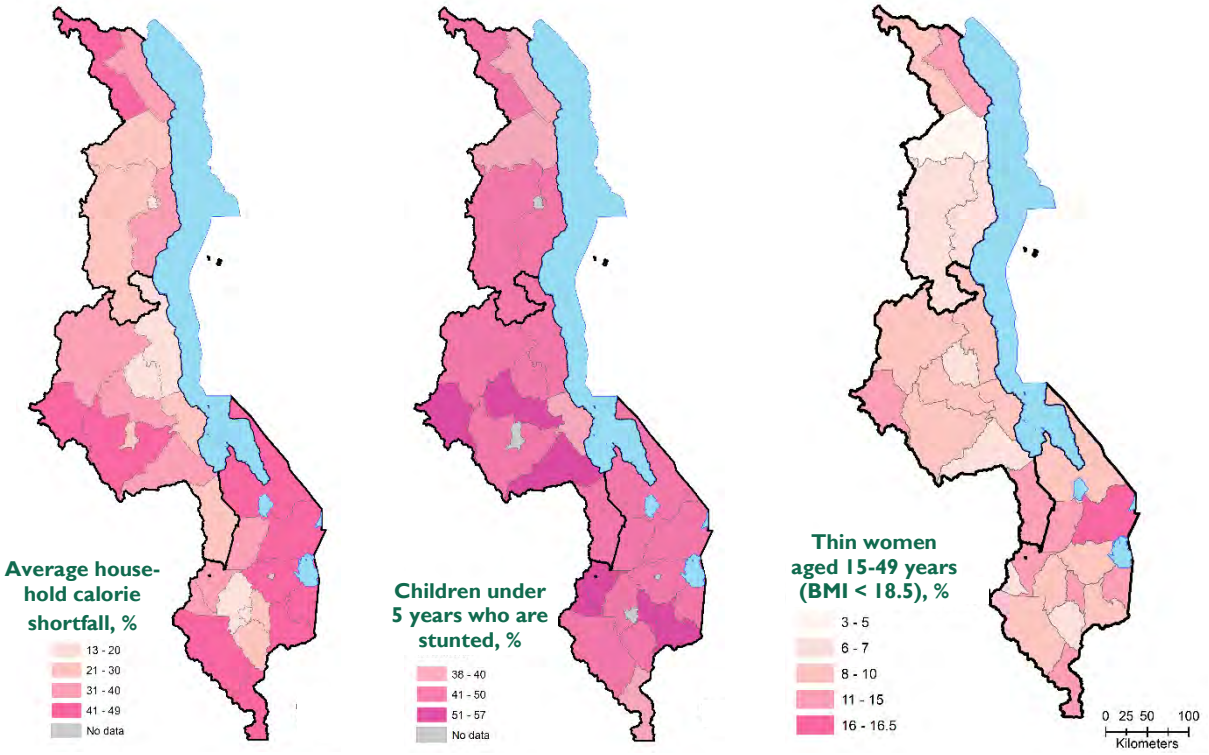
Smallholder agriculture is the mainstay of Malawi's economy. Its importance for livelihoods cannot be overstated. 94 percent of rural residents and 38 percent of urban residents engage in agriculture to some extent (Jones, Shrinivas, and Bezner-Kerr 2014), the vast majority as smallholder farmers with landholdings of less than one hectare. Smallholder crops are primarily maize—which accounted for nearly 80 percent of smallholder-cultivated land in 2011 —followed by cassava and other food crops (FAO 2008; IFAD 2011). These foods are grown for household consumption and for sale at local and regional markets. As such, the Malawian food supply, especially in rural areas where markets are thin with few buying or selling options, is shaped largely by trends in smallholder food-crop production.

In the last decade, Malawi has experienced rapid smallholder-led growth in the agricultural sector, largely attributed to the Farm Input Subsidy Program (FISP)—a major sector program providing about half of all smallholder farming households with heavily subsidized fertilizer and seed (Beck, Mussa, and Pauw 2014). In spite of this progress, the country has seen little improvement in nutrition outcomes (Figure 1.1). Almost half of all children under five years of age in Malawi suffer from undernutrition.[1] Although some of these children may be getting enough to eat in terms of total calories, few are consuming sufficient quantities of nutrient-rich foods—meat, fish, eggs, dairy, legumes, fruits and vegetables—on a regular basis. Good nutrition requires both—that is, enough total calories (quantity) and enough total vitamins and minerals per calorie (quality). Without a high-quality diet, even children who are able to fill their bellies on most days will suffer from chronic undernutrition. The most obvious sign of chronic undernutrition is stunted growth, or low height-for-age, where children are significantly shorter than well-fed and healthy children of the same age (WHO and UNICEF 2009).

In addition to suboptimal physical growth, the invisible, insidious effects of chronic undernutrition are of concern. Children under the age of two who consistently consume poor-quality diets are known to have impaired cognitive development that can lead to economic underperformance and other adverse outcomes in adulthood (Hoddinott et al. 2008). Poor school attainment, low per capita income, low wage rates, and likelihood of falling below a designated poverty line in adulthood are some of the indicators associated with chronic undernutrition in childhood (Martorell et al. 2010). And while it is individuals and families who bear the heaviest burden in terms of lives lost and potential wasted, the ripple effects of undernutrition trickle up all the way to national and regional economies. Stunting is associated with GNP losses of up to 11 percent across Africa and Asia, where prevalence is highest (Haddad 2013). In Malawi, where stunting prevalence is very high according to global standards (NSO and ICF Macro 2011), child undernutrition is a huge drain on human and physical capital, constraining national economic growth.

[1] 47 percent of children under the age of 5 are stunted (height-for-age index less than 2 standard deviations below the mean of an international reference population) according to the 2010 Demographic and Health Survey; 30 percent are stunted according to IFPRI calculations based on the 2010–11 Integrated Household Survey (Verduzco-Gallo, Ecker, and Pauw 2014).

Figure 1.1—Average household calorie intake shortfalls, prevalence of stunted children under five years of age, and prevalence of thin women aged 15 to 49 years, by district, Malawi 2010



Source: Analysis by M. Kedir, IFPRI, of IHS3 and DHS data and IHS3 calorie intake deficiency analysis results (Verduzco-Gallo, Ecker, and Pauw 2014).

Given these implications, reducing stunting rates in young children in order to improve human capital for future health and productivity is good policy. Nutrition interventions typically target young children and women of childbearing age, primarily during the key window of opportunity between pre-pregnancy and two years of age. Examples of conventional health-based interventions to improve nutrition are deworming, micronutrient supplementation, improved antenatal care, and therapeutic treatment of acute malnutrition; but, other sectors also have a role to play in reducing undernutrition. Given this paradigm, what role do smallholder-production practices and the food supply chains they influence play in affecting Malawi's nutrition statistics? And more broadly, what options exist for agriculture-based strategies to improve these statistics? Considering the concept of food security—which along with health and care is considered a key driver of nutrition outcomes[2]—provides a starting point to answering these questions.

1.1—Food Security: Where Does Nutrition Fit?

Food security is commonly defined as "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996). Nutrition is, therefore, inherent in the definition; but, it is often a component that is minimized. This definition includes four dimensions that must be fulfilled simultaneously:

- Physical food *availability* at a national or community level determined by food production, stock levels, and net trade.

[2] The conceptual determinants of undernutrition are food (security and quality), health (services and environment), and care (of young children, including feeding) (UNICEF 1990).

- Households' and individuals' economic and physical *access* to food (for example, the affordability of food).
- Food *utilization*, commonly understood as energy and nutrient intake by individuals as a result of care and feeding practices, food preparation, diversity of the diet, and intra-household distribution of food. Food utilization can be considered the most explicitly nutrition-oriented aspect of food security. It is directly related to our above discussion of the quantity and quality of foods. It is important to note that utilization of food is a biological process that is affected not only by food intake, but also by the presence of infection or disease, since a sick individual will absorb or utilize the nutrients in food less well than someone who is healthy.
- *Stability* of the other three dimensions over time.

In general, Malawian diets are heavily dominated by staple foods, maize first and foremost, but also rice and cassava in some areas. As such, food security in Malawi is often equated with maize production, or the ability of households to acquire enough calories from their chosen staple foods. What is missing by this measure is the importance of the *quality*, in addition to the quantity, of dietary intake. While maize and most other popular staple crops are high in carbohydrates, they are low in proteins, vitamins, and minerals. Because most Malawian meals rely heavily on these staples, other nutrient-rich foods, such as fruit, vegetables, fish, beans, and meat, are often consumed in small amounts or not at all. As a result, meals are often adequate in terms of total calories or *quantity,* but likely to be inadequate in terms of *quality*.

This household-level scenario is reflected in—and exacerbated by—national development priorities; food security is a top-line agenda item for agriculture, whereas nutrition is considered to be a health issue. This conceptual division facilitates conflation of food security with staple crop production, as opposed to encouraging a comprehensive perspective that systematically considers the importance of non-cereal crops and brings in the concept of utilization. It also encourages exclusively addressing nutrition needs through health-based delivery platforms, where the primary focus is on women's and children's health as described above, as opposed to seeing nutrition as a multisectoral issue for which diverse food is a key component and agriculture and food systems are an important driver.

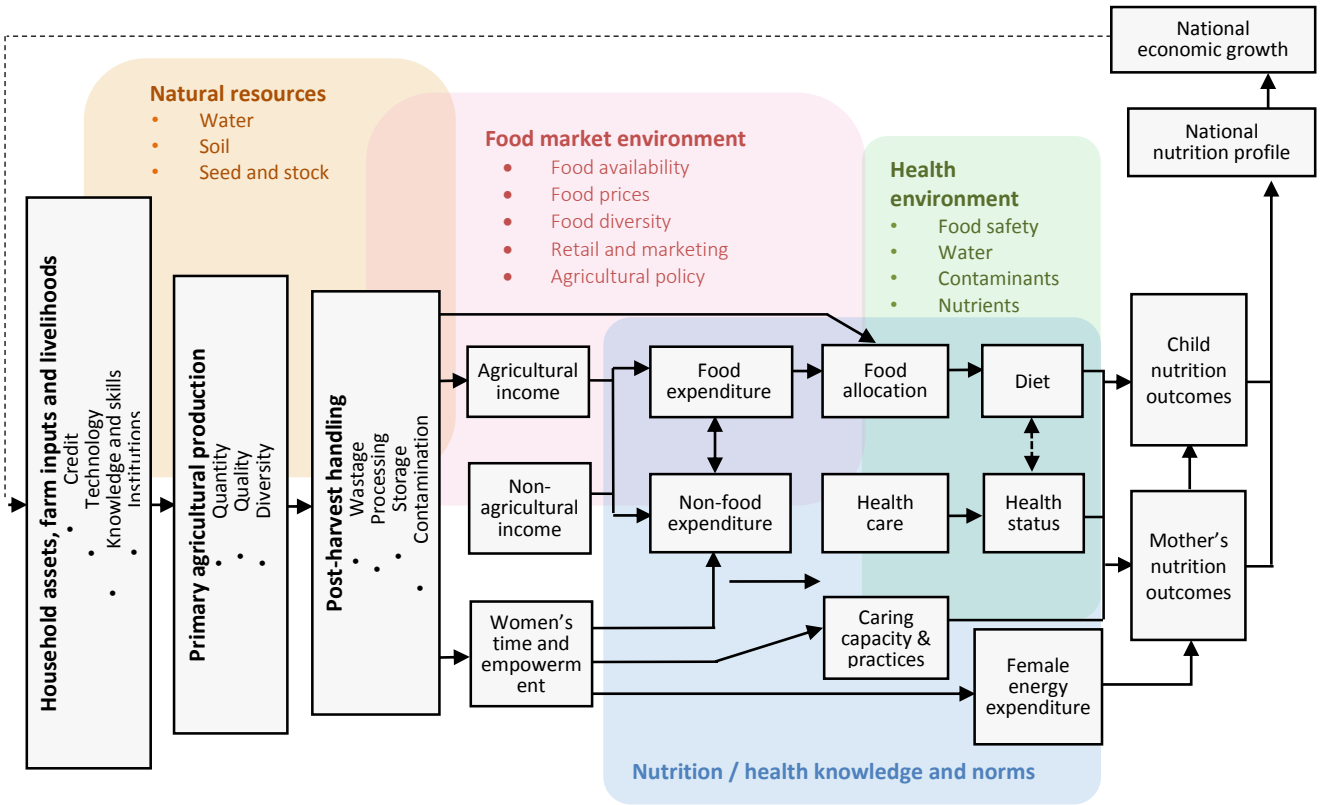
1.2—Conceptual Pathways from Agriculture to Nutrition

Applying a food and agriculture lens to nutrition requires a conceptual framework that clarifies hypothesized causal pathways from agriculture to nutrition. The framework in Figure 1.2—adapted to the Malawi context and referenced throughout this publication—does just this. Agricultural investments and activities are listed on the left of the diagram, while nutrition outcomes are listed on the right. While the trajectories from agriculture to nutrition are not always linear, in general, they can be divided into four main pathways, all of which apply to household and individual level outcomes.

1) Agriculture as a source of food: Agriculture effects nutrition most directly when food grown by the household is consumed within that household. Farm households can improve nutrition of household members if:

- their production practices and post-harvest practices improve the diversity, consistency (over the year) and quantity of foods available to the household;
- the foods available to the household are allocated to individual household members, based on age and gender-specific nutrient requirements; and
- the health status of household members does not hinder absorption of nutrients from healthy foods eaten.

Figure 1.2—Conceptual pathways between agriculture and nutrition



Source: Herforth and Harris (2014)

2) Agriculture as a source of income: Income from wages earned through agricultural labor or the sale of agricultural products can be used to purchase food and other nutrition-relevant items, such as healthcare. Agricultural income can improve nutrition of household members if:

- household income produced from agricultural activity is partly spent on diverse and nutritious foods;
- diverse and nutritious foods are available and affordable in local markets, throughout the year, for purchase by households;
- the foods available to the household are allocated to individual household members, based on age and gender-specific nutrient requirements; and
- the health status of household members does not hinder absorption of nutrients from healthy foods eaten.

3) Agriculture as moderator of women's time use and decisionmaking power: Women regularly work in agriculture and they make the majority of nutrition-related decisions for the family, and young children in particular. When women control income they are more frequently used on food and healthcare for family members (Smith et al. 2003). However, women often do not have control over household resources or power in household decisionmaking. Thus, agricultural activities that increase women's income and decisionmaking power can have positive impacts on nutrition due to increased household expenditures on nutrition-relevant goods and services, assuming that there is a positive net effect on:

- the amount of time a woman is occupied in agricultural activities, with consequences for the time she can focus on the food, health, and care of her family; and
- the amount of energy a woman expends, with consequences for her own nutrition and health outcomes, as well as those of her children (and for fetal health if she is pregnant).

4) Agriculture as a moderator of food markets: Agriculture and food-system policies affect a range of supply and demand factors that influence how well food markets perform in terms of the availability,

price, and diversity of food. Food markets are a part of the environment in which farm households fulfill their food security and nutrition needs. Food-market performance can affect nutrition through:

- the income of net seller households and the purchasing power of net buyers; and
- the availability and affordability of diverse and nutritious foods in local markets, throughout the year.

Agriculture as a moderator of food markets is of particular importance in the Malawian context given the contribution of smallholder agriculture to domestic food supply. Only 5 percent of Malawi's farmers are exclusively commercial producers, while the remainder are largely subsistence-oriented, both buying and selling food to supplement food stocks and to address cash needs (Jayne, Zulu, and Nijhoff 2006). This pathway is captured in the pink shaded box in Figure 1.2 on food market environment. This environment affects the kinds of foods that are available locally and likely to be purchased, as well as those that are likely to be produced by farm households as a response to price signals and market incentives. Farm households determine what crops they will sell to markets and what crops will be consumed at home largely as a response to the food market environment.

Food market environments also are influenced by government policy and the actions of the private sector. In Malawi, input subsidies for maize and private-sector investment in groundnut-based value chains are prime examples. In regards to value chains, it is important to note that labelling and social marketing are tools used by both the public and the private sector to influence food-purchase decisions and consumption habits. These tools send messages about foods' convenience of purchase and preparation, nutritional content, and related perceptions of quality and safety. Depending on the context, these messages can affect purchase decisions by households as much as the relative price of foods.

In addition to food markets, natural resources (in the orange box in Figure 1.2), the health environment (green box), and nutrition and health knowledge and norms (blue box) are often referred to collectively as the "enabling environment for nutrition" (see Box 1.1). Together, these contextual factors affect the trajectories of the causal pathways from agriculture to nutrition described above.

1.3—Conclusion

Agriculture has the potential to affect nutrition through all of these pathways and often through multiple pathways at once. For each pathway, increased access to and availability of nutrient-rich foods is a key step. However, achieving such increases in Malawi requires addressing major challenges in a number of areas, not least of which are strong cultural preferences for meals based heavily on maize and other starches, and the high cost of nutrient-rich foods relative to staples. National agricultural policy can contribute to overcoming these challenges by (1) promoting production of nutrient-dense foods via subsidies and other incentives; (2) promoting food processing, marketing, and consumption in ways that conserve nutrients, create demand, and decrease prices; and (3) supporting women farmers, for example, through targeted efforts to increase their productivity and bargaining power.

This publication provides a series of primary and secondary data analyses that are illustrative of these challenges and their potential mitigation. Chapter 2 begins by providing a primer on indicators that are commonly used in agriculture-nutrition analysis; this chapter also provides an overview of relevant data sources in Malawi and a discussion of current impediments to analyzing agriculture-nutrition pathways. Chapter 3 uses data from Malawi's Integrated Household Surveys (IHS) to look at how changes in particular food consumption patterns are related to changes in the prices of those foods, including how these changes affect a household's access to micronutrients. Chapter 4 presents findings from a qualitative survey that explores the implications of the production and sale of nutritious commodities for improving diets. Chapter 5 uses IHS data to examine the determinants of smallholder-production diversity and its impact on household dietary diversity, again with a focus on household access to micronutrients. Finally, Chapter 6 examines the associations between irrigation and food security and nutrition outcomes, also using IHS data.

Box 1.1—Enabling environment for nutrition: Natural resources, health, knowledge, and norms

Natural resources environment: Appropriate management of natural resources—water, land, and biodiversity—has direct consequences for the livelihoods and nutrition of farm families. Irrigation, for example, facilitates production diversity and increased yields with positive implications for food consumption and nutrition; however, it can also increase the risk of ill health due to water borne disease and fertilizer run-off.

Malawian child drinking clean water from a well

Climate change should be a routine consideration in management strategies. Early or late onset of rains, floods, droughts, shortened crop seasons, and premature harvests cause yield declines, which leads to decreased food availability and income for farming households. These challenges require farmers to continually adapt their agricultural livelihood strategies to maintain the viability of their natural resources base.

Health environment: Agricultural production interacts with health environments and related water and sanitation environments to influence nutrition for better or for worse. For example, livestock production schemes may increase exposure to zoonotic disease and impair good sanitation practices. Another example is employment schemes in rural areas which target women. While these programs may increase income, they may also reduce the amount of time women spend on child care, cooking, fetching water and firewood, and home-based agricultural work, all of which are directly related to nutrition and health. Agriculture projects will have a higher likelihood of successfully impacting nutrition when these inherent tradeoffs are acknowledged as important considerations to be routinely addressed via risk reduction measures.

Knowledge and norms: Farming and nutrition knowledge held by family and community members has a major bearing on decisions related to agriculture and nutrition that are made within households. For example, activities that promote knowledge of nutrition and health may affect decisions around food production, purchase, and consumption. The decisions may enhance positive outcomes for both the agriculture and nutrition sectors while avoiding negative impacts. Conversely, knowledge and use of key agricultural practices and skills can include information that builds awareness and protects against harm to health and nutrition. For example, nutrition-sensitive livestock-raising practices may change how animals are kept in relation or proximity to the home, or nutrition-sensitive irrigation practices may help avoid household consumption of contaminated water. Social and behavioral change activities promoting nutritious diets and healthy practices—provided by an agricultural extension system or in collaboration with other sectors—can further enhance the impact of agricultural activities on nutrition.

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CHAPTER 2 : INDICATORS FOR EXAMINING LINKS BETWEEN AGRICULTURE, FOOD SECURITY, AND NUTRITION

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2.1—Introduction

How can the nutrition impact of agriculture programs be assessed? Depending on context, data may need to be collected on: production practices for food, livestock, and cash crops; post-farm gate value chain and other market-based activities; commodity prices; household food security; women's empowerment; and diet and nutrition outcomes. While not intended as an exhaustive review, this chapter provides a primer on some of the most commonly-used indicators for research, monitoring, and evaluation of these areas. The following sections discuss the commonly-used indicators for assessing:

- diet and nutrition outcomes;
- household food security;
- gender, household decisionmaking, and empowerment;
- agricultural production, productivity, and diversification; and
- food markets and prices.

