

The Economic Causes of Malnutrition

Author's preprint from:

Good Nutrition: Perspectives for the 21st Century,
edited by Manfred Eggersdorfer, Klaus Kraemer et al.
for Sight & Life, forthcoming 2016.

This is a successor to *The Road to Good Nutrition*
published in 2013:
<http://www.karger.com/Book/Toc/261234>

Source: Mike Blome



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"Life is better now than at almost any time in history. More people are richer and fewer people live in dire poverty. Lives are longer and parents no longer routinely watch a quarter of their children die. Yet millions still experience the horrors of destitution and of premature death. The world is hugely unequal."

Opening paragraph of *The Great Escape* (2013) by Angus Deaton, winner of the 2015 Nobel Prize in economics for his work on the measurement of poverty and well-being.¹

Key messages

- For most people, nutritious foods are more widely available and affordable than ever before, yet malnutrition remains the world's leading cause of death and disability.
- Malnutrition is hard to eradicate, partly because it has different causes in different people.
- Economic analysis helps explain differences among people regarding both their food choices and the non-dietary factors that influence their nutritional status and health.
- By identifying the causes of malnutrition, economic analysis can help guide interventions and support changes that foster better nutrition.



Woman selling mandarins and oranges at a local market at Karnataka State, India. Source: Mike Bloem

This chapter reviews the available evidence concerning differences among people, and changes over time, in four distinct dimensions:

1. The global, regional and national availability of nutrient-dense foods;
2. The access that individuals and households have to nutrient-dense foods;
3. The methods employed for food use that transforms foods into meals that people can consume; and
4. The non-dietary influences on people's nutrient needs that influence their nutritional status.

Malnutrition can be caused by a wide range of problems in each of these four dimensions. These causes can also be classified in a number of other ways, using a variety of conceptual frameworks. The approach taken in this particular chapter is complemented by Chapter 2.3, *The Economics of Poor Nutrition: Patterns, consequences and cost*.

Our approach takes a holistic or systems view and is concerned with aggregate outcomes at the population level, where all outcomes are interconnected: everything is caused by everything else. Individual social and biological pathways, from particular causes to specific effects, will be addressed in later chapters, drawing on research using biomedical and epidemiological methods. Here we are concerned with broad patterns, using economic methods to identify and explain society-wide outcomes.

Availability, Access, Utilization and Needs⁴

1. Availability: What makes a healthy diet more (or less) available to people, at prices they can afford?

Globally and regionally, nutrient-dense foods and fortificants are generally more available and affordable than ever in human history, but there are still large gaps of unmet need. Great opportunities therefore exist to improve the quality as well as the quantity of food supplies.

Market supplies of raw materials and foods can keep up with demand, but they do this at prices that fluctuate over time and space as well as in respect of food type. Affordability therefore depends on government policies and public investments.

Analysis of the most successful regions and time-periods allows us to conclude that meeting increased demand without raising prices requires research, education, infrastructure and institutions that are specific to the food sector. We can also see that, historically, periods of food crisis have led to surges in public investment and subsequent periods of abundance (and complacency).

2. Access: What makes a healthy diet more (or less) accessible to all people, at all times?

Within individual countries, there are consistent patterns of poor nutrition. Unfilled gaps are greatest for young women and children, as well as the poorest. Great opportunities therefore exist to improve distribution and food access.

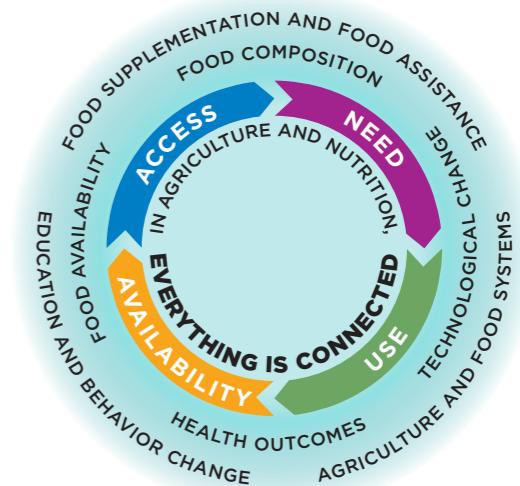
Distribution of food access is closely tied to other entitlements such as education, health care, housing and transportation. Private markets to distribute nutrient-dense and fortified foods depend on government policies (e.g. trade, standards), institutions (e.g. quality assurance, enforcement) and infrastructure (e.g. rural electrification, roads and marketplaces). Nutrition interventions are cost-effective ways to fill any remaining gaps.

