Economics of Agricultural Development

World Food Systems and Resource Use

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Fourth Edition

George W. Norton, Jeffrey Alwang, and William A. Masters

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Economics of Agricultural Development

Economics of Agricultural Development examines the causes, severity, and effects of poverty, population growth, and malnutrition in developing countries. It discusses potential solutions to these problems, progress made in many countries in recent years, and the implications of globalization for agriculture, poverty, and the environment.

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- The sustainability of the natural resource environment
- Gender issues in relation to agriculture and resource use
- The contribution of improved technologies to agricultural development
- The importance of agricultural policies and institutions to development and trade
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This new edition reflects the following developments:

- Growth in environmental challenges due to climate change
- Continued progress in agricultural and economic development in many low-income countries while other countries and regions are being left behind
- Continued growth in demand for higher-valued farm products

This book is essential reading for undergraduate students seeking to understand the economics of agricultural development and the world food system, including environmental and human consequences, international trade, and capital flows. It contains a wealth of real-world case studies and is accompanied by a website.

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World Food Systems and Resource Use

Fourth Edition

George W. Norton, Jeffrey Alwang, and William A. Masters

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Preface

Extreme poverty and undernutrition remain serious problems in many developing countries despite significant progress in reducing them globally over the last 30 years. *Economics of Agricultural Development* examines the causes, severity, and effects of these persistent problems. It identifies potential solutions and considers the implications of globalization and potential future reduction in globalization for agriculture, poverty, and the environment. It identifies linkages in the world food system and stresses how agricultural and economic situations in poor countries affect industrialized nations and vice versa. It focuses on the role that agriculture has played in improving economic and nutritional well-being and how that role can be enhanced. It explores causes and implications of agricultural commodity price volatility and potential effects of climate change on agriculture.

Much has been learned about the importance of technology, education, trade and capital flows, agricultural policies and institutions, and rural infrastructure in stimulating agricultural and economic development. In some cases, the same factors that contribute to economic growth can lead to price and income instability or environmental risk. These lessons and other issues are examined in the book using basic tools of economic analysis. The need is stressed for improved information flows to help guide institutional change in light of social, cultural, and political disruptions that occur in the development process.

The challenge in studying the economics of agricultural development is to build a broad view of the problem and to bring economic theory to bear on specific challenges faced by the rural sector and on means for utilizing agricultural surpluses to further overall economic development. The goal of this book is to help students and other interested practitioners gain an understanding of the agricultural development problem, including the environmental and human consequences of different development paths, the influence of international trade and capital flows, and the reasons for progress in reducing poverty and improving food security in some countries but not others. It is designed to help students develop skills that will enhance their capability to analyze world food and development problems.

This book interprets for undergraduates the economics of development and trade, including the importance of using economics to account for institutions, imperfect information, and the willingness of people to exploit others and to act collectively. This use of economics provides important insights for development policy and helps explain why some countries develop while others are left behind. The role of the government in promoting broad-based development is explored. The book also covers topics related to sustainability of the environment, gender roles in relation to agriculture and resource use, and the importance of macroeconomic policies as related to development and trade. This new edition of the book provides new insights into economic issues related to climate change and how they affect agriculture in developing countries.

INTENDED AUDIENCE

Economics of Agricultural Development is designed as a comprehensive text for the first course on the economics of world food issues and agricultural development. The book is aimed at undergraduate students, with the only prerequisite a course in introductory economics. Students in undergraduate courses that address world food and agricultural development represent a range of majors. Economic jargon is kept to a minimum and explained where necessary, and the book sequentially builds a base of economic concepts that are used in later chapters to analyze specific development problems. A second audience for the book is those who work for public and private international development organizations.

ORGANIZATION OF THE BOOK

Agricultural development is important for rural welfare and for overall economic development. Part 1 of the book considers the many dimensions of the world food–income–population problem in both a human and an economic context. Having established the severity and dimensions of the problem, Part 2 examines the economic transformation experienced by countries as they develop, sources of economic growth, and theories of economic development, including the role of agriculture in those theories. Part 3 provides students with an overview of traditional agriculture and agricultural systems and their determinants in developing countries, with particular attention to issues such as environmental sustainability

and gender roles. Part 4 then identifies agricultural development theories and the technical and institutional elements required for improving the agricultural sector. It stresses the need to improve domestic institutions. Finally, Part 5 considers the importance of the international environment, including trade and trade policies, macroeconomic policies, capital flows, and foreign assistance, including food aid. The concluding chapter integrates various development components addressed in the book and discusses future prospects for agricultural development.

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George W. Norton
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PART 1

Dimensions of world food and development problems

Rural family in Colombia


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1 Introduction

THIS CHAPTER

1 Examines the basic dimensions of the world food situation
2 Discusses the meaning of economic development
3 Considers changes that occur during agricultural and economic development

OVERVIEW OF THE WORLD FOOD SITUATION

One of the most urgent needs in the world today is to solve the persistent problems of hunger and poverty in developing countries. Despite significant progress in reducing these problems over the past few decades, millions of people remain ill-fed, poorly housed, under-employed, and afflicted by a variety of poverty-related illnesses. These people regularly suffer the pain of watching loved ones die prematurely, often from preventable causes. In many countries, the natural resource base is also being degraded, with potentially serious implications for the livelihoods of future generations.

Why do these problems persist? How severe are they, and what are their causes? What role does agriculture play in economic development and how might it be enhanced? What does the globalization of goods, services, ideas, technologies, and capital mean for agriculture, poverty, and environment around the world? How do policies in developed countries affect developing countries? And, how does the situation in low-income countries affect wealthier nations? An understanding of the fundamental causes of the many problems in poorer countries and the

progress that has been achieved is essential if solutions are to be recognized, encouraged, and implemented.