In addition, this chapter also provides a brief overview of survey programs in Malawi that collect the data to construct these metrics. In so doing, the concept of the *agriculture and nutrition data disconnect* is introduced (Gillespie, Harris, and Kadiyala 2012). Given that assessing the agriculture–nutrition nexus requires reliable data sources for all the indicator areas listed above, the range of data types required is extremely wide and unlikely to be captured in a single survey. The data disconnect—whereby nutrition and health data tend to be collected in separate and non-comparable surveys to those used to collect data on food and agriculture—poses a major stumbling block to investigating agriculture–nutrition linkages in most countries.

2.2—Assessing diet and nutrition outcomes

Individual diets are the essential link between agriculture and nutrition; therefore, diet should be assessed in almost every piece of research or monitoring on how agricultural activities affect nutrition. Nutrition outcomes should also be assessed if the underlying logic of the design of an agricultural program or policy being monitored suggests that these outcomes are likely to be affected. Diet and nutrition outcomes are measured at the individual level, as they relate to what an individual consumes and the physical process of absorbing and utilizing nutrients. As such, the indicators discussed below are measures of individual diet diversity and anthropometry. These types of metrics are appropriate for assessing the utilization dimension of food security (see Chapter 1) where individual nutrition practices can truly be detected.

2.2.1—DIETARY RECALL

Twenty-four hour food recall surveys collect detailed information on the precise foods[3]—including amounts—eaten by an individual over the past day. Food composition tables are then used to assess the nutrients in these foods, thus providing an estimate of an individual's diet quality and the quantity of nutrients consumed (Jones, Ngure, Pelto, and Young 2013). While a gold-standard in dietary data collection methodology—used when a new concept is being tested—24-hour recall surveys are expensive and time-consuming to administer and nutrient analysis of the data may require locally-

[3] As opposed to aggregated food groups as with the individual diet diversity scores discussed later.

adapted food composition tables (Willett 2012). These constraints make 24-hour recall a prohibitive means to assess diets in many of the resource-poor settings where agriculture–nutrition programming and monitoring is being conducted.

2.2.2—INDIVIDUAL DIETARY DIVERSITY SCORES (IYCDDS, WDDS):

Eating a variety of foods helps ensure adequate intake of essential nutrients and promotes good health. Accordingly, individual dietary diversity measures are used as indicators of diet quality. Diet diversity scores for an individual are computed from information on the number of specific food groups from which the individual consumed food over a recent short period of time. These metrics have been repeatedly validated as having a robust and consistent positive statistical association with adequacy in individual micronutrient consumption. In other words, the higher the diet diversity score for an individual, the more likely that individual has a diet which meets his or her vitamin and mineral requirements (Ruel, Harris, and Cunningham 2013).

The populations from which indicators of individual diet diversity are most commonly collected are women of reproductive age, via the Women's Dietary Diversity Score (*WDDS*), and children under two years of age, via the Infant and Young Child Dietary Diversity Score (*IYCDDS*). The specific food groups used to calculate these two scores are not the same because the micronutrient requirements for women and small children are different. For the WDDS, there are nine food groups[4] (FANTA and FAO, 2014); while for the IYCDDS, there are seven food groups[5] (WHO 2007). Both the WDDS and the IYCDDS are calculated using data on foods eaten over the 24 hours prior to the interview.

Multi-stakeholder consultations and cross-country validation studies have identified cut-off points for both indicators to classify individuals as having low or minimum dietary diversity (FANTA and FAO 2014; WHO 2007, 2008). The IYCDDS requires a minimum of four of the food groups to be consumed to achieve minimum dietary diversity. The WDDS requires at least five of the designated food groups to be consumed.

Although they do not provide data on the frequency or amounts in which different foods were consumed, individual diet diversity scores can be constructed based on an easy-to-administer questionnaire (Kennedy, Ballard, and Dop 2010).

2.2.3—ANTHROPOMETRY

Anthropometry assesses the physical growth status of an individual relative to an international reference population. As a result, anthropometric statistics are typically reported as indices based on standard deviations from the mean of this reference population, or z-scores. In children, two of the most commonly used anthropometric indices are height-for-age (HAZ) and weight-for-height (WHZ) (WHO 2008).

Children whose height-for-age is less than two standard deviations below the median height of the reference population (HAZ<-2.0) are assumed to be stunted in their growth and suffering from chronic (long-term) undernutrition. In contrast, children with low weight-for-height (WHZ<-2.0) are assumed to be wasted and suffering from acute (recent and severe) undernutrition. Stunting prevalence can be high even in situations of relative food security, depending on the quality of diets consumed and the prevalence of infectious disease. Wasting in children is often seasonal due to food shortages and disease and carries a higher risk of death.

[4] The nine WDDS food groups are: starchy staples; dark green leafy vegetables; other vitamin A-rich fruits and vegetables; other fruits and vegetables; flesh foods (meat, fish, poultry, and liver or organ meats); eggs; beans and peas; dairy (milk, yogurt, and cheese); and nuts and seeds.

[5] The seven IYCDDS food groups are: grains, roots, and tubers; legumes and nuts; dairy; flesh foods; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables.

In addition to these indicators, mid-upper arm circumference or MUAC, is also used to assess the nutritional status of children and, in some cases, adults. Body-mass-index (BMI) is a more commonly-used anthropometric indicator for adults and is used to detect both under- and over-nutrition.

Demographic and health surveys (DHS) are considered among the best sources of anthropometric data in many countries, including for Malawi. Four nationally-representative DHSs have been carried out in Malawi – in 1992, 2000, 2004, and 2010.

2.3—Assessing household food security

This section focuses on indicators that measure household food security, defined here as *access to food*. Access, in this context, is both physical and economic, including foods that a household grows for their own consumption and foods that a household purchases outside the home. Household access to food is typically used as an indicator of income and household calorie availability or lack thereof (Hoddinott and Yohannes 2002; Swindale and Bilinsky 2006).

While some of the most commonly-used household food security indicators look only at household access to different food groups, others go further, estimating per capita calorie and micronutrient availability based on international recommendations for individual requirements. However, as long as these estimates are based on household-level data that do not capture how food is divided between household members, they should not be considered representative of individual-level diets. The final category of indicator considered here is experiential. These metrics are based on indices which assess the severity of food insecurity based on common reactions to, and coping strategies for, not being able to access enough food.

2.3.1—HOUSEHOLD DIET DIVERSITY SCORE

As it is strongly associated with household calorie access and socioeconomic status, household-level dietary diversity is considered a proxy indicator for food access. It is best used to measure the quantity of foods that are being eaten by the household as a whole, thus providing information on what dietary options are *available* to individual household members, albeit without unpacking how those options may be exercised, as the allocation of food to individual members is not addressed during data collection (Hoddinott and Yohannes 2002; Kennedy et al. 2010). Household level diet diversity scores cannot be used to assess individual-level dietary intake or quality. Consequently, they cannot be used to predict individual-level nutrition outcomes.

The most commonly used indicator of household diet diversity is the household dietary diversity score or HDDS. Originally developed by the Food and Nutrition Technical Assistance Project (FANTA) to evaluate the food security and nutritional impact of USAID programs (Swindale and Bilinsky 2006), the HDDS is now used widely. It is calculated by summing equally-weighted response data on the consumption of 12 food groups[6]. These response data are gathered during an interview with the household head or other individual responsible for food preparation in the household. Nationally-representative household survey data such as Malawi's second and third Integrated Household Surveys (IHS2 and IHS3) commonly record any foods consumed in the last 7 days (although in other surveys the recall period may be the previous 24 hours). The response data are then summed to obtain a score (0 to 12) for the household as a whole.

It is important to note that, unlike the individual dietary diversity scores discussed above, the HDDS has no standard cut-offs for high or low diet diversity; however, higher numbers of food groups are associated with higher household access to calories (Hoddinott and Yohannes 2002; Kennedy et al. 2010).

[6] The 12 HDDS food groups are: cereal grain staples; roots and tubers; vegetables; fruits; meat; eggs; fish; pulses and nuts; dairy products; oils and fats; sugar; and condiments.

2.3.2—MICRONUTRIENT SENSITIVE HDDS AND HOUSEHOLD MICRONUTRIENT ACCESS

The micronutrient-sensitive HDDS or MsHDDS was created by IFPRI to increase understanding of which micronutrients were available to households through the foods that families reported eating (Verduzco-Gallo, Ecker and Pauw 2014). To date, the MsHDDS has only been applied in Malawi using the food consumption recall data from the IHS2 and IHS3 that asked the respondent, usually the household head, which and how much of 135 foods common in Malawi had been eaten by any members of the household that week.

Although based on the same idea as a conventional HDDS, the Malawi MsHDDS further subdivides the food groups used: the vegetable group is divided into dark green leafy vegetables, vitamin A-rich (red/orange/yellow) vegetables, and other vegetables; the group of fruits is divided into vitamin A-rich fruits and other fruits; and the group of meat is divided into red meat and white meat (mainly poultry). A total of 16 different food groups are used for the MsHDDS, rather than the 12 groups used for the HDDS.

IFPRI researchers then estimate per capita availability of key nutrients from all the foods the households reported eating, providing more detail on nutrients available to household members than is provided by the MsHDDS alone, which only provides a simple count of foods groups eaten. The calorie and micronutrient content of the foods eaten by household members was calculated based on the food recall data with food composition tables for Senegal and Kenya (the only available databases for sub-Saharan Africa (FAO 2010)) in order to convert the food quantities into their calorie and micronutrient contents (Ecker & Qaim 2011). These estimates of household access are then compared to age- and sex-specific nutritional requirement levels to estimate the prevalence of shortfalls in the micronutrients accessed by the household compared to what its members need as a whole to meet their nutritional requirements. Nutrient consumption threshold levels are based on individual requirement levels available from FAO, WHO, and UNU (2001) and from WHO and FAO (WHO and FAO 2004, 2006). We refer to this indicator as an estimate of *Household Micronutrient Access,* because it does not reflect actual micronutrient intake at an individual level but generates per capita estimates intakes based on household level data.

As with the HDDS, lack of information about intra-household food allocation is the primary reason why the MsHDDS and related estimates of per-capita micronutrient consumption should be viewed as a measure of household *access* to diverse foods and adequate micronutrients rather than of nutrient *intake*. Furthermore, while there are clear theoretical associations between these newly developed indicators—MsHDDS and the household micronutrient access indicator--and individual diet quality[7], these associations have not been empirically validated. Nonetheless, the MsHDDS adds a useful nutrition lens to a common food-security indicator, while the household micronutrient access indicator provides a rare example of nationally-representative food-based micronutrient access estimates. Further, the fact that the data for these indicators are found in the same dataset as socioeconomic and agricultural information reduces the data disconnect.

2.3.3—FOOD CONSUMPTION SCORE

Developed by the World Food Programme (WFP), the Food Consumption Score (FCS) is a composite score comprised of data on food groups and the frequency of consumption of those food groups. The typical recall period is usually 7 days (as opposed to the HDDS, which may be either 7 days or 24 hours) and data is collected on fewer food groups – eight, rather than 12. Each food group is weighted according to its nutritional value (for example, sugar and oil = 0.05, while meat, milk, and fish = 4.00) and the questionnaire collects information on how often each of the food groups were consumed by one or more family member over the past week. The FCS is intended to monitor changes is food-

[7] For instance, on average, individuals who belong to households which reported consuming relatively high quantities of vitamin-A rich fruits and vegetables are likely ingesting more beta-carotene than those who do not.

security status across large geographic areas such as regions or countries and is positively associated with per-capita calorie consumption (Jones et al. 2013; Lovon and Mathiassen 2014).

In addition, unlike the HDDS, the FCS uses standard cut-offs to categorize the quality and quantity of household food access as poor, borderline, or acceptable. While technical analysis of the sensitivity and cross-country comparability of these cut-offs is beyond the scope of this chapter, it is important to note that these cut-offs have been found to consistently underestimate the prevalence of poor or borderline energy consumption and that cross-country comparability is low (Lovon and Mathiassen 2014; Wiesmann, Bassett, Benson, and Hoddinott 2009).

2.3.4—HOUSEHOLD FOOD INSECURITY ACCESS SCALE AND COPING STRATEGIES INDEX

The Household Food Insecurity Access Scale (HFIAS) is based on the assumption that there is a set of predictable reactions to the experience of food insecurity that can be summarized and quantified (Carletto, Zezza, and Banerjee 2013). Based on the administration of nine questions to a household respondent, this measure has been incorporated into household surveys around the world and has been validated in Latin America and sub-Saharan Africa for reliability and validity in local contexts (Knueppel, Demment, and Kaiser 2010; Melgar-Quinonez et al. 2006). However, other validation studies suggest that this indicator's cross-cultural comparability may be weak, due largely to cultural and language issues which complicate interpretation of results across contexts (Swindale and Bilinsky 2006). In response to this criticism, the Household Hunger Scale (HHS) was created and has been cross-culturally validated, although its design only captures severe cases of food insecurity (Ballard, Coates, Swindale, and Deitchler 2011). The harmonized Latin American and Caribbean Food Security Scale (ELCSA) and the recently launched Food Insecurity Experience Scale (FIES) are examples of similar, experience-based food security scales (Cafiero, Melgar-Quiñonez, Ballard, and Kepple 2014).

As with the HFIAS, the Coping Strategies Index (CSI) takes an experiential approach to food-security analysis, assuming that there are several behavioral coping strategies used by households to manage food shortages. The CSI is comprised of a weighted average of the frequency and severity of a menu of these coping strategy behaviors, developed and assessed based on location-specific assessments and appraisal methods (Carletto, Zezza, and Banerjee 2013).

However, unlike household diet diversity indicators, the food insecurity scales and the CSI have been validated to predict food vulnerability (Carletto, Zezza, and Banerjee 2013). That is, these indicators can predict pending food insecurity as opposed to providing only an immediate snapshot of what foods households were accessing at the time of the survey.

2.4—Assessing gender, household decisionmaking, and empowerment

Women within a household are more likely than men to influence the nutrition outcomes of their family members due to their roles as primary caretakers and mothers. Consequently, agricultural interventions that include an emphasis on women's empowerment generally have proven to be more effective at improving nutrition than approaches that do not (Hawkes and Ruel 2007). Conversely, women's nutritional status and control over assets are important for improving agricultural productivity and investment (Meinzen-Dick et al. 2011). As such, measuring women's empowerment and decisionmaking power is considered an essential requirement for understanding the linkages between agriculture, food security, and nutrition (Quisumbing et al. 2014; van den Bold, Quisumbing, and Gillespie 2013).

Women's empowerment is best viewed as a process and thus is often assessed in terms of improvements in decisionmaking power over time. Proxies for decisionmaking power include women's income, education, and assets (Malapit and Quisumbing 2014). Assets can include physical assets, such as jewellery and livestock, or social assets, such as group membership. Direct indicators of empowerment and decisionmaking power include questions regarding how the earnings of the woman and her husband are spent, how much the woman earns relative to her husband, whether she owns or

co-owns land or a house, and who makes decisions concerning the woman's health care, major purchases, and visits to family (Heckert and Fabic 2013). In the context of nationally-representative surveys, these questions are primarily asked to one female in each household.

The Women's Empowerment in Agriculture Index (WEAI)—developed by IFPRI and currently used in USAID's Feed the Future projects in Malawi and elsewhere—attempts to collate multiple angles of women's empowerment as it relates to productive realms of women's empowerment (IFPRI 2012). The WEAI is a composite empowerment score, comprised of standardized questions posed to the primary male and female decision makers across the following domains: input into agricultural production decisions; autonomy in production; ownership of assets; purchases, sale, or transfer of assets; access to and decisions on credit; control over the use of income; group membership, public speaking, and other leadership activities; existence of leisure time; and workload. To date, WEIA interviews provide one of the most comprehensive data sources for assessing women's empowerment and how it relates to agriculture, food security, and nutrition outcomes.

Some challenges arise in making use of the WEAI and related women's empowerment indicators, however. First, proxies of empowerment can be viewed as either drivers or indicators of empowerment, creating a chicken-or-egg effect that creates ambiguity in interpretation. Second, indicators must be adapted to—or validated for—the specific social and cultural context in which the interviews take place (Heckert and Fabic 2013). Finally, gender-disaggregated requirements limit the usefulness of some data sources. For instance, while many surveys, such as the IHS, document aspects of gendered farm decisionmaking and who within a household is involved in various economic activities of the household, this information is generally obtained from a single household respondent. The gold standard for gaining insights into the effects of gender on various household and individual outcomes, including nutrition, is to interview both men and women within each sample household of a survey. This is uncommon for agricultural surveys.

2.5—Assessing agricultural production, productivity and diversification

Unlike nutrition and food security indicators—many of which have been rigorously validated—metrics for assessing agricultural production, productivity, and diversification are often best considered as theoretical proxies. As such the discussion below differs somewhat from the sections above. More detail is provided regarding data sources and the theoretical underpinnings of these indicators, while less is provided regarding validation and construction.

2.5.1—AGRICULTURAL PRODUCTION: CROPS

The most commonly used agricultural indicators are those pertaining to production of crops or livestock. Because of the cereal-centric nature of agriculture and food preferences in Malawi and many other countries, crop production estimates typically receive more attention than livestock production estimates. Crop yields are usually defined as output per unit of land—typically metric tons per hectare. Estimates can be aggregated to district or national levels, or assessed at the household or farm level.

Crop production estimates are based on a sample of farmer interviews conducted in order to ascertain yields using a variety of methods with varying degrees of accuracy. The most common approach is to rely on government agricultural extension workers—typically from the Ministry of Agriculture or similar agency— to provide estimates of crop yields. These plot-level production statistics are then aggregated up to district or national level. In Malawi, the Agricultural Production Estimates Survey (APES) of the Ministry of Agriculture, Irrigation, and Water Development (MoAIWD) produces three rounds of crop estimates annually. While estimates from extension officers are perhaps the easiest way to collect yield data, they are also considered highly subject to measurement error, given that they usually rely on informal interviews with farmers and local communities (Jayne and Rashid, 2010, 2). Ministerial crop estimates also tend to be vulnerable to upward or downward revision for political reasons.

Alternatively, detailed, nationally-representative data on crop land allocation, crop production, and crop sales can be captured through household surveys, such as Malawi's IHS or the less-frequent and less-detailed National Census of Agriculture and Livestock (NACAL). In Malawi, these surveys are implemented by the National Statistical Office (NSO) and may be more accurate than the annual crop estimates both because of the more accurate methods used and because the likelihood of political interference is lower.

2.5.2—AGRICULTURAL PRODUCTION: LIVESTOCK

Both crop forecast surveys and household surveys often collect data on livestock ownership. In some cases, data collected by household surveys may be quite detailed, capturing information on current livestock ownership and stock changes due to new births, purchases, sales, theft, or consumption over a 12 month period. Specific indicators include whether or not a family owns any livestock, which and how many species they own, and type or amount of animal products (for example, milk, eggs, meat, honey) produced by the household.

One convenient way of quantifying ownership of a wide range of different livestock types in a standardized manner is to convert numbers to equivalent tropical livestock units (TLU). For example, relative to a cow of 250 kilogram (with TLU = 1.0) a sheep or goat weighing 30kg will have a TLU = 0.2. The exchange ratio is based on the concept of metabolic weight (that is, energy expenditure per unit of body weight per of unit time) and the fact that smaller animals produce more heat and consume more food per unit of body size.[8] This conversion can be done in Malawi with both the NACAL and the IHS datasets.

2.5.3—CROP DIVERSIFICATION

The term agricultural diversification broadly relates to the concept of allocating resources (inputs) across an increasing number of agriculture-related activities. The concept can be applied at the farm, district, or country level. Crop diversification, more narrowly, refers to the idea of not only increasing the number of crops (or varieties) that are grown, but also to how equitably land is allocated across those crops. Crop diversification is seen as an approach towards broad-based agricultural development and an important risk-management strategy for farm households, especially in a country like Malawi that relies heavily on a limited range of rain-fed food crops, yet faces significant weather challenges in the short run (Devereux 2007).

The most commonly used indicator of crude crop diversity, that is, how many crops or varieties are being grown, is a simple crop count. However a number of indices, including the Herfindahl–Hirschman Index (HHI) and the Simpson Index of Diversification (SID), are often used with or instead of these simple counts to assess not only the number of crops grown, but also the share of land allocated to each (Minot et al. 2006; Joshi et al. 2003). The SID, for example, equals zero under complete specialization indicating that all land is allocated to one crop. Theoretically, it approaches one under increased diversification indicating that a very large number of crops are being grown under equitable land allocation.