Analysis of the most successful regions and time-periods shows that market development goes a long way, but not the whole way, to facilitating universal access. It is also important to note that even the richest countries have ongoing nutrition interventions.

3. Utilization: What makes a healthy diet more (or less) user-friendly for the most vulnerable groups?

Food utilization is a major cause of poor nutrition. Storing, preparing, cooking and serving safe and nutritious food is surprisingly difficult, especially to support the nutrition requirements of healthy gestation and infancy. Great opportunities therefore exist to facilitate improved feeding practices.

Figure 1 | Everything is connected: Availability, Access, Utilization and Needs



The transition to greater dietary diversity and animal-sourced foods calls for increasingly difficult food preparation. People shift quickly to packaged food and food consumed away from home, which exposes them both to nutritional and food-safety risks. Opportunities to improve begin with breastfeeding and complementary feeding, and they continue at every life stage.

Analysis of the most successful regions and eras indicates that availability and access are important factors, but that they are not sufficient in themselves to ensure a nutritious diet. Many kinds of labeling, norms and standards are needed to ensure a safe and healthy diet.

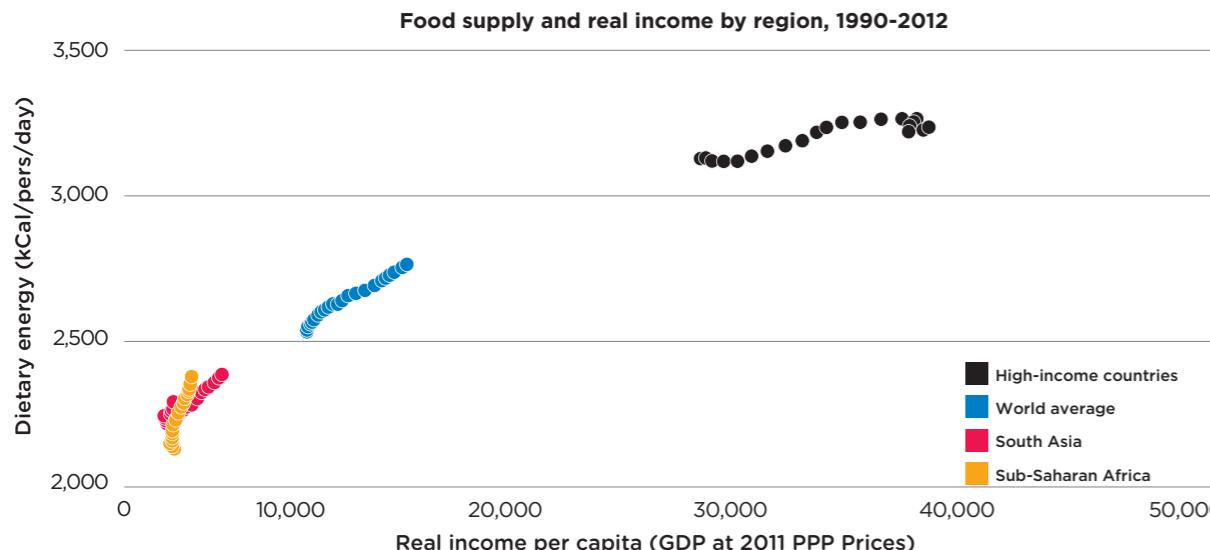
4. Needs: What changes in non-dietary factors alter dietary needs and nutritional status?

Dietary needs are not uniform or constant. Individual circumstances drive large differences in total energy and nutrient needs – for example, due to the effort of labor, the state of the individual's gut health, and the burden of various types of disease. Improving non-dietary factors strengthens the link between nutrition and health.

Dietary improvements reveal the role of other factors. Adjusting to changes in the effort of labor and physical exertion is difficult, while sanitation and environmental health pose major constraints.