Much has been learned over the past several years about the roles of technology, education, international trade and capital flows, agricultural and macroeconomic policies, and rural infrastructure in stimulating agricultural and economic development. In some cases, these same factors can be a two-edged sword: they contribute to economic growth on the one hand, but lead to price and income instability or environmental risk on the other. These lessons and other potential solutions to development problems are examined herein from an economic perspective. The need is stressed for improved information flows to help guide institutional change in light of social, cultural, and political disruptions that occur in the development process.

World food and income situation

Are people hungry because the world does not produce enough food? No. In the aggregate, the world produces a surplus of food, and it has for a long time, even during the COVID-19 pandemic. If the world's food supply were evenly divided among the world's population, each person would receive substantially more than the minimum amount of nutrients

Many farm workers in Asia earn between one and two dollars per workday

required for survival. The world population has more than doubled over the past 50 years, but food production has grown even faster.

If total food supplies are plentiful, why do people perish every day from hunger-related causes? At its most basic level, hunger is a poverty problem. Only the poor go hungry. They are hungry because they cannot afford food or cannot produce enough of it themselves. The very poorest groups tend to include: families of the unemployed or under-employed landless laborers; the elderly, handicapped, and orphans; and people experiencing temporary misfortune due to abnormal weather, agricultural pests, health crises, or political upheaval. Thus, hunger is for some people a chronic problem and for others a periodic or temporary problem. Many of the poorest live in rural areas.

Hunger is an individual problem related to the distribution of food and income within countries and a national and international problem related to the geographic distribution of food, income, and population. About 9 percent of the world's population (roughly 700 million people) lives on less than $1.90 per day (the World Bank definition of extreme poverty), and about half the world lives on less than $5 per day. These people are found primarily in sub-Saharan Africa and South Asia, although poverty is also prevalent in East and Central Asia, Latin America and Caribbean, and Middle East and North Africa. Significant strides have been made in reducing global poverty, with the proportion of the world's population living in extreme poverty cut by more than half over the past three decades. However, much remains to be done to alleviate poverty-related problems.

While hunger and poverty are found throughout the world, over the past 40 years per capita food production has grown steadily in most regions, and in the last 20 years it has grown in every major region, including Africa (Table 1.1). The result has been substantial progress in reducing hunger and poverty, although per capita calorie availability remains below minimum nutritional standards in many sub-Saharan countries. Low agricultural productivity (farm output divided by farm inputs), wide variations in yields due to climatic, economic, and political causes, and rapid population growth have combined to create a precarious food situation in these countries.

Annual variation in food production is also a serious problem in several countries, particularly in Africa. This variation has meant periodic severe food shortages in some countries, especially when production problems have been compounded by political upheaval or wars that have hindered international relief efforts. Production variability causes wide price swings that reduce food security for millions who are on the margin of being able to purchase food.

Table 1.1 Food Production Index and Average Dietary Energy

Year	*1997*	*2007*	*2017*
Food Production Index (2004–06 = 100)			
World	82	106	131
Asia	77	109	140
Africa	74	104	135
Americas	83	106	126
Europe	99	98	111
Oceania	87	92	119
Ave. Dietary Energy Supply (KAL/Cap/Day)			
World	2716	2792	2908
Asia	2580	2650	2840
Africa	2432	2537	2561
Americas	3125	3210	3279
Europe	3237	3362	3380
Oceania	2889	2988	3023

Source: FAOSTAT, 2020, www.fao.org/faostat/en/#country

Food prices

From 1970 to 2000, the real price of food for most people trended down slightly, and from 2001 to 2020 it exhibited a slight upward trend. U.S. prices (in nominal or "current" dollars) of maize, rice, and wheat (the world's major food grains) are shown in Figure 1.1. Despite peaks in 1972, 1981, 1996, 2008, and 2011, the average prices of all three grains fluctuated around a relatively constant level. The prices of most other things rose more steadily over the entire period, so for most people the *relative* price of food fell slightly, except during the peak years noted above. This reduction in the price of food was both good and bad because prices affect economic growth and social welfare in a contradictory fashion. Lower food prices benefit consumers and stimulate industrial growth but can lower agricultural producer incomes and reduce employment of landless workers. To the extent that lower prices reflect lower production costs, impacts on producers may be mitigated.

The three grains shown in Figure 1.1 have exhibited sizable year-to-year price variations. Food price fluctuations directly affect the well-being of the poor, who spend a high proportion of their income on food. Food price instability can increase human suffering and threaten political stability. Food price swings have resulted from a combination of factors

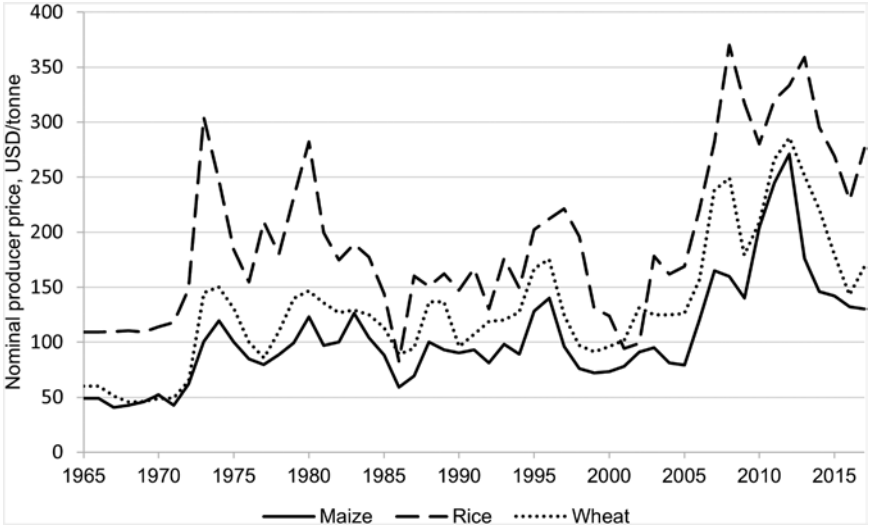


Figure 1.1 U.S. prices of major food grains in current dollars
Source: **FAOSTAT, 2019**