From a nutrition perspective, it is important to note that that studies in Kenya, Malawi, Uganda, and Rwanda have found that agricultural systems with greater agrobiodiversity are associated with greater dietary diversity at village and farm levels (Herforth, 2010; Remans et al., 2011). For the studies in Malawi, Uganda, and Rwanda, an indicator of biodiversity—functional diversity—was used to assess the association between the number of crops cultivated per farm and the diversity of nutrients available to household members (Remans et al. 2011).

2.5.4—AGRICULTURAL PRODUCTIVITY

The rate of production for given inputs is described as productivity. In a context like Malawi's where

[8] See http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Mixed1/TLU.htm.

land is scarce and productive inputs, like fertilizer, are expensive, productivity per unit of land, unit of labor, kilogram of fertilizer, or other input into agricultural production is often discussed. Raising productivity through adoption of improved farming techniques or technological innovation—such as small-scale irrigation or sustainable-intensification approaches—is seen as an important strategy for improving food availability. Increased productivity may also be associated with increased farm profits and household income, which in the presence of reliable food markets can improve access to food. Indicators of productivity generally are derived using the same agricultural production data sources as were highlighted earlier in this section.

2.6—Assessing market access, market participation, food prices, and seasonality

2.6.1—MARKET ACCESS AND PARTICIPATION

The degree to which households participate in or have access to markets is relevant to food security and nutrition outcomes. Households may engage either as sellers of their own produce, buyers of food available in local markets, or both. The latter typically includes farm households that sell produce with the intent to buy foods that they do not produce themselves. Because sales often take place via third-party traders who typically take agricultural commodities from areas of supply to areas of demand, households will not necessarily have access to markets where nutritious foods are sold.

Market access is often assessed in terms of a household's physical proximity to markets. Specific indicators include the distance to roads, traveling time to markets, and cost of transportation. Market participation is most simply defined as whether or not a farm household sells its crops and livestock products for money.

Household surveys often collect detailed information about market access and participation. For example, the agricultural questionnaire in Malawi's IHS captures information about the quantity and value of crop sales, including the place of sale (farm gate or local market) and the cost of transport to that place of sale.

These data can be combined with additional data collected by household surveys, including the quality of the local road network; access to or distance to daily (local) or weekly (regional) markets; access or distance to parastatal market depots (ADMARC); and presence of traders in the community. Taken together, this information can be used to paint a detailed picture about farm households' access to and participation in markets.

With respect to what foods households are buying, household surveys may also include questions about the source of foods that are reported eaten. Categories of sources typically include *own produce*, *gifts*, or *purchases*. Although data on where foods are purchased is not usually captured, the aforementioned information on availability and distance to markets permits inference of likely sources for purchased foods.

2.6.2—FOOD PRICES AND SEASONALITY

Food price volatility is most commonly measured by the coefficient of variation (CV), a standardized indicator of the degree to which a commodity's price in a particular market diverges from the mean regional or global price of that commodity. In this sense, the CV can be said to measure the price transmission of a particular commodity from international to domestic markets.

In addition to whether local food prices transmit or reflect regional and global prices, national and sub-national market characteristics are also relevant to households' access to food. These include the cost of transporting food to markets, usually measured by road infrastructure and fuel costs; the ratio of buyers and sellers to producers; whether markets are connected or isolated from each other in terms of geographical access and in terms of price alignment; and the presence or absence of government policies which intervene in the market, such as setting price ceilings or floors for specific foods or implementing export bans on particular commodities.

In contexts like that of Malawi, where high transport costs and few buyers and sellers relative to the number of producers cause markets to be very thin, prices are highly volatile.[9] This volatility often results in unpredictable and highly seasonal food prices which have significant implications for food security. Indicators of seasonality in food prices are typically constructed using household-level food consumption and food price data. In cases where seasonality has an adverse effect, the relationship between the food consumption and price levels will be inverse. This reflects a typical cycle of selling at a time when prices in the market are low, but when household cash needs are high, such as just after the harvest, then buying at times of high prices when household food stocks dwindle and the next harvest has not yet arrived. This vicious circle has been well documented in Malawi (Kaminski et al. 2014; Jayne et al. 2010).

2.7—Addressing the "Data Disconnect" – Opportunities for Malawi

As discussed throughout this chapter, indicators of food security and nutrition are the primary outcomes of interest when assessing the agriculture–nutrition nexus. However, as discussed earlier, household-level indicators stop short of estimating individual diet or nutrition outcomes, thus preventing assessment of the final frontier of utilization. In contrast, anthropometric indicators provide excellent estimates of how individuals are utilizing nutrients. Unfortunately, in so doing, they make it impossible to distinguish between what proportion of undernutrition is caused by health considerations such as infection and what is caused by food accessibility and subsequent dietary intake.

Given these limitations, it is individual diets in key population groups that should be considered the key outcome when assessing agriculture–nutrition linkages. The IYCDDS and WDDS are currently considered the best options for accurately measuring individual food intake in a non-invasive, inexpensive, and efficient way (Leroy, Ruel, Frongillo, Harris, and Ballard, forthcoming). Both indicators include cut-offs and use a standardized questionnaire (although adaptation to local contexts is required for the latter), thus facilitating inter-country implementation and comparability of results. Dietary recall is also a good option for measuring diets, but such surveys are more time consuming and costly. Anthropometric outcomes are best considered when examining health and sanitation dimensions, in addition to agriculture.

This clear analytical imperative to collect individual diet-quality information is significantly constrained by what is commonly referred to as the agriculture and nutrition data disconnect. This fracture occurs because of long-standing divides between agriculture and health in commonly-collected nationally-representative data sources. In Malawi, as in many other countries, agricultural data are usually not available in the same datasets as individual diet, women's empowerment, and nutrition outcome indicators. There are analytical approaches to overcome some of these constraints by bringing into a single analysis at a more general scale of analysis than the individual or household – an example of this using the results of the IHS3 with those of the DHS is shown in Text Box 2.1 following this chapter. Nonetheless, agriculture–nutrition analyses are consistently hamstrung by lack of appropriate, integrated data resources. While justifiable from a sectoral perspective, the disconnect results in there generally being no reliable data sources that provide information on diet and nutrition outcomes *as well as* agricultural production practices, market access, food prices, women's empowerment, and all the other indicator areas required to trace the full trajectory of a causal pathway from agriculture to nutrition outcomes for individuals.

That said, there are instruments that hold considerable potential for the systematic collection of data on standardized livelihood or agricultural production practices, food security, and, in some cases, nutrition (Carletto et al. 2013). In Malawi, many of these instruments already exist. Table 2.1 provides an overview of the country's key large-scale data sources that provide such complementary data in a systematic manner.

[9] Only about one-in-six maize farmers sell any maize (Jayne et al. 2010).

Table 2.1—Data sources across nutrition pathways: Options in Malawi

Data sources	Domain					
	Food Systems/ Markets	Agriculture	Food security (availability & access)	Women's empowerment	Individual diets	Individual nutrition outcomes
Demographic and Health Survey (DHS)				– Empowerment – Decisionmaking	– WDDS, IYCDDS – Dietary recall	– Anthropometry
Integrated Household Survey (IHS)	– Seasonality – Market access – Food prices	– Crop & livestock production – Crop diversification	– HDDS – MsHDDS – HH Micro-nutrient Access			– Anthropometry [10]
Women's Empowerment in Agriculture (WEIA)			– Household Hunger Scale	– Empowerment – Decisionmaking	– WDDS	– Anthropometry (women)
Agricultural Production Estimates Survey (APES)		– Crop production				
Agricultural Market Estimates Survey (AMES)	– Market integration – Seasonality – Food prices					
National Census of Agriculture and Livestock (NACAL)	– Market access	– Crop & livestock production – Tropical livestock units				

Source: Authors compilation.

Of all the surveys listed in Table 2.1, the data collection instrument with the highest potential for assessing agriculture–nutrition linkages is the Integrated Household Survey series. These surveys cover multiple sectors – the last wave collected information on household food consumption, crops grown using rain-fed and *dimba* wetland cultivation, crop sales, livestock ownership and sales, child anthropometry, and food prices. The advantage of these surveys over APES and DHS data is that agricultural production data are easily merged with detailed consumption data (including from own produce or purchased foods) and child nutrition indicators at the household level, bridging the data disconnect and facilitating analysis of agriculture–nutrition linkages.

However, even while the IHS covers an impressively high number of relevant indicators, it still fails to collect data on individual diet patterns, the intermediary between agriculture and food and nutrition outcomes. Furthermore, the quality of IHS anthropometrics have been called into question as recent figures differ significantly from those in the DHS, the traditional source of nutrition indicators for the population of Malawi (Verduzco-Gallo, Ecker, and Pauw 2014).

While substantial retrofitting of the IHS is not practical, the addition of a simple measure of individual diet – such as the WDDS, which is especially valuable given its focus on women – and improvements to the quality of the anthropometric measurements would make the IHS a powerful tool for unpacking how agriculture in Malawi links to food security and nutrition outcomes. Such dietary diversity indicators can be constructed based on an easy-to-administer questionnaire that can be completed quickly by enumerators and at relatively low cost. Creating incentives to include this type of a module in the questionnaire for Malawi's IHS surveys could facilitate more thoughtful and robust research on the agriculture–nutrition nexus.

[10] As discussed above, the Integrated Household Survey, which is the primary household socioeconomic and agricultural data source for Malawi, does include anthropometrics, but the accuracy of these data is in question.

Box 2.1—Agricultural correlates of aggregate nutritional outcomes in Malawi: A district-level rank analysis

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Obtaining empirical evidence on the relative importance of agriculture for the nutritional status of individuals is difficult. Most datasets that shed light on nutrition outcomes provide limited information on agricultural livelihoods. Here we take advantage of the fact that the 2010 Demographic and Health Survey for Malawi (NSO & ICF Macro 2011) used comparable survey strata to that of the third Malawi Integrated Household Survey (NSO 2012), a survey conducted in 2010–2011 that collected extensive information on agricultural production. While the surveys sampled different households and individuals, the results of both are representative at the district level. Using a non-parametric rank correlation approach, we use district-level results from the surveys to examine whether there are any associations between the prevalence of stunted children (low height-for-age z-scores [HAZ]) and of thin women (Body Mass Index below 18.5 kg/m^2) in the districts of Malawi (see Figure 1.1) and selected district aggregate characteristics of agricultural production. We then extend our analysis to examine other possible non-agricultural determinants of nutritional status.

Our dataset consisted of 27 cases corresponding to the 27 districts of Malawi covered by the two surveys. This small set of cases limits the sorts of statistical analyses we can use. Moreover, our analysis is based on aggregate statistics. As nutritional status is a characteristic of individuals, information on how nutritional status varies within the population is lost when one uses aggregate statistics. Similar information is also lost on the distribution of the factors examined as potential determinants of those nutritional outcomes. As no assumptions can be made about the distribution of these variables within the population, we must use a non-parametric approach to gain insights from these district-level statistics.

Here we use a rank correlation analysis. This quantifies the degree of similarity between the rankings of two variables across cases in order to assess whether there is any significant relation between the variables. We examine whether the ranking of nutritional outcomes by district is similar to the ranking of any agricultural factors by district, either positively or negatively. Where association in the ranking is seen, this indicates the potential existence of a causal relationship between the agriculture and nutrition variables and may merit further study. Where the absolute value of the Kendall's statistic for rank correlations are between 0.1 and 0.3, we consider this association worthy of note, while associations with a coefficient above 0.3 are judged to merit even closer examination.

Potentially important agricultural and non-agricultural determinants of nutrition outcomes were identified for the analysis. Primarily using data from the two surveys, we computed district-level statistics for 10 potential agricultural determinants and about 20 potential non-agricultural determinants for the analysis. The non-agricultural determinants were categorized into several groups, including diet, gender, health, and welfare.

The rank correlation analysis results for the agricultural factors are shown in Table B2.1. Relatively limited associations are seen, suggesting that direct relationships between agricultural activities and nutritional outcomes in Malawi are relatively weak. Moreover, the strongest associations run counter to expectations— for example, more district residents engaging in cropping activities is associated with a greater prevalence of thin women. Of the other agriculture–nutrition associations considered, a few are encouraging, such as for livestock and tobacco. Greater average agricultural sales in a district also are associated with improved nutritional outcomes. However, unfavorable or no associations are observed with several other district-level agricultural factors, including for irrigation intensity, district maize yield levels, horticultural production, and the number of crops grown or sold by district households. These contrary or insignificant associations signal that the relationship between all dimensions of strengthened agricultural livelihoods and nutritional outcomes in Malawi will not always be positive or benign.

Table B2.1—Strength of rank correlations between potential agricultural determinants of nutrition outcomes and those outcomes, rank correlation coefficient, district-level aggregate data, Malawi, 2010

Variable	Stunted children	Thin women
Households engaged in crop production, %	0.13	**0.36**
Landholding size, ha/hh	*ns*	*ns*
Livestock ownership, TLU per hh	-0.14	*ns*
Irrigation prevalence, % hh	0.14	*ns*
Maize yield, kg/ha	*ns*	*ns*
Tobacco production prevalence, % hh	-0.15	-0.11
Horticulture production prevalence, % hh	*ns*	*ns*
Number of crops grown per hh	*ns*	*ns*
Number of agricultural products sold per hh	*ns*	*ns*
Per capita gross agricultural sales, MK thousands	-0.12	-0.13

Source: Author's analysis of DHS (NSO 2011) and IHS (NSO 2012) datasets.

Note: Kendall's rank correlation coefficients with an absolute value less than 0.1 are judged to indicate an insignificant association between the variables and are not reported. Coefficients with an absolute value greater than 0.3 are associations that are judged to merit closer examination, so are bolded.
ns = not significant.

Table B2.2 extends the rank correlation analysis to examine associations between district-level nutritional outcomes and potential non-agricultural determinants of those outcomes. For factors related to food access, districts with higher calorie consumption per capita and greater dietary diversity show lower levels of child stunting and thin women, while those in which a higher proportion of surveyed households reported inadequate food consumption tend to have higher levels of malnutrition.

Table B2.2—Strength of rank correlations between potential nonagricultural determinants of nutrition outcomes and those outcomes, rank correlation coefficient, district-level aggregate data, Malawi, 2010

Variable type	Variable	Stunted children	Thin women
Food access	Calorie consumption per capita/day	-0.12	**-0.30**
	Dietary diversity index (HDDS - 12 food groups)	-0.16	**-0.36**
	Households report inadequate food past month, %	0.18	*ns*
Gender; empowerment of women	Female head of household, % hh	0.17	**0.32**
	Married head of household, % hh	-0.19	-0.30
	Highest level of schooling - women aged 15-49, median years	-0.17	-0.27
	Difference between men & women in years schooling completed	0.13	0.19
	Married women who decide on purchases for daily needs, %	**-0.32**	-0.21
	Married women who do not participate in household decisions, %	0.17	0.13
Health & public health	Drinking water - improved source, % population	-0.23	0.17
	Improved household sanitation facilities, % population	*ns*	-0.11
	Member had an illness in previous 2 weeks, % hh	0.10	*ns*
Welfare	Per capita annual household non-farm income, MK thousands	-0.21	-0.18
	Per capita annual total real expenditure, MK thousands	-0.13	**-0.31**
	Individual poverty headcount, % below the poverty line	0.15	0.29

Source: Author's analysis of IHS (NSO 2012) and DHS (NSO and ICF Macro 2011) datasets and spatial data from Malawi.

Note: Kendall's rank correlation coefficients with an absolute value less than 0.1 are judged to indicate an insignificant association between the variables and are not reported. Coefficients with an absolute value greater than 0.3 are associations that are judged to merit closer examination, so are bolded. Negative association (green bars) indicate improvements in nutritional status, while positive values (red bars) indicate deterioration.
ns = not significant.

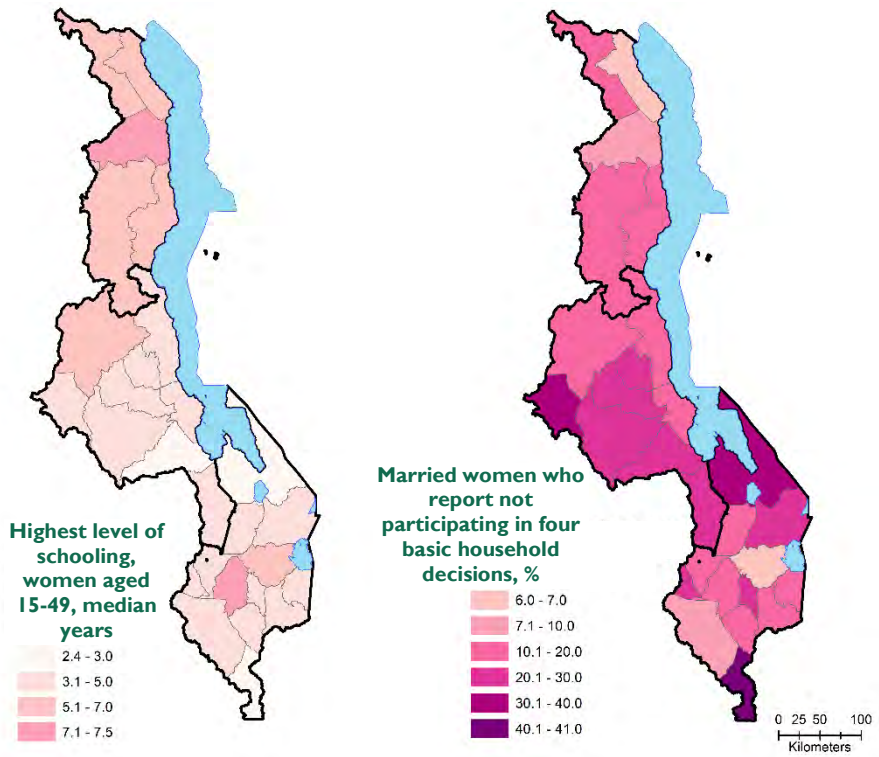
The strongest positive associations with nutritional outcomes are for the gender variables. Higher average educational attainment levels for women are strongly associated with lower district averages for the nutritional indicators considered—a strongly beneficial relationship (Figure B2.1). Moreover, larger average differences between men and women in their educational attainment are

associated with worse average nutritional outcomes at the district level. Similarly, women's participation in decisionmaking within the household demonstrates that greater women's empowerment in these decisions is associated with the reduced prevalence of stunted children and of thin women. In districts in which women are more often excluded from such decisions, average malnutrition levels are higher.

Health factors do not provide as strong associations with those outcomes as do the diet and gender variables considered, and the nature of some associations are counter to expectations. For example, better access to safe water are associated with lower child stunting levels, as expected, but also with a higher prevalence of thin women. In contrast, the associations observed for the variables in the welfare category are consistent with expectations—higher levels of nonfarm income and expenditures are associated with lower levels of malnutrition, while higher poverty levels are associated with increases in those levels.

While the principal motivation for this analysis was to gain additional understanding of how agricultural factors may contribute to nutritional outcomes, relatively limited associations were seen, suggesting that direct relationships between agricultural activities and nutritional outcomes in Malawi are relatively weak. Moreover, the nature of several of the associations examined run contrary to expectations, suggesting more complex relationships between strengthened agricultural livelihoods and nutritional outcomes in Malawi than we might expect. When we extended the analysis, non-agricultural potential determinants of nutritional status showed somewhat stronger associations—particularly for gender factors.

Figure B2.1— Women aged 15 to 49 years, median highest level of schooling attained and proportion reporting not participating in household decisions, by district, Malawi 2010



Source: Analysis of DHS data by M. Kedir, IFPRI.

The broader insight obtained from this study is that the pathways through which agriculture can lead to nutritional improvement in Malawi are indirect. A broader range of equally necessary determinants of improved nutrition must be in place if significant reductions in malnutrition are to be achieved. In considering these results, however, this analysis must be treated as exploratory. More detailed examinations of any associations of interest using individual and household-level data are required. Nonetheless, the district analysis presented here demonstrates that there are methods that

can be used with somewhat coarse and seemingly incompatible data on nutrition status and its potential determinants to skirt around the agriculture and nutrition data disconnect discussed in Chapter 2 and build a better understanding of how agricultural activities can serve to improve nutrition in Malawi.

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CHAPTER 3 : POVERTY, FOOD PRICES, AND DIETARY CHOICES IN MALAWI

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The links between household income growth, household food security, and individual dietary outcomes are complex. While we expect higher incomes to lead to an increase in the quantity and quality of foods accessed by the household—particularly in a resource-constrained context like Malawi—other considerations, such as the allocation in household budgets for non-food items and the relative prices of nutrient-dense food items, will also influence what people eat.