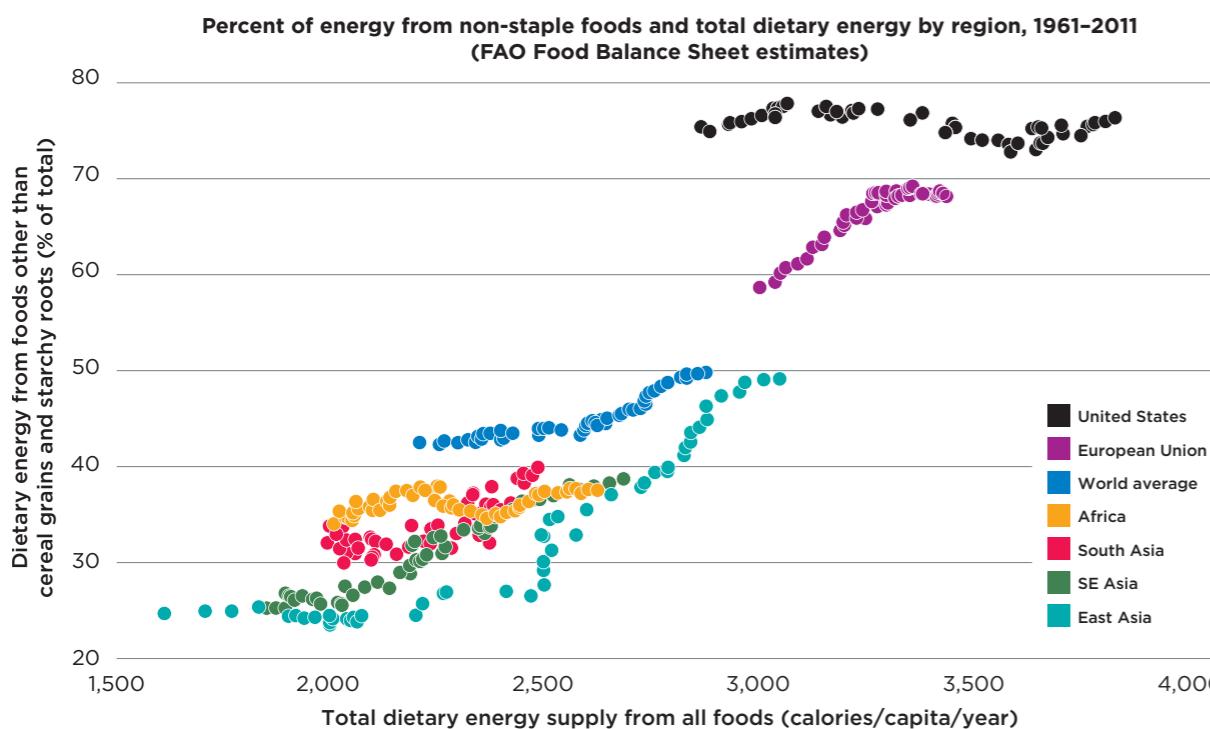
From the most successful regions and time-periods, we can conclude that dietary intake is important but not sufficient to ensure health and well-being. The path towards good nutrition involves change at every step, and embraces all aspects of health.

Figure 2 | Availability and access to food: Africa and South Asia still have far to go



Source: Author's calculations. Real income is from World Bank, *World Development Indicators* (April 2014), downloaded from <http://data.worldbank.org>. Food supply is from FAO, *Food Security Indicators* (December 2013), downloaded from <http://www.fao.org/economic/ess/ess-fs>. Each point is a 3-year average, from 1990-92 to 2010-12.

Figure 3 | Utilization of food shifts to meet nutrient needs mostly from foods other than starchy staples



Source: Author's calculations from FAO Food Balance Sheets, <http://faostat3.fao.org/download/FB/FBS/E> (June 2015).

Using economics to explain malnutrition

The relationship between individual choices, separability, and population-level outcomes

The economics approach to studying malnutrition starts with individual choices, and the separability between production and consumption that arises when people sell or buy some of what they produce. This notion of separability is intrinsic to food production: even the most remote farmer, whatever their landholding and other resources, is rarely limited to consuming solely his or her own produce.

Separability in practice

Any one person's food consumption can be separated from their food production by their trade with other people. The Scottish philosopher Adam Smith, writing in 1776, focused *The Wealth of Nations* on the consequences of our human "propensity to truck, barter, and exchange one thing for another,"² thereby launching the modern economic approach to studying human societies.

Although access to markets may be heavily constrained by factors such as poor roads, inadequate transport, inclement weather, and many other obstacles, virtually everyone, in any part of the world, will be able to find attractive opportunities to sell certain things in order to be able to buy others. This is particularly true of foods, given the need for each person to consume various foods the whole year round, and the differences among farms that lead to

specialized agricultural enterprises and diverse trading systems. Once each person can trade with many others, his or her production and consumption decisions become *separable*, with separate causes for one as opposed to the other.