that shifted supply and demand. Supply factors included such items as adverse weather conditions and fuel and fertilizer costs. Demand factors included items such as demand for grains for bio-fuel use, population and income growth in many developing countries, changes in currency values, and policy changes in countries that affected their demand for imported food. Speculative investments in commodity markets have amplified commodity price swings for brief periods of time.

Malnutrition

Hunger is most visible to people in developed countries when a drought or other disaster results in images in the news of starving children. Disturbing as such images are, in a sense they mislead. The less conspicuous but more pernicious problem, in terms of people suffering and dying, is chronic malnutrition. While accurate figures of the number of malnourished in the world are not available, and even good estimates depend on the definition used, recent estimates indicate that almost 700 million people suffer from chronic undernutrition associated with food deprivation (Table 1.2), a number that has undoubtedly grown during the COVID-19 pandemic. Adverse health effects due to micronutrient deficiencies affect about two billion people. More than 5 million children die from preventable causes each year, about half due to malnutrition. Increasing per capita incomes have allowed more of the world's population to

Table 1.2 Estimated Number of Undernourished People in the World

	Number of Undernourished (millions)						
Year	*2005*	*2010*	*2015*	*2016*	*2017*	*2018*	*2019*
World	826	668	653	658	653	678	688
Africa	193	196	217	225	232	237	250
Asia	575	424	389	382	370	385	381
Latin America and the Caribbean	49	40	39	42	44	47	48

Source: FAO: The State of Food Security and Nutrition in the World, 2020, p. 340

eat better. But for those in lower income groups, the situation remains difficult.

Health

People born in developing countries live, on average, eight years less (in the least developed countries 14 years less) than those born in developed countries. Health problems, often associated with poverty, are responsible for most of the differences in life expectancies. Mortality rates for children under age 5 are particularly high, often ten times higher than in developed countries (Figure 1.2). Though countries with high rates of infant mortality are found in all regions, sub-Saharan African countries are particularly afflicted. The band of high infant mortality stretching from the Atlantic coast across Africa to Somalia on the Indian Ocean covers some of the poorest and most undernourished populations in the world.

Poverty affects health by limiting people's ability to purchase food, housing, medical services, and even soap and water. Inadequate public sanitation and high prevalence of communicable diseases are also closely linked with poverty. A major health problem, particularly among children, is diarrhea, usually caused by poor water quality. According to the World Health Organization, 1.4 million people die annually from causes related to diarrhea, including 500,000 children under the age of 5. Lower respiratory diseases account for an additional 3 million deaths and malaria another 400,000. Basic health services are lacking in many areas; on average, ten times as many people per doctor and per nurse are found in low-income countries as in developed countries.

A major health problem that continues to plague the developing world is acquired auto-immune deficiency syndrome (AIDS). The disease is difficult to contain in many developing countries because of lack

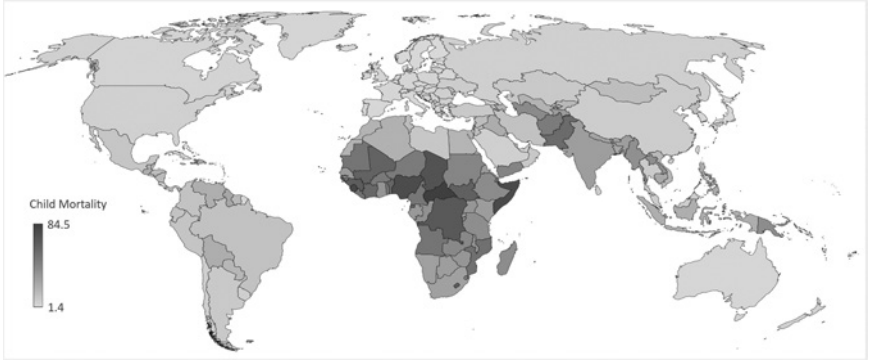


Figure 1.2 Child mortality rates per thousand live births, 2019
***Source*: World Bank, World Development Indicators 2019**

of education about the disease, limited use of protective birth control devices, and in some cases, absence of government commitment to address the problem. Effects are felt in lost productivity and increased poverty in addition to its effects on direct human suffering. According to the World Health Organization, an estimated 37 million people worldwide were living with HIV/AIDS in 2018.

The COVID-19 pandemic in 2020 is estimated to have pushed an additional 50 million people into extreme poverty, according to World Bank data. The World Food Program estimates that 130 million people will be added to the list of those suffering from extreme hunger. Most health systems in developing countries were ill-equipped to address existing health problems, let alone a pandemic.

Population growth

Population growth is important to poverty and hunger problems for several reasons. First, population is growing less than 0.5 percent per year in developed economies, but about 1.7 percent per year in developing countries, excluding China, and 3 percent or more in some sub-Saharan African countries. High growth rates place pressure on available food supplies and on the environment in many low-income countries. Continual increases in food production are needed, because regardless of how successful efforts to control population growth are, world population will not stabilize for several years. Rapid urbanization is also occurring as populations continue to grow. Second, population growth has slowed significantly in some developing countries, allowing them to benefit over time from having a high proportion of their populations being of working age. However, in countries where population growth rates have been

Children in Honduras

slow for several years, such as in Germany, the United States, and more recently China, a key issue now is how to meet the medical and income needs of large and growing elderly populations.