In this chapter we analyze Malawi's recent food consumption trends, including per capita calorie and micronutrient-consumption estimates, and reflect on how these pertain to (1) changes in poverty and household income, and (2) relative changes in food prices. In so doing, we extract from a detailed analysis of household food consumption (Verduzco-Gallo, Ecker, and Pauw 2014) and from an assessment of recent poverty trends (Pauw, Beck, and Mussa 2014). Both these studies draw on the two latest rounds of Malawi's nationally-representative Integrated Household Surveys (IHS2 and IHS3) collected in 2004–2005 and 2010–2011 (NSO 2005; 2012b).

Although in economics, the term "consumption" usually refers to the monetary value of expenditure on goods and services or both, the food consumption modules of the IHS questionnaire specifically ask respondents to report quantities and values of food actually consumed by household members during a seven-day recall period. The interpretation of consumption in this study is therefore closer to the way nutritionists understand consumption—what people eat and ingest. Although, being a household survey, we cannot comment on the allocation of food among household members or make statements about the bioavailability of food consumed.

Malawian woman selling legumes in a Lilongwe market

Our results indicate that while income poverty appears to have decreased between 2004–2005 and 2010–2011 on average, substantial disparities remain and are indeed increasing, with the richest quintile of the population of Malawi becoming disproportionately better off, and the poorest of the poor becoming even worse off, a trend that may well shape nutritional outcomes in the future. In addition, results show that households are generally allocating a larger share of their budgets to food than they did in the past, in spite of rising incomes. And while the country as a whole is consuming more of some nutrient-rich foods, such as white meat, vegetable consumption had decreased, which is likely to exacerbate micronutrient malnutrition.

3.1—Reassessing Malawi's Poverty Estimates

Malawi is ranked the third poorest country in the world. In 2010, GDP per capita was US$780 compared to figures of between US$1,105 and $3,925 in neighboring Mozambique, Tanzania, Kenya, and Zambia (World Bank 2015). However, Malawi also recorded record levels of economic growth between 2005 and 2011. During this period, national GDP growth averaged 7.1 percent annually (NSO 2012a). This translates to increases in per capita GDP of around 3.1 percent. While there were high expectations that growth would be accompanied by rapid poverty reduction, the

official narrative is that this was not the case. Malawi's National Statistics Office (NSO) reports that the national headcount poverty rate—defined as the share of the population with consumption below a poverty line that reflects the cost of a basket of essential nonfood items plus food that yields sufficient calories—declined only marginally, from 52.4 to 50.7 percent, over the period. Moreover, rural poverty reportedly *rose,* albeit by a statistically insignificant 0.7 percentage points (NSO 2005, 2012b).

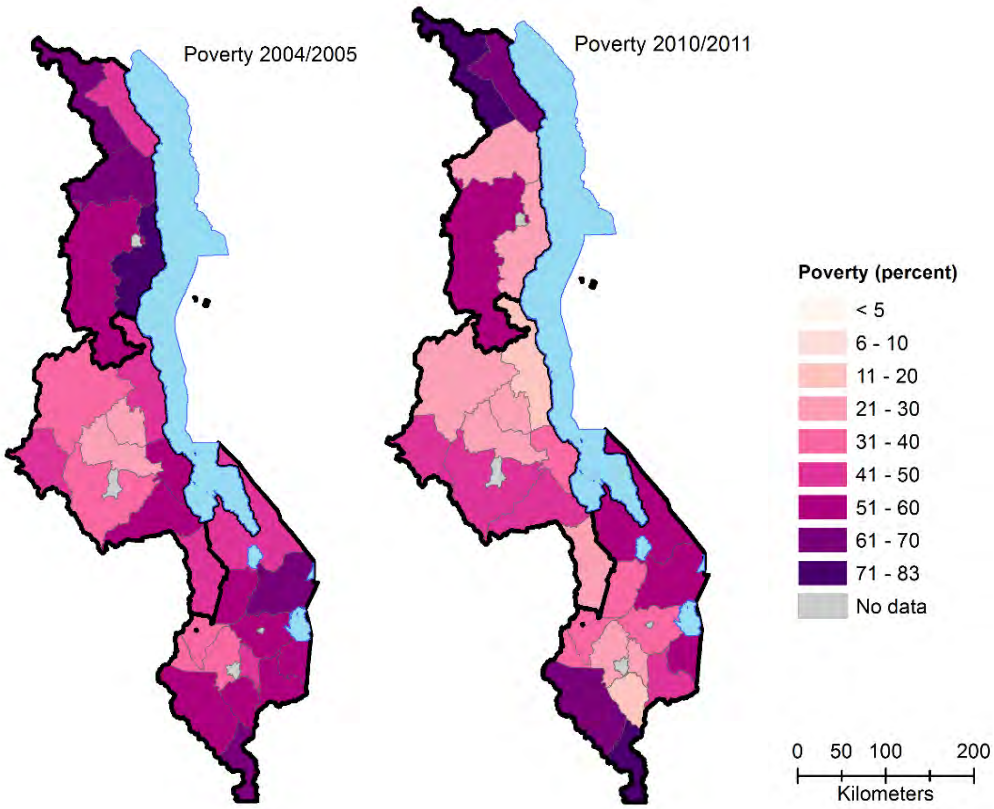
However, recent findings from Pauw, Beck, and Mussa (2014) reflect a somewhat different story. Overall, they estimate a much larger decline in national poverty than NSO found from 47.0 to 38.8 percent (that is, –8.2 percentage points). Per Table 3.1, this includes a large decline in urban poverty consistent with the NSO estimates, but a substantial 7.4 percentage point reduction in rural poverty, which stands in sharp contrast to the 0.7 percentage point increase estimated by NSO. Figure 3.2 maps the district-level poverty rates for Malawi in 2004-2005 and 2010-2011, based on estimates by Pauw, Beck, and Mussa (2014). It is apparent that the incidence of poverty is highest in the northern and southern regions, particularly in the more remote districts or those along the lake shore, but these regions have also seen the greatest declines in poverty over the period.

Table 3.1— Alternative poverty estimates for Malawi: 2004–2005 to 2010–2011

	Poverty headcount rate (%)				Percentage point change & 95% confidence intervals	
	2004/05 (IHS2)		2010/11 (IHS3)			
	Pauw et al.	NSO	Pauw et al.	NSO	Pauw et al.	NSO
Normal (food plus nonfood) poverty line						
National	47.0	52.4	38.8	50.7	-8.2 ± 2.8	-1.7 ± 2.4
Urban	37.6	25.4	27.4	17.3	-10.2 ± 9.4	-8.1 ± 6.8
Rural	48.2	55.9	40.8	56.6	-7.4 ± 2.9	0.7 ± 1.4
Extreme (food only) poverty line						
National	17.1	22.3	17.9	24.5	0.9 ± 2.0	2.1 ± 2.2
Urban	9.0	7.5	4.7	4.3	-4.2 ± 3.6	-3.2 ± 3.4
Rural	18.1	24.2	20.3	28.1	2.2 ± 2.2	3.9 ± 2.4

Source: Pauw, Beck, and Mussa (2014) and NSO (2005, 2012b).

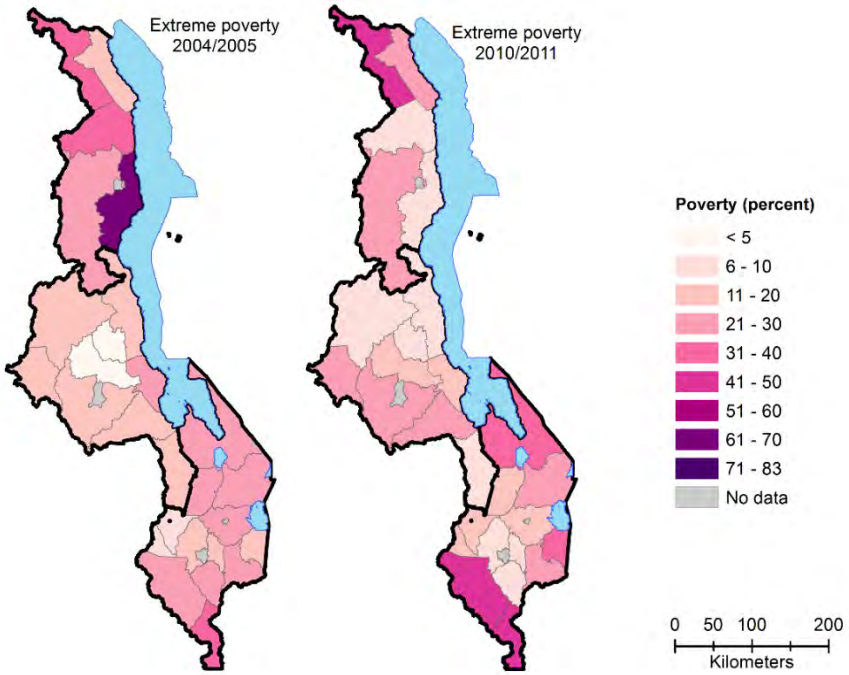
Figure 3.1—Alternative poverty headcount estimates for Malawi, by district, 2004–2005 and 2010–2011



Source: Analysis by M. Kedir, IFPRI, of alternative poverty analysis of IHS2 and IHS3 data (Pauw, Beck, and Mussa 2014).

With respect to extreme poverty (that is, share of the population with consumption below the food-only component of the poverty line), Pauw, Beck, and Mussa's figures are consistent with those of NSO in terms of the direction of change, in that both estimates indicate an increase. Although the magnitude of change is smaller in Pauw, Beck, and Mussa's findings, the fact that both analyses document a rise supports the claim that the most vulnerable Malawians were excluded from the benefits of growth between 2005 and 2011. For example, Malawi's Farm Input Subsidy Program (FISP) has been documented as being less effective in targeting the poorest of the poor (Chibwana et al. 2014); the consumption level of most recipients of the subsidy is more likely closer to the poverty line than to the extreme poverty line. Figure 3.2 shows the district-level extreme poverty rates, also based on Pauw, Beck, and Mussa (2014).

Figure 3.2—Alternative extreme poverty headcount estimates for Malawi, by district, 2004–2005 and 2010–2011



Source: Analysis by M. Kedir, IFPRI, of alternative poverty analysis of IHS2 and IHS3 data (Pauw, Beck, and Mussa 2014).

This rise in extreme rural poverty is a contributing factor to rising inequality in Malawi. Not only are the richest becoming disproportionately better off, but the poorest of the poor are becoming even worse off, a trend that may well shape nutritional outcomes in the future.

3.2—Does Increased Income Translate to Improved Food Security?

3.2.1—SHIFTS IN FOOD AND NONFOOD SPENDING

Given that the national-accounts data of NSO suggest that GDP per capita rose by 3.5 percent annually from 2005 to 2011, the expectation is that household expenditures would also rise. IFPRI's analysis of the IHS data from the same period confirms these expectations, showing average expenditure growth to have been around 2.2 percent per capita annually after adjusting for inflation (Pauw, Beck, and Mussa 2014).

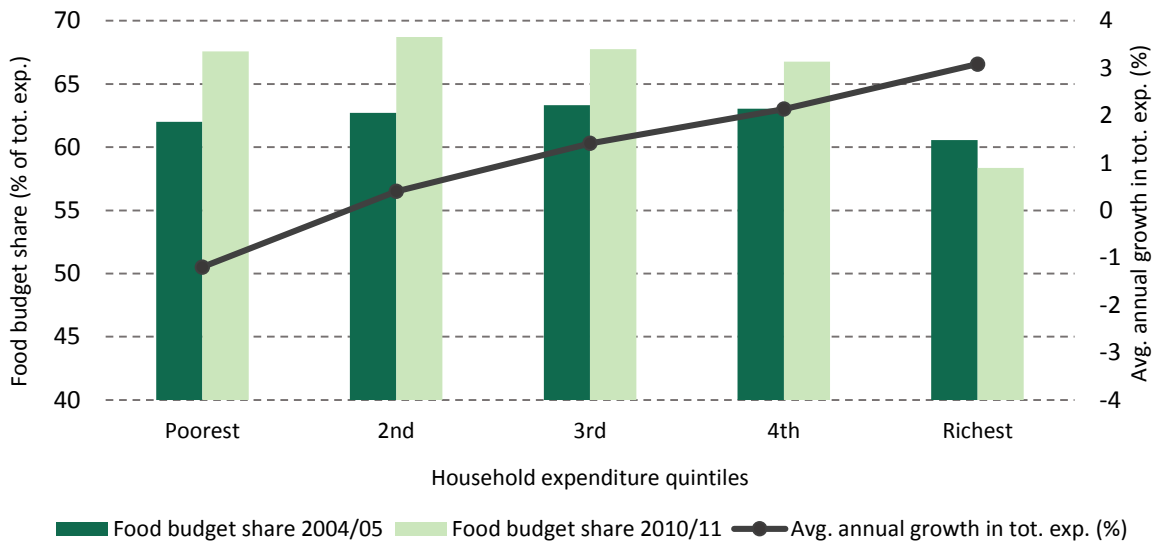
While we would also expect a rise in income to result in households spending a smaller share of their budget on food, Pauw, Beck, and Mussa (2014) find that most households actually spent a *greater* share of their incomes on food in 2011 than in 2004. On average, household food expenditures increased slightly from 61.7 to 62.6 percent between 2004 and 2011. While we might expect this scenario for the poorest quintile who were likely not able to afford to meet their basic food needs despite substantial growth, per Figure 3.3, the second, third, and fourth quintiles also increased food budget expenditures. It was only the richest income quintile that spent a smaller share of income on food.

A closer look at relative food and non-food inflation rates may help explain this outcome. Using prices underlying their estimated poverty lines, Pauw, Beck and Mussa (2014) estimate a food inflation rate of 129.0 percent, a non-food inflation rate of 93.1 percent, and a national average inflation rate of 114.7 percent. The NSO's own estimates also reveal higher food inflation, although their overall inflation rate is slightly higher at 128.9 percent.

With relatively cheaper non-food items available, households were able to increase non-food expenditures without actually spending more. For example, household survey data reveals significant *declines* in the share of households reporting inadequate access to housing (–12.5 percent), health care (–27.5 percent), and clothing (–15.5 percent) between 2004 and 2011. In consequence, households were simultaneously able to spend more money on food. The question of interest,

discussed in the remaining sections of this chapter, is whether this shift in household budget allocation translated into shifts in what foods were purchased, and if so, what the nutritional implications of such changes may be.

Figure 3.3—Household food budget shares, by quintile: 2004–2005 and 2010–2011



Source: Authors' estimates based on IHS2 and IHS3 (NSO 2005, 2012b).

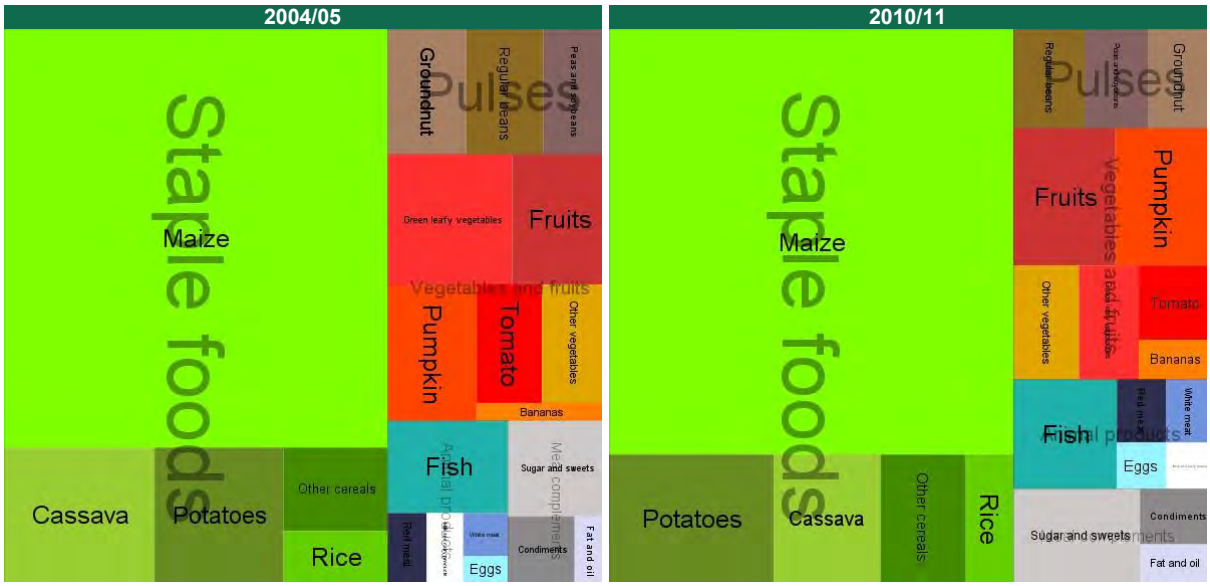
3.2.2—SHIFTS IN HOUSEHOLD FOOD CONSUMPTION PATTERNS

Before considering detailed household food consumption patterns, we first look at household dietary diversity, using IHS data to construct household dietary diversity scores (HDDS). As described in Chapter 2, HDDS is based on a simple counted score of 12 food groups constructed from recall data on household food consumption.

As expected, results indicate that HDDSs in Malawi tends to increase as incomes increase. Nationally, alongside the increase in average incomes, the average HDDS increased from 7.9 to 8.2 between 2004–2005 and 2010–2011. However, this national average masks substantial variation across income quintiles. In line with findings on extreme poverty, the poorest Malawians did not increase their HDDSs at all. There was actually a very marginal decline from 6.4 to 6.3. HDDSs increased across all other quintiles, but most markedly in the fourth (8.7 to 9.4). This is not surprising, as the HDDS for the wealthiest households will tend to increase at a slower rate than that of relatively poorer household groups for a given rate of income growth as the wealthiest are already closer to their optimum HDDS (see Swindale and Bilinsky 2006).

Regarding estimated consumption of specific food items, several important household food-consumption shifts appear to have occurred between 2004 and 2011. These shifts are shown graphically in Figure 3.4 for the country as a whole in terms of what share of the quantity (by weight) of food consumed came from what food sources. In both rural and urban areas, there was a substantial increase in the consumption of staple foods, namely rice and maize, the latter being already the most widely-consumed food crop. Overall consumption of maize, rice, fruit, and animal products increased in both rural and urban areas, while consumption of vegetables and cassava declined. Consumption of pulses declined sharply in rural areas, but increased in urban areas. Potato consumption also increased in urban areas.

Figure 3.4— Graphical representation of changes between 2004/05 and 2010/11 in the share of the quantity of food consumed in the average Malawian diet by food source



Source: Authors' estimates based on IHS2 and IHS3 (NSO 2005, 2012b).

3.3—Relating Food Consumption Shifts to Changing Food Prices

To better understand the shifts in household food consumption, we also estimate the daily per capita consumption of various foods and the change in consumption per day between 2004–2005 and 2010–2011. These estimates of average per capita availability of specific foods and food groups are based on household consumption data not individual diet data.

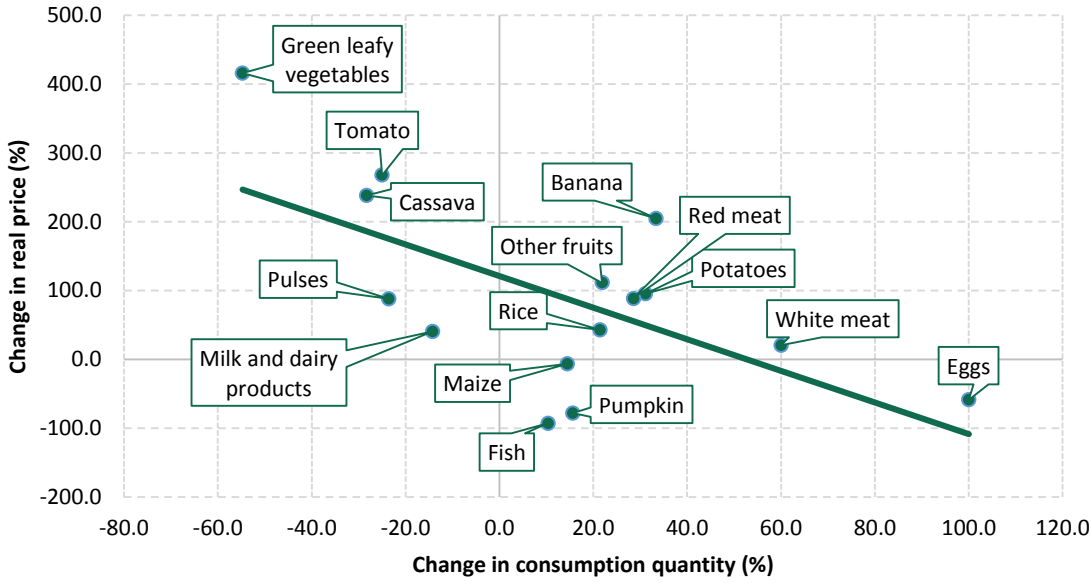
Figure 3.5 plots changes in the consumption levels of these foods (x-axis) against changes in their national median prices. While the figure disregards potentially significant regional price variations, it nevertheless conveys a powerful message of how, on average, price increases may explain decreases in consumption, as evidenced by the downward sloping fitted trend line. However, for a significant number of food items we see increases in consumption despite rising prices, including luxury items such as rice and meat. These results may reflect shifting preferences associated with rising welfare levels among wealthier households.