At the individual level, separability ensures that the production – and hence the availability – of nutrient-dense foods is determined by agricultural conditions and prices, as farmers adjust their activities in response to the scarcity of each thing relative to their own farm's productivity. Similarly, dietary intake and nutritional outcomes among individuals is then determined by the relative scarcity of each thing, relative to people's household income and decisions regarding consumption. Different outcomes arise depending on individuals' access to nutrient-dense foods, which in turn follows from market opportunities (the real cost of what they buy, relative to the prices of all other things) relative to their livelihoods (the full income they earn from all sources).

The logic of separability is graphically illustrated in Figure 2, in which availability is shown by the curved blue set of production possibilities, from which people can access additional food by buying and selling along the dashed diagonal line showing real income. Dietary intake and health outcomes are determined by utilization along the red indifference curve, whose position indicates their need and level of well-being in terms of both nutrition and other aspects of living conditions.



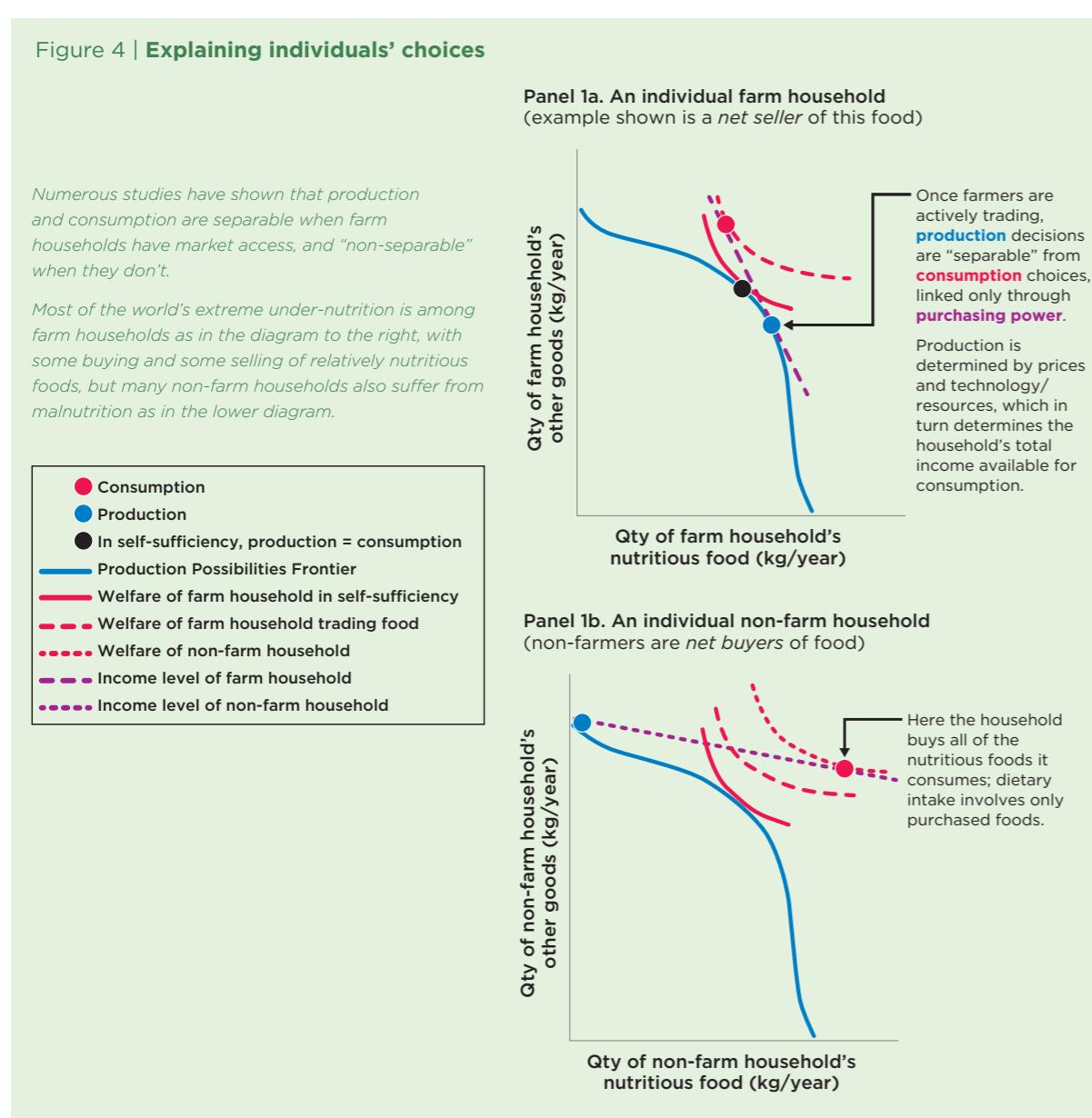
Stall on a fruit and vegetable market in Antananarivo, Madagascar. Source: Sight and Life