Globalization

Food and economic systems in less-developed countries are affected by the international economic environment far more today than they were in years past. Trade and other economic policies abroad and at home, international capital flows, migration, disease transmission, and oil price shocks have combined to increase the instability of and opportunities for improving the food and economic security of developing and developed countries.

International trade in agricultural products (as with other products) has grown over the past half century, building on improvements in transportation and information systems. As exports and imports of farm products constitute a higher proportion of agricultural production and consumption, effects of agricultural policies aimed at farm sector and world prices become more important to farmers than they were previously. Possibilities for maintaining a nation's food security at the aggregate level are improved, although price volatility remains an issue. Production and policy changes abroad also tend to have an expanded effect on domestic agriculture as international trade grows. The need to be price competitive with other countries has grown, as has the need to participate in international

negotiations to alter the policy environment. Growing demand in developed countries for non-traditional exports from developing countries, such as fresh fruits and vegetables, presents new opportunities for farmers. Quality and phytosanitary requirements in global markets create challenges for farmers wishing to exploit these opportunities.

International capital (money) markets, through which currencies flow from country to country in response to differences in interest rates and other factors, are as important as trade to the food and economic systems in less-developed countries. Capital flows affect the values of national currencies in foreign exchange markets. The foreign exchange rate, or the value of one country's currency in terms of another country's currency, is an important determinant of the price a nation receives for exports or pays for imports.

Many countries also have serious foreign debt problems. The decade following the 2008 global financial crisis was characterized by cheap credit for borrowers and increased private and public investments in developing countries. The need for foreign exchange to repay external debts has increased the importance of exports for these countries, forcing them to examine their trade and exchange rate policies. Fluctuations in global markets expose debtor nations to foreign exchange crises; when world commodity prices fall, heavy debt burdens can constrain domestic spending on social services and exacerbate political instability.

The lesson of two world wars, 9/11, the food price spike in 2008, and the recent COVID-19 pandemic is that we live in a globalized world that cannot be ignored, or if we do ignore it, it is at our own peril.

Environmental degradation

As populations grow, environmental problems become more severe. Deforestation, farming of marginal lands, overgrazing, and misuse of pesticides have contributed to soil erosion, desertification, poisoning of water supplies, and climate change. Global climate change has gradually warmed the climate and made weather more variable, contributing to stronger storms and harsher droughts. Water has become scarcer. Some environmental degradation is intentional, but most is the unintended result of people and governments seeking means of solving immediate food and economic problems, often at the cost of long-term damage to the environment. Some of this damage may compromise the ability of countries to raise incomes in the long run. When people are hungry, it is hard to tell them to save their resources for the future, and environmental conservation represents a form of savings. However, many potential solutions exist which are consistent with short-term increases in food

production and long-term goals of simultaneously sustaining or improving environmental quality while raising incomes.

Risk and uncertainty

Most of the factors mentioned above are associated with increased exposure to risk and uncertainty. Fluctuating prices, exchange rate instability, agricultural pests, and rapidly changing weather patterns represent risk factors. Risks and risk management imply real costs that may compromise short- and long-run in well-being. For example, the COVID-19 pandemic spread rapidly throughout the world and exposed the limitations of public health systems in poor and wealthy countries alike. More than a million people perished as a result of the pandemic, and economic damage from it and efforts to contain it erased decades of progress in reducing global hunger and poverty.

Pandemics are devastating, but not all risks faced by individuals and countries are necessarily bad. Innovation and entrepreneurship are risky activities with high payoffs. It is how risks are managed that most influences economic growth. Risk management needs to be conducted efficiently; the proper balance must be found between managing risks and pursuing other goals.

The preceding overview provides brief highlights of some of the dimensions of the food–income–population–environment problem.

Slum close to river bank in Katmandu, Nepal

These problems are discussed in more depth in subsequent chapters, and solutions are suggested.

Meaning of development

The term *development* means a change over time, typically involving growth or expansion. *Economic* development involves changes in people's standard of living. For most of human history there was little such change, but over the past 300 years there has been a rapid and (so far) sustained increase in almost every kind of human activity. Growth occurred first and has been sustained the longest in Northwest Europe and North America, but similar kinds of expansion have occurred all around the world. Economic growth reduced the poverty headcount in China from 66 percent of the population in 1990 to about 1 percent in 2015, based on the World Bank poverty definition of earning less than $1.90 of income per person per day.

Development is a process with many economic and social dimensions. For most observers, *successful* economic development requires, as a minimum, rising per capita incomes, eradication of absolute poverty, and reduction in inequality over the long term. The process is a dynamic one, including not only changes in the structure and level of economic activity, but also increased opportunities for individual choice and for improved self-esteem.

Development is often a painful process. Adjusting to new circumstances is always difficult: as Mark Twain famously wrote, "I'm all for progress – it's change I can't stand". There is often dramatic social upheaval with traditional ways of life being displaced, existing social norms being challenged, and increasing pressures for institutional and political reform. The physical and cultural landscape of a country can change radically during economic development. And at the individual level, the standard of living for the poorest people in a society can decline, at least for a while, even as average real incomes increase. Usually, the fruits of improvement are unequally distributed. By any measure, poverty and deprivation remain widespread, despite the astonishing improvements in living standards experienced by many across the globe.