3.3.1—STAPLE FOODS

As incomes increase, households often substitute away from coarse grains (maize, barley, or sorghum) and starchy staples (potatoes or cassava) toward finer grains such as rice or wheat (Fuglie, 2004). However, in Malawi, our analysis indicates that maize consumption increased by 14 percent. This increase is significant in absolute terms given that maize already accounts for around two-thirds of all calories consumed in Malawi. The most likely explanation for this is the increase in maize supply under FISP, which coincided with a real decline in maize prices.

There was also a relatively sharp rise in potato consumption. The more detailed analysis reveals that this increase was driven mostly by rising potato consumption in urban areas.

Figure 3.5—Food consumption changes and relative price shifts: 2004–2005 to 2010–2011



Source: Authors' estimates based on IHS2 and IHS3 (NSO, 2005, 2012b).

Unlike maize and potatoes, the typical substitution response did seem to hold for cassava, for which consumption declined substantially. Cassava is traditionally a food crop for which demand rises when maize supply is low, and so ample maize harvests and stores during the period in question are perhaps one reason for the decline in cassava consumption. However, cassava prices also more than tripled during this period, which suggests the decrease in consumption may be as much due to a price effect as an income effect. Much of the price increase was likely due to increased demand for cassava as a commercial input for manufactured food and non-food products (see Kambewa 2010).

Finally, despite an increase in the price of rice, consumption rose by an estimated 21 percent. This pattern may be due to a strong consumer preference for rice, facilitated by increased purchasing power.

3.3.2—PULSES

The per capita decline in pulse consumption (24 percent) is likely also linked to increased prices (88 percent). However, it is important to note that this national decline in pulse consumption masks substantial difference in regional price changes—overall, rural pulse prices increased by 99 percent, while in urban areas they only increased by 47 percent. Moreover, when the data were disaggregated by variety, groundnut prices actually *declined* in urban areas, while peas and soyabean prices increased by only around 10 percent, compared to sharp increases in the prices of these particular varieties in rural areas. These regional price trends explain regional consumption behavior to some extent, namely substantial decreases in per capita pulse consumption among rural households, but a rise in urban pulse consumption (see Verduzco-Gallo et al. 2014 for details).

3.3.3—VEGETABLES AND FRUITS

Per capita consumption of fruit and pumpkin increased nationwide, while consumption of tomatoes and green leafy vegetables declined considerably. These consumption trends are fairly similar across rural and urban areas, with relative price shifts again providing a likely explanation for the changes: pumpkin prices declined by 82 percent; while tomato and leafy green prices rose sharply, by 264 and 412 percent, respectively. The one exception within this group was bananas and other fruit. Despite two- to three-fold increases in the price—admittedly from a relatively low level compared to, say, animal source foods—consumption increased fairly substantially. As with rice and meat products, this pattern may be due to strong consumer preferences for fruit, facilitated by increased purchasing power.

3.3.4—ANIMAL-SOURCE FOODS

Per capita consumption of white meat (mostly chicken) increased substantially—by 60 percent—nationwide. Nationwide consumption of red meat also increased, albeit less drastically than for chicken, by 29 percent. Importantly, prices for both these animal source foods also increased. White meat prices rose by 20 percent nationally, but declined in rural areas, possibly because of the availability of cheaper feed. In both rural and urban areas, red meat prices rose steeply and rose by 88 percent nationally. As with rice and fruit, it is likely that household increases in income combined with preferences for meat outweighed national average price increase, with the net effect being increased per capita consumption.

In contrast, price increases for milk and dairy products—41 percent—may have led to a concomitant decline in consumption of 14 percent. Egg consumption doubled, likely due to a substantial price decrease of around 58 percent.

Fish is an important part of the traditional Malawian diet, especially for communities near the lakeshore. Per capita fish consumption increased by 10 percent alongside a sharp 93 percent decline in fish prices. This outcome is somewhat surprising in the context of dwindling fish stocks in Lake Malawi (FAO 2013) and, indeed, the numbers change substantially when the data are separated into dried fish versus fresh. Disaggregation reveals an almost three-fold *increase* in the real price of fresh fish, and alongside that a decline in per capita fresh fish consumption. In contrast, per capita consumption of dried fish, some of which is imported from neighboring Tanzania and Mozambique, doubled alongside a significant decline in dried fish prices.

3.4—Nutritional Implications of Changes in per Capita Consumption of Specific Foods

To better understand how shifts in household food consumption impact diet quality, in the absence of individual dietary data, we approximate daily per-capita calorie and micronutrient intake given the foods and quantities accessed by the household. These per-capita estimates are then compared to the daily recommended intake requirements for household members to yield Household Micronutrient Access estimates. Estimates for average per-capita consumption of calories, iron, and vitamin A via these food groups are based on food composition tables from Kenya and Senegal and are shown in Table 3.2. (More details on this estimation process can be found in Chapter 2.)

3.4.1—CALORIES

The average Malawian household increased its per-capita consumption of calories by 4.6 percent between 2004—2005 and 2010—2011. Calorie consumption also increased across all income quintiles in both rural and urban areas. However, despite these increases, average estimated consumption among the poorest rural households remained below minimum calorie requirements.

In both rural and urban areas, the richest quintile recorded the largest increase in calories, despite already consuming calories well above required amounts. This trend is common in many other developing countries and is often considered as an early step in the nutrition transition. The nutrition transition is characterized by a shift away from relatively monotonous diets of varying nutritional quality toward an industrialized diet that is usually more varied and includes more processed food; more food of animal origin; more added sugar and fat; and often more alcohol. This transition is accompanied by a shift in the structure of occupations and leisure toward reduced physical activity and leads to a rapid increase in the prevalence of overweight and obese individuals, with implications for diet-related non-communicable diseases and their associated health care costs (Popkin 1994).

Table 3.2—Calorie and micronutrient consumption, by residence and consumption quintile (2004–2005 to 2010–2011)

	Calories (kcal/day)			Iron (mg/day)			Vitamin A (RE mcg/day)		
	2004–2005	2010–2011	*Change (%)*	2004–2005	2010–2011	*Change (%)*	2004–2005	2010–2011	*Change (%)*
Total	**2,204**	**2,305**	***4.6***	**20.0**	**19.5**	***-2.5***	**417**	**373**	***-10.6***
Rural	*2,176*	*2,232*	*2.6*	*20.2*	*19.5*	*-3.5*	*420*	*375*	*-10.7*
Poorest	1,387	1,441	*3.9*	13.5	13.8	*1.8*	304	219	*-27.9*
2nd	1,857	1,895	*2.1*	17.8	17.4	*-2.0*	379	303	*-20.0*
3rd	2,211	2,245	*1.6*	20.9	20.0	*-4.1*	427	392	*-8.2*
4th	2,632	2,642	*0.4*	24.3	22.6	*-7.3*	467	468	*0.1*
Richest	3,269	3,431	*5.0*	28.5	27.2	*-4.6*	592	586	*-1.0*
Urban	*2,423*	*2,704*	*11.6*	*18.4*	*19.5*	*6.3*	*393*	*360*	*-8.5*
Poorest	1,712	1,838	*7.3*	15.5	15.6	*0.6*	350	210	*-40.1*
2nd	2,104	2,387	*13.4*	17.6	18.7	*5.8*	365	311	*-14.8*
3rd	2,457	2,791	*13.6*	19.1	20.5	*7.3*	375	392	*4.5*
4th	2,752	3,157	*14.7*	19.7	21.4	*8.3*	446	463	*3.8*
Richest	3,385	3,867	*14.2*	21.0	23.6	*12.2*	451	503	*11.7*
Requirement	**1,701**	**1,728**	***1.6***	**17.2**	**17.5**	***1.7***	**375**	**380**	***1.3***

Source: Authors' estimates based on IHS2 and IHS3 (NSO 2005, 2012b).

3.4.2—IRON AND VITAMIN A

In urban areas, estimated changes in per-capita access to iron appear to have been income-dependent and in line with estimated increases in nationwide red meat consumption. However, this does not hold true for rural areas where, counterintuitively, the highest declines were in wealthier households. Only the poorest rural quintile increased access to iron, based on our estimates. With respect to non-heme (that is, plant based) iron, one partial explanation is the aforementioned decreased pulse consumption that occurred across income quintiles in rural areas due to rising rural pulse prices. However, this does not explain the distribution across quintiles. One possibility is increased consumption of dried fish. When consumed whole, dried fish are an excellent source of iron. Further, it is possible that this food product, which may be considered an inferior good relative to increasingly expensive fresh fish, is consumed primarily by poorer households, with positive implications for iron intake.

Nationwide, estimated vitamin A consumption deteriorated sharply during the period 2004–2005 to 2010–2011, especially among poorer urban and rural households whose consumption patterns appear more price-sensitive to the significant price increases. This trend is not consistent with the nationwide increase in fruit and pumpkin consumption, both of which are sources of vitamin A, and is congruent with national decreases in dairy product and leafy green consumption, also sources of vitamin A. With respect to the latter, a line of inquiry which remains unexplored is whether high horticulture prices are creating incentives for farmers to sell more of their vegetables, rather than retaining them for their own consumption.

3.4.3—ESTIMATED CALORIE AND MICRONUTRIENT SHORTFALLS

Table 3.3 reports on Household Micronutrient Access indicators for calories[11], iron, and vitamin A. Table 3.3 represent the share of households whose approximated calorie, vitamin A, and iron intakes are below the nutrient intake requirements of its members. The share of households whose consumption falls short of requirements is indicated for rural and urban areas and the country as a whole.

[11] While calories are macronutrients, not micronutrients, the indicator for calorie shortfall is calculated the same way as for micronutrients.

Table 3.3—Estimated shortfalls in calorie, iron and vitamin A consumption, by residence (2004–2005 to 2010–2011)

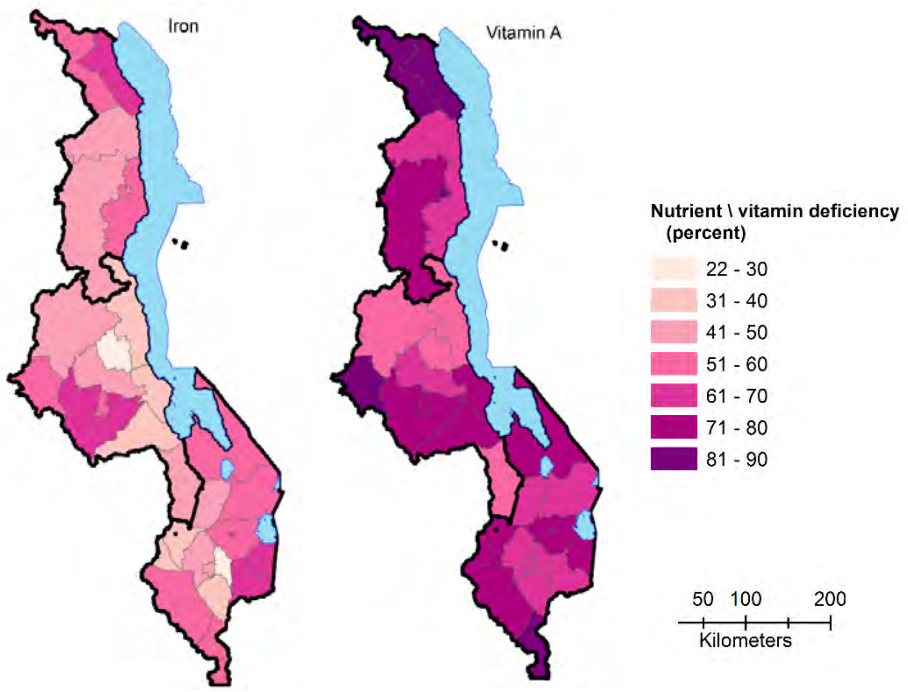
	Calorie shortfall (%)			Iron shortfall (%)			Vitamin A shortfall (%)		
	2004–2005	2010–2011	%-point change	2004–2005	2010–2011	%-point change	2004—2005	2010–2011	%-point change
Total	**39.4**	**34.3**	***-5.1***	**44.1**	**48.6**	***4.5***	**62.0**	**69.9**	***7.9***
Rural	40.5	36.7	*-3.8*	42.6	47.7	*5.1*	61.8	69.8	*8.0*
Urban	30.9	20.6	*-10.3*	55.1	54.0	*-1.1*	63.1	70.8	*7.7*

Source: Authors' calculations with IHS2 and IHS3 data (NSO 2005, 2012b).

While access to calories improved from 2004–2005 to 2010–2011, there are significant differences in the levels and rate of decline in rural and urban areas. The number of rural Malawian households that failed to access sufficient calories changed from 40.5 to 36.7 percent. While the improvement in urban households was far greater, changing from 30.9 to 20.6 percent. See Figure 3.6 for a district-level map of average estimated household calorie intake deficiency.

The picture looks different for micronutrients (Figure 3.6). A sharp increase in the rural iron shortfall rate (5.1 percentage points) caused the national shortfall to increase by 4.5 percentage points (offsetting a decrease of 1.1 percent among urbanites). Vitamin A shortfalls also increased sharply in both urban and rural areas, giving rise to a 7.9 percentage point increase overall. As above, while the reasons for this trend are difficult to tease out due to conflicting patterns of consumption between various vitamin A-source foods, one partial explanation may be the steep price increase of green leafy vegetables and a concomitant sharp decline in their consumption.

Figure 3.6— Average estimated household iron and Vitamin A intake shortfalls, by district, Malawi 2010



Source: Analysis by M. Kedir, IFPRI, of IHS3 calorie deficiency analysis results (Verduzco-Gallo, Ecker, and Pauw 2014).

3.5—Synopsis of Findings and Concluding Remarks

In this chapter, we present per capita food consumption estimates and associated changes in calorie and micronutrient access for Malawi between 2004–2005 and 2010–2011. Consistent with growth in GDP per capita, poverty declined across urban and rural areas. This was accompanied by an increase in food expenditures across all household expenditure quintiles except the richest. As a result, per capita food consumption, calorie access, and household dietary diversity in Malawi increased

nationwide and in both rural and urban areas, despite evidence of rising food prices. In fact, the rise in food prices may reflect a shift in consumption preferences toward more costly food sources, a shift made possible in part by a decline in the price of the major staple maize and the ability of households to increase their budgetary allocation to food without reducing the quality or quantity of nonfood purchases. However, these dietary changes did not appear to translate into generalized improvements in micronutrient access. Estimated Household Micronutrient Access for vitamin A declined in rural and urban areas, particularly among poorer quintiles, while estimated Household Micronutrient Access for iron declined significantly among most income quintiles in rural areas.

Apart from the increase in consumption of a select number of foods for which we observed price increases, most consumption choices can be construed as consistent with the direction of changes in relative prices of food items. Particularly, a sharp increase in the consumption of calorie-rich maize can be linked to a decline in real maize prices. We also note a reduction in consumption of iron-rich pulses, specifically in rural areas, together with sharp increases in pulses prices. Finally, the decline in vitamin A may be partially associated with a sharp decline in the consumption of green leafy vegetables, which have also become significantly more expensive in real terms and relative to other food products.

These changes suggest that substitution effects in food consumption may have, indeed, contributed to reducing the vulnerability of Malawian households to severe food insecurity (that is, calorie insecurity), but also contributed to increasing the risk of micronutrient malnutrition and related health consequences. The changes are disconcerting, especially considering the potentially harmful long-term effects of shortfalls in vitamin A and iron, because both the NSO and IFPRI estimates indicate that the most vulnerable families have been bypassed by recent reductions in income poverty, leaving them that much more vulnerable to rising food prices and inflation. Conversely, the pattern among the highest income quintile appears to be overconsumption of calories. In line with global trends, it is likely that this pattern has been accompanied by increased intake of processed foods, including those high in sugar, sodium, and fat, with negative implications for nutrition and health.

Beyond raising incomes and educating households about the importance of healthy, balanced diets, these results suggest a need for economic incentives that alter relative prices of different food items in a way that would stimulate demand for those nutrient-rich foods for which consumption levels are currently inadequate.

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CHAPTER 4 : UNDERSTANDING THE PATHWAYS TO IMPROVED DIETS FROM THE PRODUCTION OF NUTRITIOUS AND MARKETABLE COMMODITIES

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Value chains and agricultural commercialization are increasingly being promoted as mechanisms for agricultural transformation, inclusive growth, and, more recently, improving food security and diets. Views of commercialization in agricultural development discourse have fluctuated over the years. Initially framed in terms of moving subsistence farmers into cash cropping and specialization, and subsequently criticized for exposing the poor to the high risk of engaging in commodity markets, the discourse shifted over a decade ago to include commercialization in terms of its effects on nutrition (Alderman 1987; Kennedy and Cogill 1987; Dewalt 1993; Peters and Herrera 1994; von Braun 1995). Theoretically, market-oriented production should allow farmers to increase their incomes and purchase more nutritious foods. However, there is very little empirical understanding of the pathways through which such production impacts diets and under what circumstances. What is clear is that there are a variety of constraints posed by commercial farming that can impede positive dietary changes. These include the tendency of men to control income from cash crops, the inherent price instability of cash crops, and the tendency to spend lumpy income (income based on few irregular payments in the year) on non-food items (DeWalt 1993).

Because Malawi's current development agenda increasingly focuses on measures to transform and commercialize a largely subsistence-based agricultural sector, the implications of commercialization for diets and nutrition is highly relevant for Malawi, especially when the country's extremely high rates of child stunting is considered.

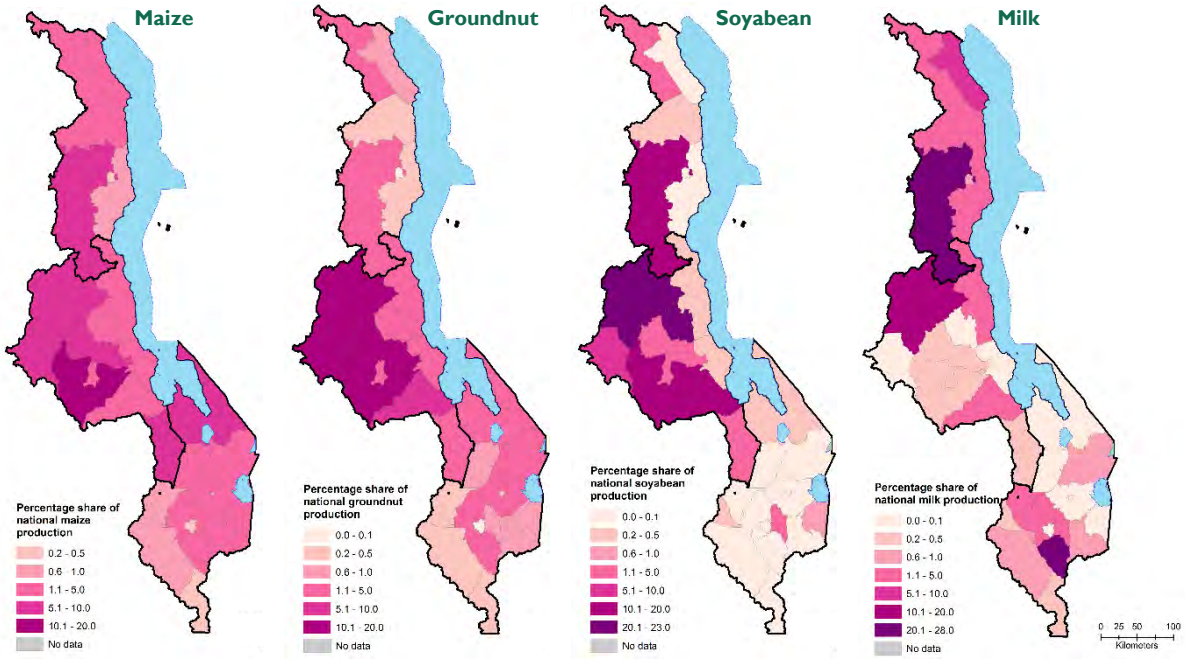
Maintenance of subsistence farming practices alongside cash crops can be viewed as a mechanism to minimize the inherent risks associated with volatile market prices (Gillespie, Harris, and Kadiyala 2012). Furthermore, crops that are both nutritious and commercially viable can overcome the inherent risks in engaging in markets because they can be consumed if market prices are not profitable. This type of approach can be viewed as promoting value chains with an emphasis on nutrition, or value chains for nutrition (VCN) (Gelli et al. 2015). VCN aim to increase the commercialization of agriculture, while simultaneously decreasing inherent risks, therein improving diet and nutrition outcomes (Hawkes and Ruel 2011)

For instance, groundnut and soyabean are both nutritious foods that, in Malawi, are (1) eaten raw or as a minimally-processed food by households, (2) exported raw regionally or internationally, (3) sold for medium- or large-scale domestic processing into higher-value products for human or animal consumption, or (4) processed on a small-scale at the village level for human consumption. As such, groundnut and soyabean in Malawi are high-potential commodities for VCN, as they play an important role for livelihoods development, risk reduction, private-sector development, and improvement of diet quality. (See Figure 4.1 for maps on district-level production of several commodities discussed in this chapter)

However, the effectiveness of the VCN approach for improving diets is mediated by social norms about preferred foods and appropriate intra-household allocation; control over decisionmaking for farm activities and use of income; and knowledge about nutrition and willingness to pay for nutritious foods (Gelli et al. 2015). All of these are closely linked to gender relations in the household.