Individual choices

The logic of Figure 4 is an abstract representation of ideas that are universally familiar in everyday life, but easily forgotten in the design of policies and programs to improve nutrition. Farmers almost never eat all they grow, or grow all they eat. Selling one thing so as to buy another is often the best way for farmers to meet their own nutritional

needs, just as it is almost everyone's best way to acquire almost everything than can readily be bought and sold. Poor farmers usually try hard to limit what they must buy, but this is because they have so little to sell in exchange. Taking account of market behavior is often key both to predicting behavior and to designing interventions to improve farmers' circumstances.

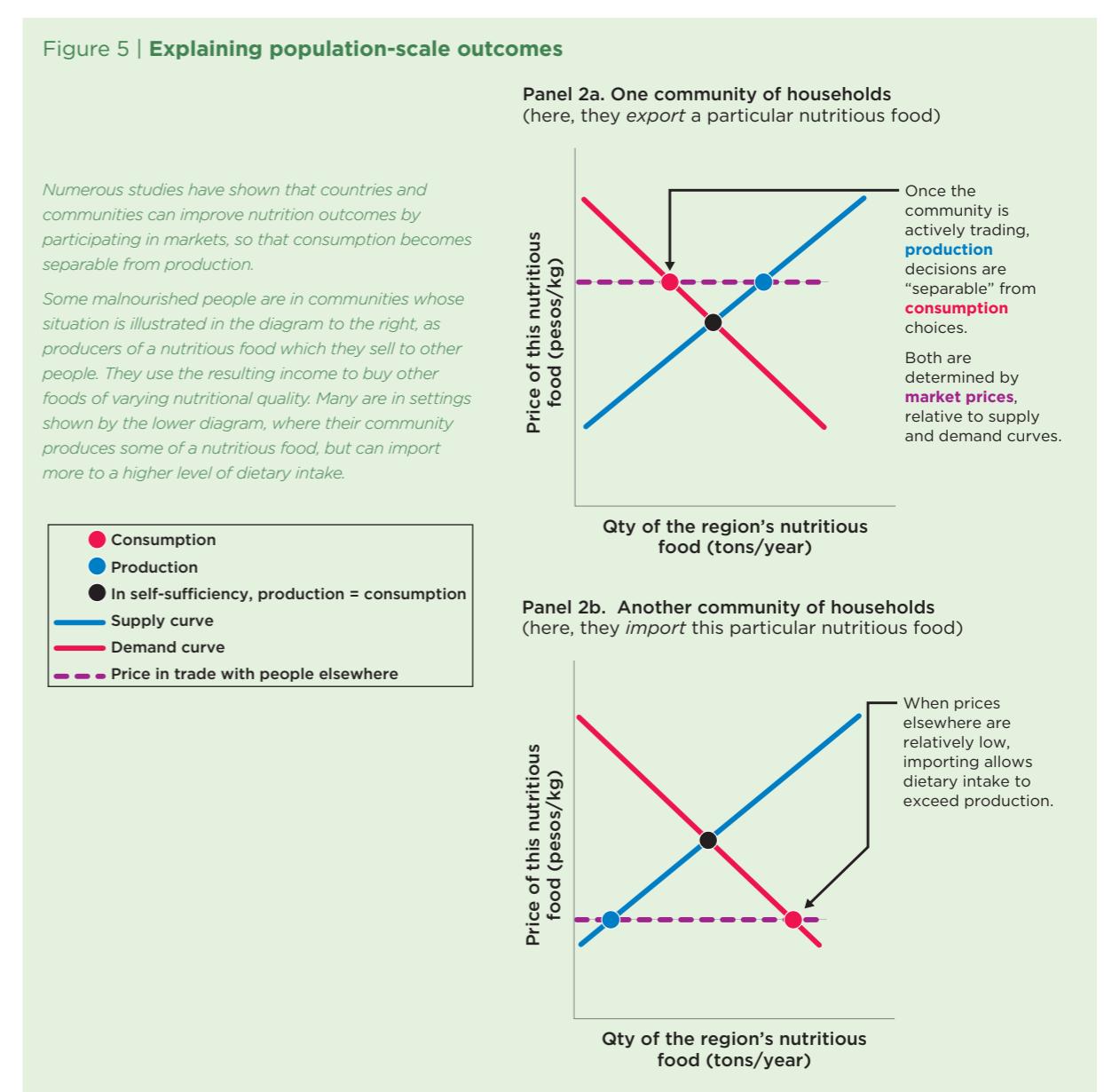
Figure 4 | Explaining individuals' choices