As economic activity continues to expand, there is continuous concern with the constraints imposed by natural resources and environmental factors. The World Commission on Environment and Development has defined sustainable development as "development that meets the needs of the present without compromising the ability

of future generations to meet their own needs".[1] Thus, the term "development" encompasses not only an economic growth component, but also distributional components, both for the current population and for future generations.

Sustainable Development Goals

In 2015, United Nations countries adopted a set of 17 Sustainable Development Goals for the world to meet by 2030 (Figure 1.3). The first three goals are: no poverty, zero hunger, and good health and well-being. These goals appear ambitious, but having targets helps to focus attention on serious global problems and encourages measurement of progress in each country toward achieving improved and sustainable well-being for its citizens. In 2000, a set of similar goals were established for 2015, such as cutting extreme poverty and hunger in half. Some of these goals were achieved. The prominence among the goals of reduced poverty and hunger and of improved health reinforces their over-riding importance for the well-being of people around the world.

Measures of development

Achieving development is difficult to measure, illustrated in part by the sheer number of Sustainable Development Goals in Figure 1.3. However,

Figure 1.3 United Nations Sustainable Development Goal poster
***Source*: UNDP: Sustainable Development Goals, 2020, www.undp.org/content/undp/en/home/sustainable-development-goals.html**

measurement is often necessary in order to assess the impacts of specific, particular programs, including foreign assistance, and for evaluating progress in meeting goals. Because of its several dimensions, single indicators of development can be misleading. Measures are needed that are consistent with the objective of raising the standard of living broadly and sustainably across the population. Average per capita income is frequently used as a measure of development (Figure 1.4). Is it a good measure?

Average per capita income is not a perfect measure of living standards for several reasons, but finding an alternative indicator that can incorporate each dimension of sustainable development is impossible. Because development is multidimensional, collapsing it into a single index measure requires placing weights on different dimensions. Average per capita income is an inadequate measure even of the economic dimensions because it misses the important distributional elements of development and is a crude measure of people's well-being. The World Bank converts local currencies into U.S. dollars to allow income comparisons to be made across countries. It does this conversion using either official foreign exchange rates (Atlas method) or by a method called purchasing power parity (PPP method) that considers cost differences across countries. Because the cost of living is generally lower in developing countries than the United States, the PPP method usually gives a higher estimated per capita income for developing countries than does the Atlas method.

Alternative multidimensional development indicators have been suggested. One of the oldest is a level of living index proposed by M.K. Bennett that weights 19 indicators.[2] Examples of indicators include caloric intake

Figure 1.4 GNI per capita (Atlas method)
***Source*: World Bank, World Development Indicators Online Database, 2019**

per capita, infant mortality rates, number of physicians per 1000 of total population, and years of schooling. Another index is the Human Development Index[3] (HDI), which weights life expectancy, education, and income. Weighting schemes are subjective, however, and average per capita income is highly correlated with many of the indicators. Consequently, average per capita income, measured as gross national income (GNI) or gross domestic product (GDP) per capita, is often employed as a first approximation; then measures such as income distribution, poverty rates, literacy rates, life expectancy, gender empowerment, and child mortality, among others, are examined separately or as part of an index. Even these supplementary indicators can be misleading due to regional disparities within countries.

Incomes and development

Poverty and low incomes are most frequently associated with underdevelopment, while growing per capita incomes should indicate increasing levels of development. As discussed earlier, increasing average incomes may not necessarily mean more development, because the distribution of this income often determines whether poverty and inequality are diminished as the mean grows. Some of the relationships between poverty and inequality are discussed in Box 1.1.

Numerous measures of inequality and the extent of poverty exist. For example, the Human Poverty Index (HPI) measures the extent of deprivation with respect to life expectancy, education, and income.[4] An Inequality-adjusted Human Development Index (IHDI) is also available.[5] If, as is argued earlier, the meaning of development contains some element of poverty reduction or increased equality of income distribution, then clearly the incomes of the poor and destitute should be raised during the development process.

Policies undertaken to promote development have diverse effects on the incomes of the poor. Some people benefit, but often some do not, and, at times, incomes fall for certain population groups. It is important to consider the winners and losers in the development process. Income distributions and changes in them are indicators of the impact of development policies on different groups in society.

Value judgments or premises about what is desired or not are inextricably related to development economics. Concerns for economic and social equality, poverty eradication, and the need to improve health and education derive from subjective beliefs about what is good and what is not. Solutions to specific development problems often involve tradeoffs, and decisions about public resource allocations always involve tradeoffs. Governments make such tradeoffs every day, as most public actions are costly to some people even as they benefit others. Economics can be a

BOX 1.1 POVERTY AND INEQUALITY

Poverty is generally defined as the failure to achieve a minimum standard of living. It refers not just to *averages*, but to *distributions*. Poverty is not, however, synonymous with inequality; countries with perfect equality could contain all rich or all poor people. Measurement of poverty requires three steps: determining an appropriate measure or indicator, deciding on its minimum level, and counting the number or percentage of people falling below it. Alternatively, a measure of degree or intensity of poverty would indicate the amount by which people fall below the poverty line.

Poverty refers to a level or position with respect to a measure such as income, while inequality refers to the distribution of that measure among a population. For example, evidence from 21 developing countries indicates that, on average, 6 percent of household income is received by the poorest 20 percent of the households, whereas 48 percent of household income is received by the richest 20 percent. In some countries, the extremes are even more dramatic. It is possible for poverty to decrease in a country during the development process, but for inequality to increase, at least for a period of time.

powerful tool for evaluating these tradeoffs, providing insights into the costs and benefits of different actions, winners and losers, and longer-run consequences of policy, investment, and consumption decisions. Economics is, however, less well-suited for making value decisions.