This chapter presents findings from a qualitative study of social drivers (or limiters) that influence how the production of nutrient-dense, commercially-viable foods affects diets in rural Malawi. Gendered household preferences and decisionmaking dynamics related to the production, consumption, and sale of nutritious commodities are emphasized. The findings are based on information obtained through a series of individual interviews with cohabitating women and men from a sample of households in Balaka, Karonga, and Ntchisi districts of Malawi.

Figure 4.1—District-level production of maize, groundnut, soyabean, and milk in Malawi, by percentage of national production share, 2010



Source: Analysis by M. Kedir, IFPRI, of IHS3 data.

Note: Annual national production level estimates based on weighted analysis of household production data reported by IHS3 respondents are maize: 1,684,000 mt; groundnut: 235,000 mt; soyabean: 30,000 mt; and milk: 31,000 mt.

4.1— Plausible impact pathways

Adding a nutrition lens to the commercialization discussion provides several potential benefits. The possible impact pathways include the traditional benefits of commercialization as well as the possible benefits of increasing own consumption of nutritious commodities. This is the most direct impact pathway, wherein increased production ostensibly for commercial purposes could increase the quantity and diversity of food consumed by individuals within the household. The second pathway is through the sale of crops. Increased income from commercial sales can be used to purchase higher quality nutrient-dense foods for household consumption, if the foods are available in the market and acceptable to or preferred by family members. Third, the increased production of nutritious foods can increase their availability in markets, making it easier and more affordable for people to access them.

The final pathway is through impacts of commercialization of agricultural production on women's time and decisionmaking power. Commercialization may increase household income, but the degree to which women have the ability to influence decisions about how to spend that income or how much of the nutritious commodities produced by the household they will keep, will mediate the degree to which any improvements to diets will be achieved. In addition, the impact of commercial activities on the time commitments women face can either free up or further constrain the time required for the feeding and care of household members. Central to the impact this pathway has on nutritional outcomes are the prevailing social and cultural norms at play that determine the role of women—traditionally the primary caretakers in the household—in commercialization.

The empirical evidence is not conclusive in terms of the relative effectiveness of these pathways, globally or in Malawi. An evaluation conducted in Kenya in 1987 found that households participating in a sugarcane out-growers scheme had greater calorie consumption but no improvement in child nutrition outcomes, compared to non-participating households (Kennedy and Cogill 1987). A study in Malawi showed that, while cash-cropping families had higher incomes, the lumpiness and seasonality of their incomes mitigated the effects on household food intake (Masangala 2005). And, while a 1994 study on tobacco producers found income source had no effect on stunting in children

(Peters and Herrera 1994), a more recent study found that, when faced with an income shock, children in tobacco-producing families fared worse in terms of stunting (Wood and Nelson 2013).

Recent studies examining crop diversification in Malawi show that as farming families' incomes rise and they engage in markets, they tend to increase household calorie consumption and household dietary diversity (Jones, Shrinivas, and Bezner-Kerr 2014; Snapp and Fisher 2014). Similarly, a study on the commercialization of cassava in southeastern Africa documents the food-security benefits of cassava production. Cassava was seen as both insurance against a failed maize crop and a marketable commodity (Haggblade et al. 2012). This may point to the effectiveness of crop diversification in improving food security through overcoming the barriers of income lumpiness discussed above, although these studies did not examine effects on individual diets or nutrition outcomes.

When farm households produce nutritious commodities, the commodities may be used to augment diets or may be sold in the market. An early study of dairy cooperatives in India found that the nutrient consumption of commercialized farmers increases, but not through own-consumption (as they do not consume more milk), but rather through purchasing other nutritious foods in the market (Alderman 1987). Value chains studies on groundnut, soyabean, and pigeonpea in Malawi show a complex household decisionmaking process over consumption and sale of some of the harvest (Cook et al. 2014; Makoka 2009). Pigeonpea is largely consumed by the producing household, though some is sold domestically and internationally (Makoka, 2009). However, soyabean and groundnut fluctuate between being cash-crops and own-consumption crops depending on the local context, such as the gender dynamics, profitability, and need for inputs (Cook et al 2014).

4.2—Methods

This is an inductive analytical study that seeks to contribute to a clearer understanding of how the production of nutrient-dense, commercially-marketable foods affects diets in rural Malawi. In particular, we are interested in better recognizing the social drivers (or limiters) of the possible impact pathways, already clearly defined in the conceptual literature. Because women's time use and decisionmaking power mediate all of the possible impact pathways from production of nutrition commodities to improved diets, we primarily examine the gendered household preferences and decisionmaking dynamics related to production, consumption, and sale of these commodities.

In particular, we examine

- social norms and perceptions about preferred foods and eating patterns, including how social norms influence intra-household allocation and food substitution when sufficient preferred foods are not available;
- perceptions about what is consumed and what is sold, including perceptions about which crops are purely cash crops or too valuable for own-consumption, even if they are culturally acceptable or preferable to eat;
- social norms about gender relations, because they affect control over farm decisionmaking and the use of income from sold commodities; and
- knowledge of nutrition, because it can influence demand for nutritious foods and feeding practices.

While we highlighted three commodities of interest for their nutritious and marketable qualities, during interviews we allowed respondents to define what they considered to be nutritious commercial crops. Generally, when asked what commercial crops they produce, respondents included all crops that can be sold in the market. The commodities we focused on were soyabean, groundnut, and cow's milk.

Soyabean, while not widely considered a locally preferred food, is highly nutritious in terms of protein, fiber, and micronutrients; is in high demand by domestic processors and the regional export market; and has positive impacts on soil quality through biological nitrogen fixation. Soyabean uses in Malawi include large-scale oil pressing and processing the resultant soyabean cake into chicken feed or for export. Typical food uses include processing into flour for porridge or into soy pieces, a meat substitute. Ntchisi was targeted as a high soyabean production district.

Secondly, groundnut is in high demand as a locally-marketed and consumed food. In addition, there is local processing of peanut butter, other snack products, and ready-to-use-therapeutic-foods (RUTF) for moderately and severely wasted children. There is also very high demand regionally and from high-value markets, such as Europe and South Africa. Access of Malawian producers to these markets is currently impeded by the high-aflatoxin levels of domestic groundnut. In fact, the nutritional benefits of consuming groundnut must be weighed against the negative effects of high aflatoxin levels. Balaka was targeted as a high groundnut production district.

Finally, consumption of milk is extremely low in Malawi, as is cattle ownership. While per capita production has increased moderately over the last decade, it is still among the lowest in the world at 4.3 kg annually in 2011 (FAO 2015). However, milk could provide critical nutrients that are missing from a staple-heavy Malawian diet. While lack of adequate cold-chains makes export of milk products challenging, initiatives to promote local storage and marketing of milk could have significant impacts on diet quality. Because the northern region of Malawi has a relatively higher level of cattle ownership, Karonga was targeted as a milk-producing district.

We took a purposive sampling approach, starting with targeting districts that are producing the products of interest for the study. Then we relied on the government agricultural extension staff in the target districts to guide us on the choice of an appropriate study village based on two criteria: (1) that many village members produce one or more of the crops of interest and (2) that they are located within 5 km of a major daily market. The second criterion allows us to take the focus off market access constraints— which are usually greater for women than for men, but are not the focus of this study— and allow us to discuss in-depth other factors related to the decision to market their products. Three communities were targeted using these criteria and 12–15 households within each community were sampled for in-depth individual interviews, with a total of 80 individuals interviewed (39 men and 41 women).

Interviews were digitally recorded, transcribed, and translated from Chichewa and Chitumbuka to English. Transcriptions were thematically coded using NVivo software. An initial coding pass was used to determine the main concepts arising from the interviews, which were used to augment and enrich an a priori, deductive coding schema. Interviews were then systematically coded against this list. A range of code- and text-based search protocols, including both Boolean and proximity searches, was then applied to extract findings on each topic of interest, prior to writing-up.

Ethical clearance was obtained from IFPRI's Institutional Review Board. Respondent confidentiality was assured at all times by removing any reference to personal names from written results and safeguarding recordings and transcripts at all times. Field research staff members were provided with orientation in ethical compliance, appropriate behavior in the field, and concepts of informed consent, which was obtained prior to every interview in the study.

4.3—Findings

4.3.1—PREFERRED FOODS AND EATING PATTERNS

Although the study districts were purposively selected to capture production of soyabean (Ntchisi), groundnut (Balaka), and milk (Karonga), accounts of foods consumed at home were quite similar. With the exception of dairy products which were most intensively consumed in Karonga, aggregate dietary patterns in the study households exhibited little convincing variation by either district or household.

Nsima (maize meal polenta) is the starch par excellence in these areas. Breakfasts are often porridges made from maize or other starches, cakes or sweet fritters, and occasionally tea with or without milk and sugar. Meals taken at midday and in the evening are *nsima* accompanied by 'relish'. Relish is any food item that accompanies *nsima* and almost always includes green vegetables such as okra; pumpkin leaves; and *Brassicas*, such as rape, mustard greens, and cabbage; and tomatoes and onions if available. In Karonga only, *chambiko*, or soured milk, is highly appreciated as a relish to accompany *nsima* or other starchy foods. If cooking oil can be afforded, the relish is cooked with oil. Relish may also include protein foods such as legumes (pigeonpea, cowpea, and other beans), soyabean, groundnut (pounded and added to leafy vegetable stews), small dried fish (*matemba* or

bonya), chicken, eggs, and more rarely, meat (typically goat or occasionally beef; pork and rodents are generally tabooed, and bushmeat was not mentioned). Chicken and eggs are popular and widely appreciated; both are kept for food consumption, but may be sold when money is needed. Duck meat is more complicated: several respondents asserted that it produced an allergic skin reaction, while others stated that duck was prohibited under halal dietary laws (in fact, duck is considered to be halal if it has been slaughtered in accordance with halal rules).

This meal format is ubiquitous to the point of universality. Other starches such as cassava, bread, and rice are mentioned in interviews, but the archetypal meal is based around *nsima*. This is not unusual; staple starches often occupy a very dominant position in food repertoires internationally; in such cases, the inclusion of a staple may be a defining criterion of what constitutes a meal. Certainly in these districts, our household respondents' (largely shared) concept of a proper meal took the form of *nsima* with relish. As one informant from Balaka explained, "Relish only or *nsima* only does not make a meal. In that case, you do not have food." The preference for *nsima* was explained on the grounds that it is "satisfying", but also by allusion to tradition or upbringing—*nsima* is the main food that everyone has grown up with. Following Bourdieu (1977), it may be considered to be part of the *quotidian habitus* of the people composing the study population. As one Balaka respondent noted, "the reasons why it's ideal is we grew up used to these foods. We did not grow up used to other foods. I feel good, satisfied, and it tastes good. The meals that we eat in most cases are *nsima* with vegetables like cabbage, pumpkin leaves, and mustard greens." Fruits such as mango, papaya, banana, citrus, apple, and pineapple were also mentioned in interviews, chiefly as purchased items, since people do not tend to cultivate them in their gardens. Market availability of these items is seasonal. In a very small number of Ntchisi households, respondents stated that they made soy milk for home consumption, but this does not appear to be at all common, even in this district which was chosen based on its soyabean focus. Even in these soy milk producing households, respondents complained about the lengthy processing required to make soy milk. In one Balaka household, the respondent noted that she would like to consume soy milk, but did not have any.

Malawian family substitutes mangos for nsima during the hunger season

Maize is a critically important cultivar and there is a clear prioritization of keeping it for food security rather than selling it—some respondents made the point that it did not make sense to sell one's maize crop, only to have to purchase maize later on in the year. That said, maize is sold, and at times purchased, but there is certainly a widespread concern that enough should be kept to avoid running out later in the season. Many other foodstuffs are bought, however, at local markets when money and produce are simultaneously available. These include protein items, such as fish, meat, beans, soyabean and groundnut; vegetables, including greens, *Brassica*s, tomatoes, and onions; and occasionally other starches, such as rice, potatoes, and cassava. Market purchasing is periodically subject to various constraints, the most-frequently mentioned of which is financial – when respondents articulated desires to eat "aspirational" foods, such as more meat, rice, chicken, cooking oil, milk (fresh or fermented), sugar, eggs, soy products, or simply more-frequent *nsima*-and-relish based meals, the most common constraint was money. Respondents explained their choices of aspirational foods with reference to satisfaction, better nutritional quality, and tastiness. In addition to financial constraints on obtaining desired foodstuffs, respondents flagged distances to markets—in spite of the fact that communities were purposefully chosen to be within 5km of a major daily market—and the limited availability of a wider range of foods in the markets.

It is instructive to examine responses to a line of questions about substitution—what do people do when they do not have access to key foodstuffs? It is clear that the choices available are often

limited. It is also evident that the absence or shortage that most concerns people is not relish, but *nsima* – when asked about substitutions, informants focused principally on explaining what they did if they did not have *nsima*.

One strategy mentioned by several informants is to substitute porridge for *nsima*. In effect, this means increasing the proportion of water to maize flour, so that a given amount of starch—maize meal or other—feeds more people. Another approach is to increase the amount of gathered fruit in the diet (especially mangoes, which may be boiled). This is considered to be a particularly poor substitution, in the event that no starch is available. Interestingly, rice is mentioned as a potential substitute for *nsima*, which seems contradictory, given the frequency with which it is mentioned as an aspirational food – in the latter category, rice is an object of desire, while in the former, it is a second choice if *nsima* is unavailable. Cassava is also regarded as a potential substitute for maize meal *nsima*.

4.3.2—CONSUMPTION AND SALE

Box 4.1—Priorities guiding sales of food crops

I had one and a half pails of soyabean, but sold one pail because of a problem of school fees for the child, and I am remaining with half pail. I kept half a pail for consumption, and there was no influence from any organization. I just keep some soyabean for porridge at home. On the part of maize, I did not sell any of the 22 bags I produced, because it is the main food for the home, but I also expected some money from the soyabean that were submitted for sale, so there was no pressure to sell maize. As for beans, I produced 60 kg, and it was all sold in August, but the money is not yet received. I just kept a little beans, about 2.5 kg for consumption. Otherwise, we are not allowed to keep any of it if it is a contract. I also produced 2 bags of cowpea. It was all sold at K300 per kg in August, I did not keep any following the contract terms. Groundnut produced six unshelled bags, and I sold three bags in August, I kept some for consumption by adding to relish, but also for roasting, as it provided nutrition to the body.

(Male respondent in Ntchisi).

The majority of food cultivars which are sold in these districts are also used for household consumption, although the converse is not true. These include maize, pigeonpea, and other beans; groundnut; and soyabean. Sesame, cultivated in Karonga, is technically a consumable crop, but in practice, it is not consumed; instead, it is treated as a non-food cash crop like cotton. In better-off households, livestock is kept: cattle, pigs, goats, ducks, and chickens. Cows produce milk and work as draught animals at home or rented out for extra income, while also serving as insurance policies in the event of serious income shocks. *Chambiko,* or soured milk, a popular food in Karonga, is generally either bought in the market or made from milk that is produced by family cows. It is only made from cow's milk; goat milk being reserved for drinking. Only three of the 15 Karonga households mentioned selling their *chambiko*; on the whole, in Karonga, *chambiko* is more often consumed than sold. Chicken and eggs are kept for both household consumption and for cash sale, though slaughter and consumption of chicken is less common than keeping the birds for sale.

Small livestock are often used as a way of saving cash, though perhaps not large amounts. When a household needs money, a smaller animal may be slaughtered and sold. They might also be used for home consumption.

Households in our study communities give careful thought to balancing consumption and sale; this is important given that the foods grown do dual duty as foods and as commodities. Study participants explained in interviews that they took a range of factors into account when making decisions about what or how much to sell. This is an especially relevant point when considering a VCN approach because it demonstrates that a population mainly composed of subsistence horticulturalists is accustomed to evaluating a broad range of factors before selling nutritious food commodities. In terms of programming implications, this means that much of the educational groundwork is already in place—people have a good understanding of how to make decisions based on assessments of competing

priorities. In other words, while some priorities might need to be reassessed (for example, the very heavy focus on *nsima*), in the light of limited nutrition knowledge, the analytical apparatus, in fact, is present.

Key issues which are taken into consideration in decisionmaking about food sale and consumption include:

- Food security: This is the first-and-foremost factor to consider. People are very unwilling to jeopardize their household food security, particularly as it relates to maize. As one Balaka informant explained, "It is always expensive to buy maize, especially knowing that you had it and you sold it. It is only due to a lack of income that makes us sell our maize…". The food security argument is not only relevant to maize – indeed, people are careful to keep some of all their cash crops for consumption. But maize is certainly the commodity that people feel most strongly about. Informants also noted that a household which found itself without maize would need to engage in piecework to earn money in order to buy maize.
- Financial needs: Families require cash for a range of household needs, such as school items, building materials, soap, relish ingredients, medical items, and productive assets, such as tools and fertilizer. Once food security has been taken into account, families consider these needs and make decisions about sales. Note that in cases where families hire labor, another requirement is paying the pieceworkers, either in cash obtained from commodity sales or in maize meal.
- Quantity: Related to the discussion of food security above, if harvest quantities are too low, selling is not considered a viable option.
- Seed banking: As subsistence horticulturalists, residents of these districts understand the need for making their seed supplies sustainable. In particular, quantities of peas and beans are held back from both sale and consumption in order to sow fields again the following season.
- Pricing: Particularly in relation to maize, respondents noted that they were strategic about when to sell their production. If prices are too low, maize can be stored until prices rise again. This principle also applies to other commodities. We do not have direct responses on this, but it may be the case that in situations where maize prices are unattractive for sale, people respond to more immediate financial needs by slaughtering and selling livestock.
- Social: Feeding needier relatives is culturally important. Households take this into consideration, particularly after ensuring that their own food security is adequate.
- Insurance: As noted above, livestock ownership may serve as both a device for saving money and as an insurance policy against severe income shocks.

4.3.3—GENDER AND DECISIONMAKING

"But the ones I control are like useless crops because they are kitchen crops" (woman in Karonga).

Our data shows great, though largely unpatterned, variation in responses to a line of questioning which sought to explore the relationship between gender and decisionmaking in production and sale of crops as well as on expenditures made with the proceeds of such sales. This variation principally revolves around the question of who makes decisions in the household and is evident not only between households but within them, given that in many cases both husbands and wives within households were interviewed:

Wife, Balaka:

Q: Are there any decisions that you are supposed to make because you are a woman?

A: Yes, especially on maize and other edible crops. Mostly men are never home, so if you put all the control on a man, he can disappoint you when he has gone out. Sometimes they go

away for weeks; it is better that I should have my own input as a woman. A woman is the one who prepares food for the family compared to men.