Population-level outcomes

The economics approach to population-level outcomes focuses on the interactions among people, and the many kinds of exchange between them. Figure 5 illustrates the economic interactions among individuals that generate observed outcomes at the level of a country or a subnational population.

Figure 5 | Explaining population-scale outcomes



The availability of a particular food is shown by the upward sloping blue "supply" line. Access depends on the dashed horizontal line showing the price at which this food can be bought or sold, while utilization and needs are illustrated by the downward sloping red "demand" line. These lines, and the resulting points, follow directly from adding up the choices of individuals illustrated in Figure 4, as they interact with each other at the population level.



Agricultural transformation links rural and urban communities, and brings rapid change to the food system as illustrated by these crops and chickens loaded on the roof of a commuter minibus in East Hararghe, Ethiopia, 2010. Source: William A. Masters

Two structural changes associated with economic development: Agricultural transformation and demographic transition

Agricultural transformation is a shift in employment and expenditure from food to other enterprises.

In the world's poorest societies, most people have no choice but to live in rural areas, relying on natural resources and household labor to obtain food, fuel and water. If opportunities arise to improve productivity, either within agriculture or in other activities, then people can save and invest, specialize and trade, ultimately moving into a wide array of services and manufacturing.

This transformation occurs within rural areas, and also allows migration to towns and cities, which sustains further economic development. The transformation out of agriculture as incomes rise explains why the poorest people and most malnourished children are typically found in the most agriculturally-oriented places, both across and within countries. Agricultural transformation creates the apparent paradox that people and places most heavily engaged in food production are the most likely to be malnourished, but that paradox can typically be resolved by controlling for real income.

Demographic transition is another kind of structural change with surprising implications for child nutrition.

This familiar shift towards longer life and then also lower fertility almost always starts with lower child mortality, often associated with an improvement in nutrition. That can quickly lead to a decline in birth rates, particularly if accompanied by opportunities for education, women's employment and access to contraception. In the meantime, however, there is a burst of population growth and a demographic burden of more children per household.

The rise in child dependency during the demographic transition helps explain why child malnutrition often worsens over time, before it improves. The demographic burden of child care falls disproportionately on young women, until declining fertility rates help the age structure swing back toward more working-age adults per child. The eventual rise in the workforce as a fraction of the population then offers a demographic gift that can fuel rapid economic development, particularly when combined with agricultural transformation and off-farm employment growth.

Demographic transition interacts with agricultural transformation in a way that often makes nutrition improvement harder in low-income countries, and then easier at higher-income levels. In poor countries, the non-agricultural sector is initially so small that even very rapid rates of off-farm employment growth cannot absorb all of the increasing number of working-age people. Despite successful year-to-year economic development and rapid urbanization, there will be a rising number of workers who have no choice but to farm, typically with less and less land and other natural resources per worker. That burden of declining land area per farmer in poor countries can be offset only by raising their crop yields, until the size of their country's non-agricultural sector has become large enough via its annual growth to absorb each year's increase in the adult workforce.

In summary, these two structural changes associated with economic development impose temporary burdens on child nutrition in low-income countries. By the arithmetic of year-to-year change, they serve to raise the number of children per adult and to lower the area of land per farmer in the early stages of structural change, making progress harder before it gets easier.

At later stages of economic development, child dependency rates and area per farmer can increase – both of which factors help the poorest and most malnourished escape more quickly from poverty. The development process may start earlier or later, varies widely in speed, and occasionally stalls altogether. But to the extent that economic development proceeds, it is characterized by remarkable similarities that help explain the patterns we see across countries and over time.