ROLE OF AGRICULTURE

Many alternative development paths or strategies exist. The strategy followed by an individual country at a point in time is, or at least should be, influenced in part by its resource endowments and stage of development. Some countries with vast oil and mineral resources have generated capital for development by exporting those resources. Others have emphasized cash-crop exports such as coffee, cocoa, and tea. Some have focused on industrial exports, while others have stressed increases in basic food production. The optimal development path will vary by country, but the choice of an inappropriate path, given the existing resource endowments and stage of development, can result in long-term stagnation of the economy.

Agriculture is not very productive in most low-income countries. Early in the development process, much of the population is employed in agriculture, and a high percentage of the national income is derived from that sector[6] (see Table 1.3). As development proceeds, population grows and per capita income increases. As incomes grow, more and different types of food are demanded; either agricultural production or imports

Table 1.3 Relationship among Per Capita National Income, the Proportion of National Income in Agriculture, and the Proportion of the Labor Force in Agriculture, Selected Countries, 2018

Country	*Per capita income (in PPP dollars)*[1]	*Agriculture GDP as a percentage of total GDP*	*Percentage of active labor force in agriculture*	
			Female	*Male*
Uganda	1,753	24	76	65
Mali	1,982	39	63	66
Bangladesh	4,057	13	59	31
Moldova	6,770	10	28	36
Philippines	9,540	9	15	31
Ecuador	10,128	9	24	29
Indonesia	11,256	13	28	32
Colombia	12,859	6	8	22
Brazil	14,068	4	4	13
Thailand	16,129	8	28	33
Argentina	17,623	6	0	0
Mexico	17,672	3	4	18
Italy	36,218	2	2	5
Korea, Rep.	36,757	2	4	5
Japan[2]	40,344	1	3	4
France	40,459	2	2	4
Canada[3]	43,632	2	1	2
Australia	44,041	2	2	3
United States[4]	56,651	1	1	2

Source: World Bank, World Development Indicators Online Database, 2019

1 PPP stands for purchasing power parity and means that the incomes are converted to dollars that consider cost of living differences across countries.

2 Per capita income and agriculture GDP share for Japan are for 2017.

3 Agriculture GDP share for Canada is for 2015.

4 U.S. agriculture GDP share is for 2017.

must increase. Because agriculture commands so many of the resources in most low-income countries, few funds are available for importing food or anything else unless agricultural output grows.

The capacity of the agricultural sector to employ an expanding labor force is limited. As incomes continue to rise, the demand for non-food commodities grows as well. Therefore, economic development requires a structural transformation of the economy involving relative expansion of nonagricultural sectors. The agricultural sector must contribute food, labor, and capital to that expansion. It also provides a market for nonagricultural goods.

This economic transformation is illustrated in Table 1.3. Agriculture accounts for a large percentage of total income, and an even larger percentage of total employment for the lower income countries. The contribution of agriculture to national incomes declines from 30 to 50 percent for the lower-income countries, to 15 to 20 percent for the middle-income range, and below 3 percent for the highest income countries.

The initial size and low productivity of agriculture in most developing countries suggests an opportunity for raising national income through agricultural development. Because of the initial size of and low per-capita income in the agricultural sector, there is real scope for improving the distribution of income and enhancing the welfare of a major segment of the population through agricultural development.

One key to agricultural development is to improve information flows. In primitive societies, economic activities are local and information is basically available to all. Inappropriate activities are constrained by social and cultural norms. As development begins to proceed and economies become more complex, information needs increase, but traditional forms of information transmission are incapable of meeting these needs. Modern information systems are slow to develop, creating inequalities in access to new and accurate information. Those with greater access than others can take advantage of this situation to further their own welfare, often at the expense of overall agricultural and economic development.

Some changes required to foster broad-based and sustainable development require institutional changes and capital investments. Institutional changes typically require government involvement. Capital investments necessitate savings. Such savings are channeled into private and public investment, the latter to build the infrastructure needed for development. Saving requires striking a balance between present and future levels of living because it requires abstention from current consumption. Means must be sought to reduce this potential short-run versus long-run conflict during the development process. However, certain types of investments necessary for development, such as education, provide both short- and long-run benefits, as do investments in technologies and employment-intensive industries.

Improving agriculture

How can agriculture be improved to facilitate its role in providing food and contributing to overall development? There are still a few areas of the world, particularly in parts of Latin America and Africa, where land suited for agricultural production is not being farmed. Most increases in agricultural production will have to come, however, from more intensive use of land currently being farmed. Such intensive use will require improved technologies generated through research as well as improved irrigation systems, roads, market infrastructure, and other investments. It will require education and incentives created through changes in institutions such as land tenure systems, input and credit policies, and pricing policies (Box 1.2).

BOX 1.2 HISTORICAL PERSPECTIVE ON AGRICULTURAL DEVELOPMENT

The historical progression of agricultural development can be broadly broken into four distinct periods, marked by three "revolutions" in production technology and social institutions.

First, from the time that we first appeared on earth, human beings hunted and gathered their food. Hunter–gatherer societies typically lived in small groups and experienced little population growth.

Second, more than 10,000 years ago, a combination of climate changes and other factors created conditions for the development of settled agriculture. In the Middle East and elsewhere, people began to collect and cultivate the seeds of plants that eventually became modern barley, wheat, and rye. This development is known as the *first agricultural revolution*, and it permitted a slow but significant increase in human population density.