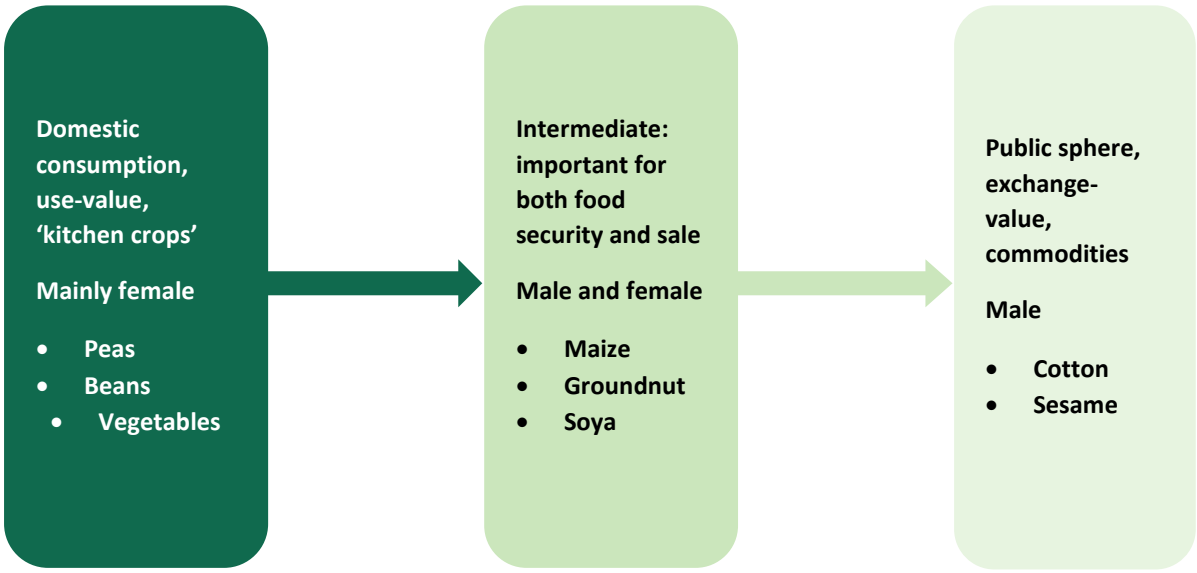
Husband, same household, Balaka:

Q: Who made a decision on selling the crops that you sold?

A: On sales, I was the one who decided to sell maize. I made that decision and told my wife and she obeyed. I did the same with pigeonpea.

In spite of this variation, it is possible to discern a basic overall pattern of decisionmaking. This pattern evokes the highly-critiqued concept of domestic (female) and public (male) spheres and references the quotation at the beginning of this section—on the whole, men have more decisionmaking weight around crops where exchange-value dominates use-value, that is, with crops which engage more closely with the public sphere of exchange. Women, on the other hand, have more decisionmaking power around crops whose use-value dimension is stronger, that is, with crops which tend to be conceptualized as occupying the domestic sphere of consumption. While informants tended to reject ideas about "women's crops" and "men's crops", this is, in effect, the operative division. Beans, pigeonpea, vegetables, and cowpea fall into the former category, while non-food crops, such as sesame and cotton, occupy the "men's crops" end of the spectrum. Soyabean, groundnut, and maize occupy a middle ground because of their important dual roles as key items for household consumption and as a market commodity. This is illustrated in Figure 4.2.

Figure 4.2—Role of key commodities among Malawian farm households



Source: Authors

While this model is quite dominant among the study households, it is also important to note that in a significant number of households, reference was made to collective decisionmaking and discussion. The key message for any contemplated VCN programme would be that, with the exception of non-food cash crops, most of the crops produced by the study households exhibit some degree of duality in terms of male and female decision-making. That said, there are certainly cultivars which tend to be gendered.

4.3.4—NUTRITION KNOWLEDGE

Respondents were asked a series of questions about nutritious diets. Nutrition knowledge is generally quite good in the study sample, although we note that different respondents tended to emphasize different aspects. We also note that informants were not asked about specific infant and young child feeding practices, even though suboptimal young child feeding practices and lack of understanding of their specific, rapidly changing nutrition requirements are considered to be a major contributor to child undernutrition. Rather, the focus was simply on their knowledge about nutritious foods and concepts of nutrition in general. Key points raised were:

- The importance of dietary diversity—Respondents mentioned a wide range of foods, including starches, legumes, meat, fish, chicken, vegetables, dairy, fruits, and fats, and stressed the importance of varying these in the diet and producing mixed and balanced meals.
- The role of good nutrition in resisting disease, building and repairing the body, and providing energy—Several respondents were able to associate these qualities with vitamins, proteins, and carbohydrates and fats, respectively.
- The importance of proper food preparation to maximize nutrient access.
- The importance of good hand washing and sanitation practices to avoid illness.

4.4—Discussion

Respondents had a relatively good understanding of nutrition; however, it was not seen as a priority issue compared to other criteria underlying their food decisions. Food security was top-most and was largely reflected in concerns about maintaining sufficient supplies of maize for *nsima*. Needs for cash are numerous and important, but people avoid selling food crops if they do not feel they can meet their immediate food needs with their stocks. Holding on to food stocks may also serve as a means of hedging, waiting for a better price, or holding it as a store of assets in case of an income shock or unexpected major expense.

While financial barriers were the most commonly mentioned barriers to purchasing preferred or nutritious foods in the market, lack of availability was also a major barrier. As such, it is possible that specific VCN approaches could effectively combine nutrition trainings—promoting consumer demand of key commodities—with value chains approaches to decrease price and increase availability. Many nutritious crops that households produce are both consumed and sold. Decisions about what or how much to sell are based on consideration of a range of factors.

Regarding specific commodities, many legumes and grains, in particular soyabean, groundnut, and maize, are both sold and consumed and thus have potential for responding to VCN approaches to improve their impact on nutrition through increased productivity, nutrition training to increase consumption, or linking producing households to nutrition-enhancing supply chains. Because fruit does not tend to be produced at home, but purchased in the market, there may be an opportunity to promote more household fruit production as well as improved linkages to nutrition-enhancing supply chains for farm households producing fruit.

A common deficiency in Malawian diets is the lack of animal-sourced foods, including meat, poultry, and dairy (Government of Malawi 2009). Unfortunately, livestock and poultry are more often viewed as banks of wealth rather than as a food source. Fresh milk and, more importantly, homemade *chambiko* that has a longer shelf-life and is used as relish, may be exceptions, particularly in Karonga. Milk and *chambiko* consumption are very low in the other two study districts and, as discussed above, do not make up a central part of typical diets there. However, it is possible that a combination of nutrition training and promoting supply-chain linkages for milk and dairy products to decrease prices may increase demand marginally. In fact, there is evidence that *chambiko* consumption increases when its price goes down; whereas, fresh milk consumption increases only in response to an income increase (Akaichi and Revoredo-Giha 2012).

Past research has documented shifts in gendered control over crops like groundnut and soyabean when commodity commercialization programs moved such crops from largely being under the control of women to under the control of men (Cook et al. 2014; Quisumbing et al. 2014). Our research shows that household decisionmaking dynamics between women and men are more diverse and complex than that. Respondents tended to reject the idea of men's and women's crops; however, on the whole, they tended to conform to stereotypical gendered roles in terms of men having more power over crops with high exchange value rather than those produced primarily for consumption. Soyabean, groundnut, and maize fit into a unique category as they play an important dual role for household consumption and as commodities and, thus, a dual role in terms of gendered control. These crops are also more likely to be the focus of intra-household, cross-gender discussion and debate over whether they should be sold or consumed.

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CHAPTER 5 : FOOD AND NUTRITION SECURITY IMPLICATIONS OF CROP DIVERSIFICATION IN MALAWI'S FARM HOUSEHOLDS

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Although dramatic increases in maize yields since the implementation of the Farm Income Subsidy Program (FISP)—the major national program that subsidizes fertilizer and improved seed primarily for maize cultivation—have likely enhanced household maize self-sufficiency (Chibwana et al. 2012), Malawian diets remain poorly diversified. Indeed, the contribution of foods other than maize to national per capita dietary energy supply appears to have actually decreased slightly in recent years.

Poorly diversified diets characterized by an overreliance on starchy staples are a red flag for malnutrition. Conversely, diets which include a variety of foods are considered important for positive health. Diets which include nutrient-rich legumes and animal-source foods as well as vitamin-rich fruits and vegetables are associated with micronutrient adequacy and reductions in chronic undernutrition (Arimond and Ruel 2004; Thompson and Amoroso 2011).

While crop diversification is an explicit goal of the Government of Malawi, continued support to achieving maize self-sufficiency through the provision of input subsidies also remains a strong policy objective (MOAFS 2011). Theoretically, these two objectives are not mutually exclusive; increasing maize yields through intensification methods, such as those involving increased use of inorganic fertilizer and improved seed facilitated by the FISP subsidies, could potentially free land resources for cultivation of other, more nutrient-dense food crops (Arndt, Pauw, and Thurlow 2013). However, this hypothesis assumes that diversification in household-level production of food crops does, indeed, lead to diversification in the diets of individuals, with possible subsequent positive results their nutritional status.

Evidence on this assumption is scant. Although a large number of empirical studies analyze the determinants of crop diversification *or* dietary diversity, only a handful assess causal linkages between the two (Herforth and Harris 2014; Hirvonen and Hoddinott 2014; Remans et al 2014). For Malawi specifically, a recent study presented new evidence on precisely this pathway. Using the nationally-representative IHS3 survey data, Jones, Shrinivas, and Bezner-Kerr (2014) found that farm production diversity was associated with greater household-level dietary diversity.

Our study builds on these results by analyzing the same IHS3 data on household-consumption, but with an additional focus on the determinants of crop diversification and looking more specifically at micronutrients. In addition to constructing a household dietary diversity score (HDSS), we also construct Household Micronutrient Access indicators to estimate the effect of crop diversification on household access to zinc, iron, vitamin A, and folate. In so doing, we attempted to further refine Malawi-specific findings on pro-nutrition investment returns from food-crop diversification.

Malawian woman farms groundnut plot

Our results indicate significant and positive associations between food-crop production diversification and both nutrition indicators. The strongest associations were for households' micronutrient access. Production diversification was associated with a 35 percent increase in access to iron, a 47 percent increase in access to vitamin A, a 45 percent increase in access to folate, and a 35

percent increase in access to zinc. These findings support the hypothesis that crop production diversification is a viable option to increase nutrition sensitivity in agriculture.

5.1—Plausible impact pathways

Three main theoretical pathways can be used to hypothesize the effects of crop production diversification on household food security and the diets of household members. They correspond directly with the pathways described by the conceptual framework on causal pathways from agriculture to nutrition provided in Chapter 1.

- Production diversification can directly alter the food a family consumes if they eat what they produce, as most farm families in Malawi do. If a farm family produces a more diverse set of foods, then they have access to consuming a more diverse set of foods. Furthermore, if some of these foods are sold, then others who rely on markets for meeting some of their food needs will also have access to a more diverse set of foods.
- Production diversification can lead to increased income for farm families with which they can buy more diverse and more nutritious foods. This can be achieved through the production of marketable, higher-value crops if local markets are able to offer producers good prices for those crops. It is important to note that the extent that agricultural income influences household nutrition and food security depends on a number of factors, including the characteristics of food markets, decisions on household food purchases, and household nutritional knowledge. Depending on how these factors—captured in the enabling environment component of our conceptual framework—come together, agricultural income generating activities can have a positive, negative, or neutral effect on nutritional outcomes (World Bank 2007).
- The degree to which the above two pathways will lead to improved food security and diets is moderated by the bargaining power and control that women have over choices about: 1) consumption of what the family produces, and 2) the use made of income from crop sales.

5.2—Methods

We used data from the IHS3 for this analysis. Carried out between March 2010 and March 2011, the nationally representative survey is designed to provide information on various aspects of household assets, consumption, and welfare in Malawi. It includes a household questionnaire that has modules that cover a range of topics, including household income, food and non-food consumption, demographics, education, asset holdings, and employment.

With respect to agriculture, households surveyed for the IHS3 provided detailed reporting on cultivation and production practices for the most recently completed rainy and dry seasons, including any input subsidies received. Our analysis here used information provided by the 10,234 sample households from the IHS3 who defined themselves as “agricultural”, that is, “involved in agricultural or livestock activities” (NSO 2012).

Production practices were assessed based on the definition of crop diversification used by the Ministry of Agriculture, Irrigation, and Water Management, which is “the production of more than one crop”. Household dietary diversity was assessed using Household Dietary Diversity Scores (HDDS) and Micronutrient-sensitive Household Dietary Diversity Scores (MsHDDS):

- The HDDS was calculated based on a simple counted score of how many food groups from a total of 12 food groups sample household reported consuming food over the past seven days. This score was constructed from IHS3 recall data on food expenditures and household consumption.
- The MsHDDS disaggregates and reorganizes the HDDS food groups into 16 micronutrient-based groups. As with the HDDS, MsHDDS were calculated based on a simple counts taken from IHS3 recall data.

- Constructed from detailed IHS3 recall data on what all household members ate, we estimate the per-capita calorie and micronutrient intake of the survey sample households based on the quantities of foods they reported consuming. These calculations were used to estimate Household Micronutrient Access indicators for iron, vitamin A, folate, and zinc.

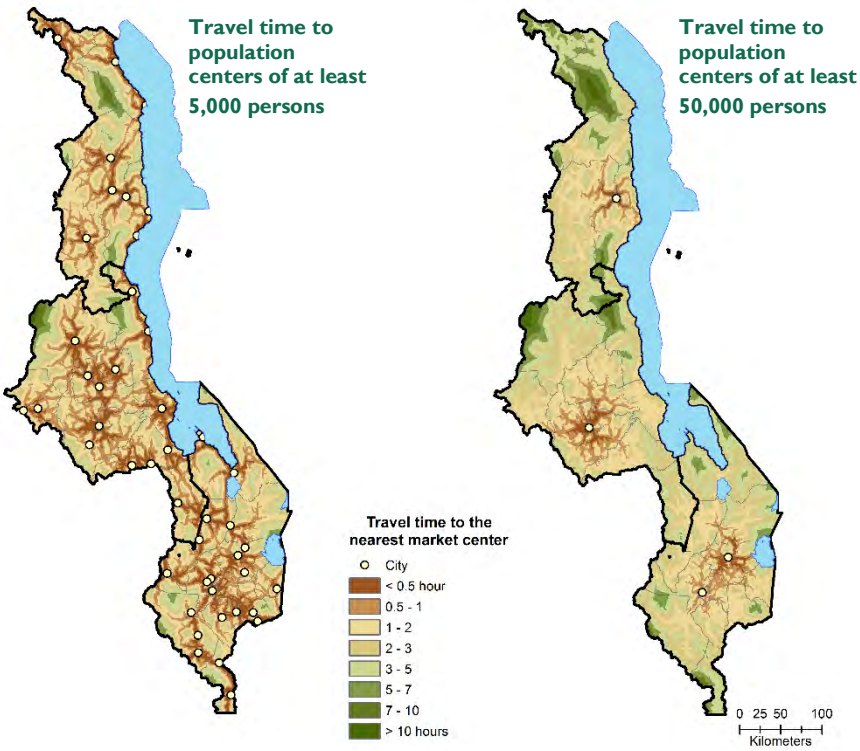
Based on these variables and econometric models, a series of regression analyses were conducted to identify the determinants of production diversification and the degree that production diversification is associated with HDDS, MsHDDS, and Household Micronutrient Access. For each regression, we controlled for demographic and socioeconomic characteristics.

5.3—Findings

A majority (76 percent) of the sample was categorized as practicing some crop diversification and about half (53 percent) reported being engaged in crop sales. Only 8 percent of the sample reported having access to credit, 46 percent reported access to extension services, and 54 percent reported receiving fertilizer subsidies. The average distance to the nearest local market was 7 kilometers. (See Figure 5.1 for maps of travel time to larger market centers.) The average landholding was less than one hectare (0.75).

Education (19 percent), size of land holdings (198 percent), access to subsidized fertilizer (38 percent), and market participation (86 percent) were all positively and significantly associated with crop diversification. The association with access to extension services was also positive and significant, though with a smaller effect at 8 percent. Interestingly, access to credit is negatively and significantly associated with diversification (-12 percent). There was also a positive and significant, albeit small at 0.01 percent, association between distance to markets (Figure 5.1) and crop diversification—that is, the greater the distance from markets the more likely a household is to diversify its production.

Figure 5.1—Maps of travel time to market centers in Malawi with populations of 5,000 and 50,000 persons



Source: Analysis by M. Kedir, IFPRI, of spatial data for Malawi on population centers, the road network, and land use and land cover.

Mean HDDS for surveyed households was 7.9 for the 12 groups. Crop diversification was associated with a substantial 19 percent increase in HDDS and MsHDDS. However, when the data

were disaggregated into urban and rural households, families living in rural areas appeared to be at a distinct disadvantage, with regression results showing rural households to be associated with a 25 percent decrease in HDDS and 24 percent decrease in MsHDDS. While the effect is quite small at 0.5 percent, owning some livestock is also positively and significantly associated with HDDS and MsHDDS.

With respect to micronutrients, results indicated a significant and positive association between crop diversification and all four indicators of household micronutrient access. Diversification was associated with a 35 percent increase in adequate access to iron, a 47 percent increase in adequate access to vitamin A, a 45 percent increase in adequate access to folate, and a 35 percent increase in adequate access to zinc. Interestingly, while owning livestock is associated with improvements in access to vitamin A, folate, and zinc, there is no significant association with iron, which is one of the key nutrients most easily absorbed from animal-source foods and one of the nutrients for which Malawians have high levels of deficiencies (Government of Malawi, 2009). 80 percent of household heads had some formal education. Formal education was positively and significantly associated with all the dependent variables: HDDS, MsHDDS, and four household micronutrient access indicators.

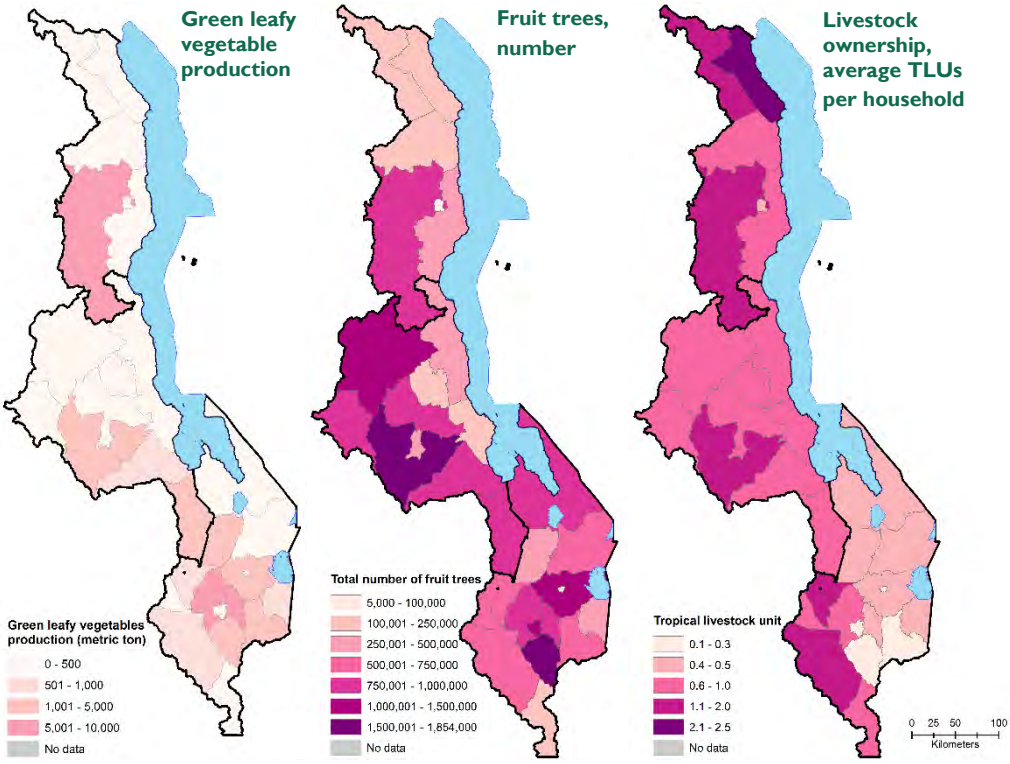
In terms of gender, results controlled for female and male-headed households. Male-headed households were slightly—1 percent—more likely to diversify production. In addition, male-headed households were associated with a 5 percent increase in HDDS and MsHDDS. The household micronutrient access scores also indicated that households headed by men were accessing higher amounts of micronutrients, except vitamin A, for which insignificant results were obtained. While this is at odds with Jones, Shrinivas, and Bezner-Kerr (2014), who found that male-headed households to be associated with a slightly lower HDDS, they also included a variable for control over agricultural income that indicated a much larger significant effect. This suggests that shared control over income between spouses may be more important than the gender of the household head alone.