In that sense, successful societies are alike, even as their progress towards that shared destination involves a variety of diverse forces.

Adapted from: Masters WA, (2016), "Child Nutrition in Economic Development", in Duggan CP, Watkins JB, Koletzko B et al, eds., *Nutrition in Pediatrics*, 5th ed. Shelton, CT: PMPH-USA.

The separability between production and consumption:

Example of the fruit vendor from Makoni District, Zimbabwe

In 1986, as a young teacher in a rural school near Nyazura, Zimbabwe, I used to buy lemons and other fruit from a vendor named Amai Nickson, who would walk over the hill from a neighboring village to sell her wares. She was much poorer than the other villagers, and could rarely afford to eat the produce she sold. All her money went on more basic needs, including school fees for her children..

When I returned to Nyazura in 2010, I found Amai Nickson's³ life much changed. She was now caring for

grandchildren as well as her own youngest children (shown in the photo). She had saved up over the years and invested in her farm, including some backyard chickens. One consequence of these changes was that she could now buy fruit, instead of selling it. Amai Nickson's transition from seller to buyer of fruit is an example of how the relationships shown in Figure 4 can change over time and vary among neighbors, with differences explained by variation in income, market prices and the affordability of each food relative to farm production.



Source: William A. Masters

Child nutrition and economic development

Individual choices and separability

Children's nutrition is both a cause and a consequence of broader health conditions, household income and living standards. Some of these changes are mediated by national or community-level policies and programs as well as medical interventions. Most of the patterns, however, occur autonomously as individuals respond to changing circumstances associated with economic development. These changes often occur slowly, without the conscious knowledge of those involved. They have only recently been documented, thanks to the accumulation of evidence from a wide range of social environments.

Leo Tolstoy's classic novel *Anna Karenina* begins: "All happy families are alike; each unhappy family is unhappy in its own way." This claim starts an epic, questioning search for whatever it might be that successes have in



Recipient of Heifer International cow named Esther, Uganda.
Source: William A. Masters

common. For economic development, an extensive social science literature documents wide variation in people's living conditions. These circumstances have often stagnated for centuries, with almost all people experiencing relatively poor health, low income and less preferred living standards, until new opportunities and forms of social organization trigger the onset of sustained improvement.

Rising income is eventually associated with large gains in adult height, weight, and many measures of health and even measurable increases in subjective well-being. It turns out that success in one dimension is typically accompanied by successes in other areas. Many different obstacles might slow development, but successful societies often move in similar directions as people gradually achieve similar objectives.

Many aspects of child nutrition are likely to change as children's families acquire more purchasing power. Surveys of several million children from more than a hundred countries over multiple decades allow us to look systematically at changes in child height, stunting and wasting, as well as various contributors to nutritional status. These include food availability and diet quality, sanitation and water supplies, breastfeeding behavior, treatment of childhood diarrhea, vaccination, and vitamin A supplementation. Each of these measures reflects a different aspect of child nutrition.

Many factors other than economic development clearly matter for child nutrition. Ethnographic studies describe in detail how children are raised, finding that social norms and beliefs can lead to a variety of choices regarding complementary feeding and other nutritional practices. These norms may eventually adjust to income changes, or may introduce variation that is unrelated to economic circumstances.

Adapted from: Masters WA, (2016), "Child Nutrition in Economic Development", in Duggan CP, Watkins JB, Koletzko B et al, eds., *Nutrition in Pediatrics*, 5th ed. Shelton, CT: PMPH-USA.

Agriculture and nutrition as a factor in health and development

Agriculture, nutrition, and health are interrelated through biological and behavioral pathways that tie these sectors to ecological and socioeconomic conditions.

Place-based factors constrain and influence people's nutrition and health outcomes at every scale and in every context. For example, rainfall, temperature, and soil nutrients interact with crop genetics to influence plant growth and food quality as well as farm incomes, which in turn influence food-purchasing and health-seeking behaviors, all of which combine to influence individuals' nutrition and health outcomes.

Ecological conditions also influence the growth and reproduction of pathogens, parasites, and disease vectors of all kinds, weighing heavily on the effectiveness of interventions aimed at meeting development goals.