Third, a few hundred years ago, rising population density and opportunities for trade led to a *second agricultural revolution*. In Northwestern Europe and elsewhere, farmers developed crop rotations and livestock management systems that permitted rapid growth in output per person, fueling the *industrial revolution* and the eventual mechanization of many important tasks.

Finally, in the late nineteenth and early twentieth centuries, scientific breeding, chemical fertilizer, and other innovations allowed rapid increases in output per unit of area. The spread of these biological technologies to developing countries, known as the *green revolution*, was a powerful engine of economic growth and poverty

alleviation, allowing low-income people to produce more food at lower cost than ever before.

These historical trends played out at different speeds and in different ways across the globe. Very few people, and only in the poorest countries, still devote substantial energy to hunter–gatherer activities, although millions of farmers still cultivate the same seeds in the same ways as their ancestors. Because of population growth, these techniques and institutional arrangements yield less output over time. The development and spread of higher-productivity systems to suit people's needs is among the major humanitarian challenges of our time.

Some of the basic dimensions of the world food–poverty–population–environment problem were examined. The aggregate world food situation was reviewed, and questions such as who the hungry are, and why they are hungry even though the world produces a surplus of food, were addressed. The significance of population growth and a series of forces in the global economy that influence developing countries were stressed.

SUMMARY

The meaning and measures of development were discussed and Sustainable Development Goals were identified. While alternative development strategies can be followed, agriculture has an important role to play in overall development in most developing countries. Development will require a complex set of improved technologies, education, and institutions.

IMPORTANT TERMS AND CONCEPTS

Agricultural productivity
Development
Enhanced information flows
Environmental degradation
Food price instability
Foreign exchange rates
Globalization
Health problems
Institutional change
International capital markets
International trade
Measures of development
Population growth
Poverty
Purchasing power parity
Structural transformation of the economy
Sustainable Development Goals
Technology

LOOKING AHEAD

In order to visualize more clearly the relationships among food supplies, food demand, population growth, and nutrition, it is important to examine facts, scientific opinion, and economic theory. We make this examination in the remaining chapters of Part 1 in this book. We turn first in Chapter 2 to the causes and potential solutions to hunger and malnutrition problems.

QUESTIONS FOR DISCUSSION

1. Are people hungry because the world does not produce enough food?
2. Has food production in developing countries kept pace with population growth there?
3. Is malnutrition more widespread today than in the past?
4. Why did food prices rise sharply beginning in 2008?
5. What are some factors that will influence the price of food over the next 10 to 20 years?
6. Is there much hope of bringing more land into production to help increase food production?
7. Why is agricultural development particularly important in less-developed countries?
8. Approximately what proportion of the world's population lives on per capita incomes of less than $2 per day?
9. What is development? To what extent are values important when discussing development issues?
10. Is average per capita income a good measure of level of living?
11. Why is most of the labor force engaged in agriculture in many less-developed countries?
12. Does economic development require expansion of the nonagricultural sector in low-income countries?
13. What is the conflict between increasing near- versus long-term levels of living in developing countries?
14. What are some of the major health problems in developing countries and what are their primary causes?
15. How fast is population growing in developing countries?
16. Why has international agricultural trade become more important over the past 40 years?
17. Why have international capital markets become more important to developing countries over the past 40 years?
18. Why might low food prices be both good and bad?

19 Why has environmental degradation become an increasing problem in developing countries?

NOTES

1 World Commission on Environment and Development, *Our Common Future* (New York: Oxford University Press, 1987), p. 43.
2 See M.K. Bennett, "International Disposition in Consumption Levels", *American Economic Review*, vol. 41 (September 1951), pp. 632–649.
3 United Nations Development Program, *Human Development Report 2011* (New York: Palgrave Macmillan, 2011), with the HDI, http://hdr.undp.org/en/statistics/hdi/.
4 United Nations Development Program, *Human Development Report* 2007 (New York: Palgrave Macmillan Press, 2007), p. 357.
5 United Nations Development Program, *Inequality Human Development Report 2011* (New York: Palgrave Macmillan, 2011), with the IHDI, http://hdr.undp.org/en/statistics/ihdi/.
6 A warning about measurement is appropriate: in most countries it is difficult to measure the number of people employed in agriculture. Multiple job holdings, seasonal labor use in agriculture, and unpaid household labor all complicate the measurement problem. Often, data on the number employed in agriculture are obtained by (generally high-quality) census estimates of the rural population. Even in rural areas, many people are employed outside of agriculture.

RECOMMENDED READINGS

Food and Agriculture Organization of the United Nations, *State of Food Security and Nutrition in the World 2020* (Rome: FAO, 2020).
Norton, George W., *Hunger and Hope: Escaping Poverty and Achieving Food Security in Developing Countries* (Long Grove, IL: Waveland Press, 2014), Chapter 1.
Runge, C. Ford, Benjamin Senauer, Philip G. Pardey, and Mark W. Rosegrant, *Ending Hunger in Our Lifetime: Food Security and Globalization* (Baltimore: Johns Hopkins University Press, 2003).
Todaro, Michael P., *Economic Development* (New York: Prentice Hall, 2011), especially Chapters 1–3.
United Nations Development Program, *Human Development Report 2013* (New York: Palgrave Macmillan, 2013).
World Bank, *World Development Report 2008, Agriculture for Development* (New York: Oxford University Press); see earlier and later volumes as well.