5.4—Discussion

Taken together, these results indicate a tendency for farm households to practice market-oriented production diversification when land, inputs, and market access allow. However, the fact that access to credit actually *decreases* probability of production diversification suggests that market-oriented production diversification may reflect a need for cash, rather than a deliberate shift towards increased diversification for own-consumption. Furthermore, the positive association between subsidized fertilizer and production diversification may be due to a propensity for smallholders to diversify their production only after they have satisfied household requirements for maize. Sometimes referred to as *filling the maize basket*, this theory is based on the assumption that farmers who produce more maize—often due to the receipt of FISP-subsidized inputs—are in a better position in terms of their level of household food security to risk expanding the number of crops they produce to other food crops (Snapp and Fisher 2014).

Both the HDDS and MsHDDS showed a positive and significant association with production diversity, implying that when crops other than maize are grown (Figure 5.2), whether for market sale or for own consumption, this increases household food security and allows households to access a more diverse set of foods. The fact that these relationships held true across all four Household Micronutrient Access indicators is noteworthy, particularly because micronutrient deficiencies remain a major challenge in Malawi (Government of Malawi, 2009). Theoretically, it follows that the ability to diversify should improve individual nutrition outcomes. However, this hypothesis could not be tested here due to the fact that the IHS3 did not collect information on individual-level dietary intake.

Figure 5.2—Maps of district-level production in Malawi of nutrient-dense products – green leafy vegetables, fruit, and livestock



Source: Analysis by M. Kedir, IFPRI, of IHS3 data.

With respect to gender, our results showed that male-headed households were more likely to be food secure and have access to more diverse foods. There is strong evidence highlighting the food insecurity challenges faced by women, who are often more constrained than men in terms of access to credit, land, extension services, and other productive resources (Alkire et al. 2012). As such, female-headed households often operate at a disadvantage relative to male-headed ones, which has adverse food security and nutrition implications for all household members.

In addition to addressing constraints of female-headed households, the extent to which women have control over agricultural income, regardless of household head, is a critical part of improving food security outcomes. These findings support the call to better incorporate gender considerations into agriculture-based programming, captured in the pathway on "Agriculture as a way to affect women's decisionmaking power" mentioned in Chapter 1.

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CHAPTER 6 : ASSOCIATIONS BETWEEN IRRIGATED FARMING AND IMPROVED NUTRITION IN MALAWIAN FARM HOUSEHOLDS

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Expansion of irrigation is a recurrent objective of the agricultural development plans formulated by successive governments in Malawi. More intensive and continual use of Malawi's water and agricultural land resources is expected to increase and stabilize production of food and export crops, thereby increasing farm incomes, spurring growth in the agricultural sector, and enabling the country to more reliably meet the increasing food needs of its growing population.

In addition, irrigation should allow for a more diverse set of crops to be grown throughout the year, with significant expansion desired particularly in the production of micronutrient-rich vegetables and fruit. With increasing use of irrigation across the country, Malawians will gain greater access to more food and a more diverse range of foods. The nutritional status of young children and other vulnerable groups should improve as a result. Conceptually, this nutritional argument to build support for expanding investments in irrigation in Malawi seems reasonable; however, there is little empirical evidence from Malawi or elsewhere to confirm whether irrigation improves nutritional status.

Using data from the Third Malawi Integrated Household Survey (IHS3) of 2010–2011, this chapter presents an assessment of whether increased use of irrigated farming by smallholders in Malawi might improve household-level diet diversity or child nutrition outcomes. We find no strong association between the use of irrigation by farm households in Malawi and the growth performance of children in those households. However, we do find that irrigating households tended to have more diverse diets—including vegetables—than households that do not irrigate, suggesting that irrigation enables households to produce a wider range of crops for home consumption than they can with purely rain-fed production. We also find that irrigation reduces the negative effects of seasonal food insecurity. The insight we take from these findings is that one of the principal contributions that irrigation can make to improved nutrition outcomes, particularly for subsistence farming households, is to ensure reliable, year-round access to a diverse diet that facilitates access to micronutrient-rich foods such as vegetables.

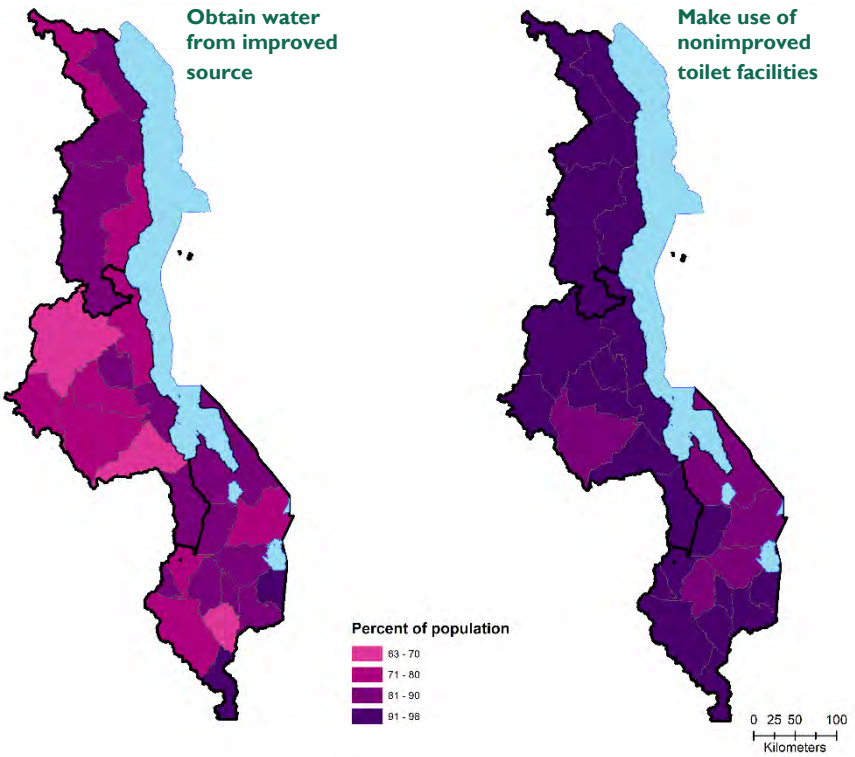
6.1—Plausible impact pathways

There are several direct pathways through which irrigation can be hypothesized to affect the nutritional status of farm households:

- Irrigation can improve food security—an immediate and underlying determinant of nutrition—through increasing agricultural production per unit area. Particularly in climates with sharply seasonal rainfall patterns, such as Malawi's, irrigation enables exploitation of arable land for production throughout the year, significantly increasing the amount of food that a farm household can produce from the same area.
- Irrigation may improve dietary quality by enabling production of a broader diversity of crops. For example, vegetables are commonly produced in many of the small, traditional irrigated plots in Malawi. Of the almost 1,300 irrigated plots reported on by the IHS3, 40 percent were used for vegetable production, while 58 percent were used for staple crops (primarily production of maize for green maize consumption) (NSO 2012). Vegetables are important sources of vitamin A and iron—both of which are lacking in many Malawians' diets. With irrigated production of micronutrient-dense crops such as vegetables, household dietary diversity might increase, resulting in improved micronutrient intake, with subsequent reductions in the incidence of health problems linked to micronutrient deficiencies.

- As mentioned in Chapter 1, inadequate dietary intake weakens the immune system and increases susceptibility to disease. Infectious disease, in turn, increases nutrient requirements and weakens the immune system. Irrigation can help disrupt this vicious circle by increasing access to safe water, thus improving sanitation and reducing the burden of disease in communities. (See Figure 6.1 on use of improved water sources and unimproved toilet facilities in Malawi.) However, irrigation may also increase exposure to malaria and schistosomiasis, the vectors of which—*Anopheles* mosquitoes and freshwater snails—thrive in surface water. In these scenarios, nutrition would be *adversely* affected by infections facilitated by irrigation-related circumstance. However, there is evidence that these potential health shocks due to irrigation often are offset by the increased income resulting from the use of irrigation (Keiser et al. 2005).

Figure 6.1—District-level maps of percentage of households obtaining water from an improved source and using traditional, nonimproved toilet facilities



Source: Analysis by M. Kedir, IFPRI, of DHS data.

- Finally, the indirect income effects of irrigation on nutrition are potentially significant. If irrigation is used to produce marketable, higher-value crops, and local markets are able to offer producers good prices for those crops, subsequent increases in purchasing power may be used to better meet the food, health, and sanitation needs of household members. Further, if a significant portion of this income is controlled by women (for example, via the sale of horticultural crops traditionally grown by women), additional nutritional benefits may be realized as the resources and income flows that women control have been shown to have disproportionately positive impacts on nutrition (Smith et al. 2003; World Bank 2005; Herforth and Harris 2014).

6.2—Methods

In order to better understand the impact that irrigation might have on the nutritional status of Malawian smallholders, we used data from the IHS3 to investigate (1) whether irrigation was significantly associated with the height-for-age of children in IHS3 sample households and (2) whether there was a significant association between irrigation and the dietary diversity of surveyed households.

The IHS3 was a national household consumption survey administered by the National Statistical Office of Malawi between March 2010 and March 2011. The survey included a household questionnaire on a range of topics, including income, food and non-food consumption, demographics, education, asset holdings, and employment, as well as data collection on the height and weight of young children (6 months to 5 years) from surveyed households. The latter were used to calculate height-for-age z scores (HAZ), which is the gold standard for measuring stunting in young children. Stunting is caused by long-term insufficient nutrient intake and frequent infections.

For the 9,750 surveyed households who reported undertaking agricultural activities, an additional agricultural questionnaire was administered to them. Of these households, 1,132 (11.6 percent) reported irrigating some of their crops. Our analysis used data from this agricultural subsample, differentiating in our analysis between irrigating and non-irrigating farm households.

We used two indicators as outcome variables in our models: HAZ scores for young children[12] and Household Dietary Diversity Scores (HDDS) for households. HAZ scores were computed by comparing the height-for-age of each child in the subsample with the 2006 child growth norms of WHO, as described in Chapter 2. HDDS were calculated for each sample household based on a simple counted score of whether household members consumed any food from each of 12 food groups over the previous seven days. This was constructed from IHS3 recall data on food expenditures and household consumption, as described in Chapter 2.

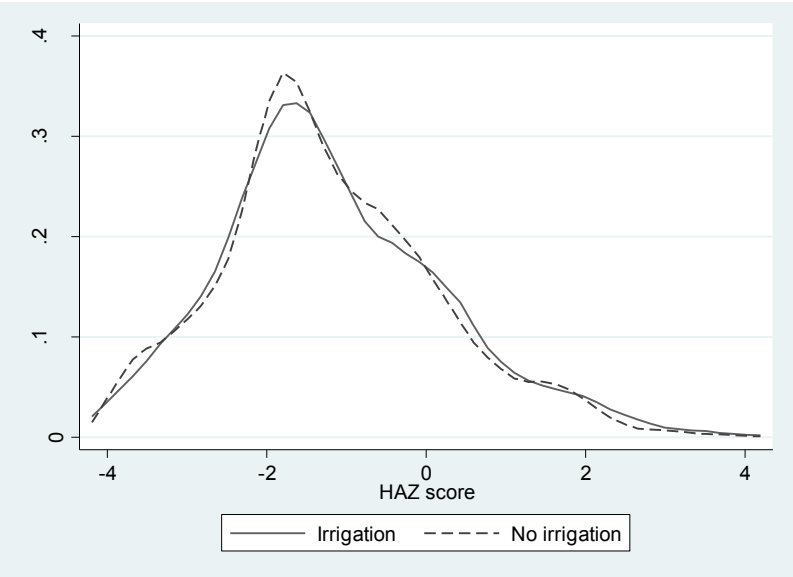
We conducted means comparisons and used a series of regression analyses to model the impact of irrigation on both of these outcomes. For each regression, we controlled for demographic and socioeconomic characteristics, agricultural and agroecological characteristics, and institutional factors. For models looking at household dietary diversity, we also included fixed-effect variables for the month that the sample household was interviewed. This allowed us to investigate seasonal differences in dietary diversity between irrigating and non-irrigating farm households.

6.3—Findings

For our initial means comparison, we found virtually no difference in the distribution of HAZ scores between young children in irrigating households and those in non-irrigating households (Figure 6.2). These results were confirmed in the regressions. None of the models found a statistically significant association between predictors of irrigated farming, related independent variables, and the HAZ scores of young children. These findings do not negate the expectation that irrigated farming, through its impact on the food consumption and incomes of farm households, is of considerable benefit to the nutrition of young children in those households. However, it does indicate that the pathways through which irrigated farming can lead to improved child growth are more complex and indirect.

[12] The quality of the anthropometric data in the IHS3 data have been called into question as they differ significantly from those in Malawi's 2010 Demographic and Health Survey that was implemented at about the same time (see Chapter 2). However in this analysis, measurement error of prevalence rates was of less concern than the difference in means between irrigating and non-irrigating households. As such, we report on IHS stunting data here, but with this important caveat.

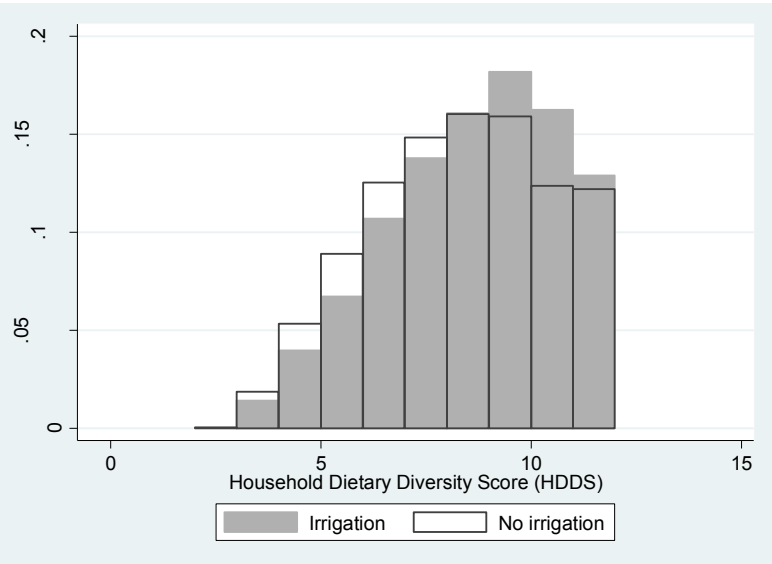
Figure 6.2—Distribution of children's HAZ scores, disaggregated by whether households engage in irrigated agriculture



Source: Author's analysis of IHS3 data (NSO, 2012).

Conversely, on the mean, we found that irrigating households tend to have more diverse diets than households that do not irrigate (Figure 6.3), suggesting that irrigation enables households to produce a wider range of crops for home consumption than they can with purely rain-fed production. This hypothesis was also supported in our regression results. In our models, a statistically significant result was obtained across all specifications for the variable on household production of irrigated vegetables. In the most tightly controlled model (which included variables for district and monthly seasonal effects), production of irrigated vegetables was found to increase dietary diversity by 2.7 percent. In contrast, the production of irrigated *staple* crops and the proportion of household land that was irrigated did not significantly affect household dietary diversity.

Figure 6.3—Histogram of household dietary diversity scores for Malawi farm households, disaggregated by whether households engage in irrigated agriculture

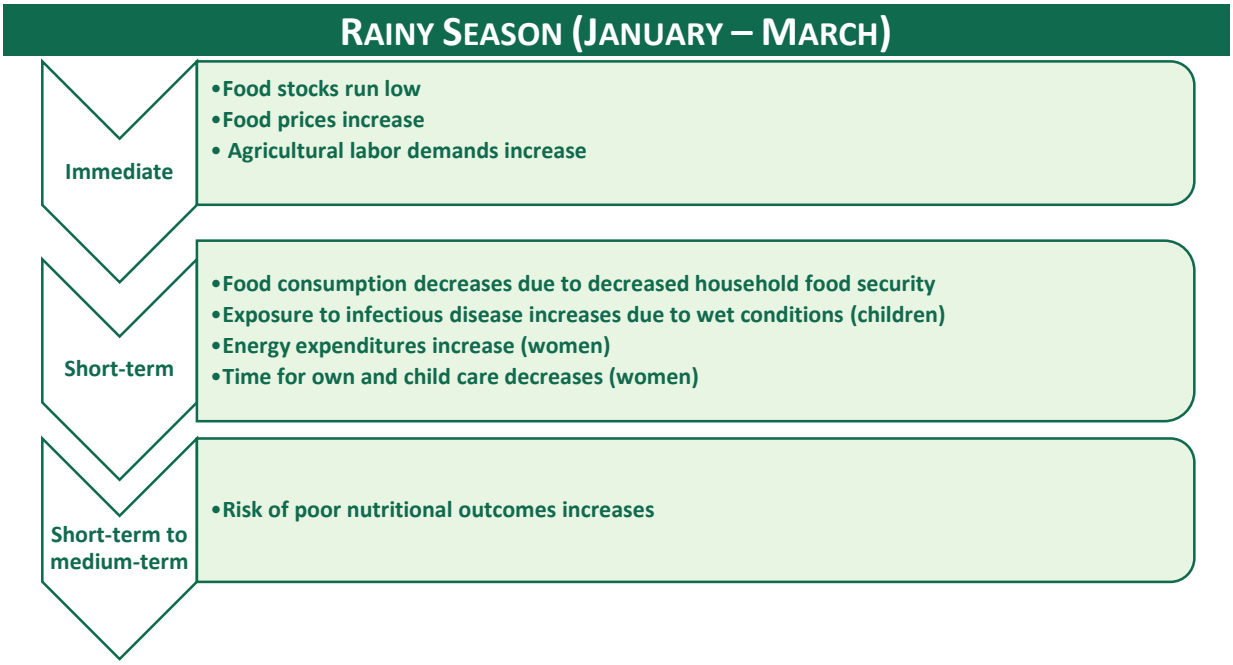


Source: Author's analysis of IHS3 data (NSO, 2012).

The addition of monthly fixed-effect variables to the HDDS model provided useful insight into how irrigation can reduce the negative effects of seasonal food insecurity on the diversity of diets consumed by farm households. Many Malawians experience a *hungry season* every year in the months just prior

to and during the rains (October through March) before green maize, groundnuts, and other early crops are mature enough for consumption or sale. During this season, food stocks run low, food prices increase, and food consumption decreases. The rainy season is also a period of intensive agricultural work with higher energy needs, coupled with greater exposure to infectious diseases due to wet conditions (Wijesinha-Bettoni et al. 2013). Because women are actively involved in agriculture—especially during the busy planting season—and children are especially susceptible to infections, the nutrition status of these vulnerable groups is negatively affected (Figure 6.4).

Figure 6.4—Effects of the rainy and hungry season, through a nutrition lens



Source: FAO 2014

Our modelling of the association between irrigation and HDDS provides some insight into how irrigation reduces these seasonal effects. When the model was adjusted to include monthly fixed effects, a pattern of seasonal food insecurity was clearly reflected in the diet diversity scores for the non-irrigating households subsample. Scores for this group were lowest in the "hungry season" months of February and March.

In contrast, no significant seasonality in the diversity of household diets was evident in the models developed from the irrigating households subsample. The insight we take from this result is that one of the principal contributions that irrigation can make to improved nutrition outcomes—particularly for subsistence farming households—is to ensure reliable, year-round access to a diverse diet that facilitates access to micronutrient-rich foods, such as vegetables.

6.4—Discussion

There is some merit in using nutritional arguments to support increased public investment in irrigation in Malawi. The analyses reported on here provide no evidence that irrigation has adverse effects on nutrition. However, our models did not generate any evidence that irrigation can be a significant determinant of improved child nutritional status – we found no strong association between the use of irrigation by farm households in Malawi and the growth performance of children in those households. Using improved child nutrition outcomes as a development objective to support the expansion of irrigation is a vague argument at best. A stronger argument may be made for the contribution of irrigated farming to the diversity of foods consumed by farm households, particularly because irrigation was shown to be an important component in reducing seasonal food insecurity.

Women and children—the two populations that are most vulnerable to malnutrition—are highly susceptible to effects of seasonality. Increased exposure to infections, decreased caloric intake, and increased energy expenditure can all increase risk of malnutrition during these periods. Indeed, seasonal availability and access to different foods have been identified as a constraint to successful Infant and Young Child Feeding (IYCF) interventions by WHO and UNICEF (Daelmans et al. 2009). As such, irrigation's mitigation of seasonal food insecurity is far from a negligible impact from a nutrition perspective.

That said, as demonstrated by our analyses, the pathways through which irrigated farming can lead to improved nutrition outcomes are indirect and difficult to assess empirically. Though increased use of irrigation can contribute to household food security, it must be recognized that household food security does not ensure improved nutrition. A broader range of equally necessary determinants—sanitation, access to clean water and health care, adequate care and feeding practices for all household members—must also be in place.

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