Since the 2007–08 food-price crisis, increasing attention to agriculture and nutrition as a factor in health and development has led donors and governments to pursue more integrated national plans, with a view to capitalizing on potential synergies between sectors in each location. For example, countries as diverse as Nepal, Haiti, and Kenya all promote intersectoral coordination and interministerial collaboration to achieve common goals around enhanced nutrition, health, and food security. Indeed, the call for integrated action represents a new global agenda, as highlighted by the L'Aquila Joint Statement on Global Food Security, which argued that: "food security, nutrition and sustainable agriculture must remain a priority issue on the political agenda, to be addressed through a cross-cutting...approach."

The potential gains from integrated interventions call for enhanced research methods that explicitly account for biological and ecological relationships at their natural scale, to reveal regional-level effects that may be quite different from the sum of individual-level changes potentially observed in a limited-scale randomized control trial. However, the increasing focus of policies and programs on intersectoral integration to solve location-specific problems poses deep challenges for researchers, regarding how the value added from integration is most appropriately measured.

The challenge is illustrated by controversy and confusion regarding what constitutes appropriate evidence in relation to multisectoral programming at the village level or in economic development more generally. Programs that seek to link food, water, health, and nutrition at a

regional scale are already being implemented around the globe, but few have been rigorously analyzed, and most remain focused on measuring siloed outcomes within sectors and then aggregating these as if their impact equaled the sum of their parts.

To measure synergies, we need a research agenda that explicitly addresses intersectoral linkages and the cost-effectiveness, replicability, and scalability of integrated processes.

Source: Agriculture, nutrition, and health in global development: typology and metrics for integrated interventions and research, <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12352/full>, accessed August 28, 2015 and lightly adapted.



Testing new sorghum varieties at Melkasa Research Station, Ethiopia.
Source: William A. Masters

My personal view

William A. Masters

When I was 20 years old, I took a semester off from school to live and travel in Haiti, where I saw widespread malnutrition in both rural and urban areas. I later worked in Colombia and Zimbabwe, before starting my PhD at Stanford. An especially inspiring teacher there was Reynaldo Martorell, whose research helped suggest new ways to overcome the many obstacles to good nutrition.

Further reading

FAO (2015), *The State of Food Insecurity in the World 2015*. FAO: Rome. <http://www.fao.org/hunger/en>.

IFPRI (2014), *Global Nutrition Report: Actions and Accountability to Accelerate the World's Progress on Nutrition*. IFPRI: Washington, DC. <http://globalnutritionreport.org>.

Masters WA, (2016), "Child Nutrition in Economic Development", in Duggan CP, Watkins JB, Koletzko B et al., eds., *Nutrition in Pediatrics*, 5th ed. Shelton, CT: PMPH-USA.

Masters WA, Webb P., Griffiths JK et al. (2014). "Agriculture, nutrition, and health in global development: typology and metrics for integrated interventions and research." *Annals of the New York Academy of Sciences*, 1331(1), 258–269.

Masters WA. (2011), "Economic Development, Government Policies and Food Consumption", chapter 14 in Jayson Lusk, Jutta Roosen and Jason Shogren, eds., *Oxford Handbook on the Economics of Food Consumption and Policy*. New York: Oxford University Press.

Norton G, Alwang J, Masters WA (2014). *Economics of Agricultural Development* (3rd ed.). New York: Routledge.

Smith LC, Haddad L. (2015). *Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era*. World Development, 68: 180–204.

Vollmer S, Harttgen K, Subramanyam MA et al. (2014). Association between economic growth and early childhood undernutrition: evidence from 121 Demographic and Health Surveys from 36 low-income and middle-income countries. *Lancet Global Health*, 2(4), e225–e234.

Prof. Martorell's teaching also opened the door to many new questions, and emphasized the need for each of us to use our own skills and perspectives to help solve problems collaboratively.

My own interests focused then, as now, on how people's behavior influences local agriculture, markets and nutritional outcomes. I like using economic methods in part because economics offers a platform for collaboration with natural scientists and health scientists, leading to the kind of fruitful partnerships discussed throughout this book.

References

- 1 Deaton, A. *The Great Escape: Health, Wealth, and the Origins of Inequality*. Princeton University Press, 2013.
- 2 Smith A. *An Inquiry into the Nature and Causes of the Wealth of Nations*, Book I Chapter 2, London, 1776. Penguin Classics, new edition 1982.
- 3 This phrase means "Mother of Nickson." In Shona society, both women and men are frequently called "Mother of" or "Father of" their firstborn child, even if they have other children.
- 4 The definitions employed here are the author's and are based on recent scientific insights and detailed economic analysis.