2 Poverty, hunger, and health

THIS CHAPTER

1 Describes the world food situation
2 Examines different forms of poverty, hunger, and malnutrition: their magnitudes, consequences, and how they are measured
3 Identifies principal causes of and potential solutions to problems with poverty, hunger, and malnutrition in developing countries

THE WORLD FOOD SITUATION

World food demand and supply

On a global level, sufficient food is produced to feed everyone on earth. And the overall food situation has improved significantly over the last 50 years. Cereals are the most important sources of food, and since the mid-1960s, world cereal production has risen by roughly 1 billion tons per year. It is likely that an additional billion tons of production per year will be needed by 2040 to meet food needs of a world population expanding in numbers and in income. It is also likely that cereal imports by many developing countries will continue to grow.

Until recently, overall numbers and projections had suggested gradual improvement in reducing undernutrition in the world. However, several countries, mostly in sub-Saharan Africa, have seen per capita food production and consumption stagnate for decades, or not increase enough to significantly reduce the number of malnourished. According to data from the Food and Agriculture Organization of the United Nations (FAO), the index of per capita food production in Africa has grown only about 10 percent since 1970, with most of the increase coming in

the period between 2000 and 2014. In some countries, per capita food production and consumption has declined since 1970. For example, the Democratic Republic of the Congo has experienced a 50 percent decline in per capita food production since 1970, due in part to conflict-related disruptions.

Even in countries with growing average food consumption, some groups may not see their consumption levels increase: household food consumption is closely related to household incomes, and the most disadvantaged are afflicted by low and uncertain incomes. In addition, the rate of growth in agricultural output for the world as a whole has slowed since the 1980s, and the use of cereals and sugar to produce bio-fuel products has created competition for use of these products as food. For people in many countries, the struggle for food will continue. Therefore, we turn now to how poverty and access to food manifest themselves in terms of hunger, malnutrition, and, in some cases, famine.

POVERTY

Poverty has many faces and is one of the major challenges facing the development community. Poverty is widely understood to be an inability to meet basic needs, and the poor tend to be hungry, lack adequate shelter, and have limited access to health care. The poor lack opportunity, and their powerlessness often leads to hopelessness and despair. To most people reading this book, poverty is an invisible and abstract problem, somewhere out there. We seldom think about it, and when we do, we often don't know what to do about it. Global poverty has been cut roughly in half since 1990, but stark challenges remain. In 2019, almost 700 million people – about 9 percent or a sixth of the world's population – lived in extreme poverty, as defined by making less than $1.90 per day. About 1.3 billion people in developing countries are "multidimensionally poor", according to a survey by the UN Development Program. However, for the first time since 1998, the number of extremely poor rose rapidly in 2020 due to jobs lost during the COVID-19 pandemic, likely by more than 100 million people and perhaps by hundreds of millions.

Measuring poverty

Since poverty is multidimensional, efforts to measure it can be complicated by attention to its different dimensions. Two broad types of measurement schemes exist: monetary and non-monetary. Monetary

measures consolidate the different dimensions of poverty into a single unit of measure – money. Their strengths include the ability to make comparisons in a common unit, a non-arbitrary measurement scheme, and ability to quantify the extent, depth, and severity of poverty (see Box 2.1). However, monetary approaches often fail to capture dimensions of poverty that may be especially important and intractable, such as social exclusion and political powerlessness.

BOX 2.1 MONETARY MEASUREMENT OF POVERTY[1]

Three primary challenges in measuring poverty are: (1) deciding what to measure, (2) identifying a value, below which a household is deemed to be poor, and (3) adding it up for the population. Poverty involves an inability to control sufficient resources to meet a minimum level of well-being, and analysts use household income or consumption expenditure to measure it. Consumption is generally preferred because income, particularly in rural areas, is seasonal and variable, while consumption is smoother and often easier to measure. The poverty line is the value of income or expenditures on a daily, monthly, or annual basis below which a person is deemed to be poor. This poverty line can be determined many ways. In the United States, the poverty line was created in 1963 using the minimum cost of achieving an adequate diet based on U.S. Department of Agriculture food plans. Non-food expenditures were accounted for by observing that poor households generally spend about a third of their total budget on food: the food poverty line was multiplied by 3 to obtain the total poverty line. This line has been updated over time by adjusting for changes in the cost of living. A commonly used international poverty line is the World Bank's use of $1.90 person per day (in 2011 prices) to reflect extreme poverty and $3.20 per day (2011 prices) to reflect moderate poverty.

With a household survey, incomes or expenditures can be compared to the poverty line: households with values below the line are poor. Policymakers are not only interested in which households are poor, but also in where the poor are located, what they do, and how poverty has changed over time. Monetary indices of poverty are used to address these concerns, and the most commonly used

poverty index, called the Foster, Greer, Thorbecke (FGT) Index,[2] is one that reflects the prevalence (proportion of the total population that is poor), depth (the degree of shortfall below the poverty line), and severity of poverty (the degree of inequality among the poor). This index gives policymakers a nuanced view of the total poverty picture: for example, a policy may increase the depth of poverty among some while reducing the total proportion of the population that is poor. For example, 40 percent of the population in South Asia was poor in 2005 compared to 51 percent in sub-Saharan Africa. In contrast, the poverty severity measures were 3 percent for South Asia compared to over 10 percent for sub-Saharan Africa, indicating a far more serious problem in poverty severity in sub-Saharan Africa than in South Asia at the time.

[1] For more information, see: www.worldbank.org/en/topic/poverty.
[2] J. Foster, J. Greer, and E. Thorbecke, A Class of Decomposable Poverty Measures, *Econometrica*, Vol. 52, 1984, pp. 761–766.

Non-monetary measures include qualitative assessments and indices that combine different dimensions, such as the Human Development Index (HDI) and Human Poverty Index (HPI) described in Chapter 1. These indices often face the criticism that the weights used are arbitrary, and measures vary significantly when the weights are changed. They also fail to capture dimensions such as social exclusion and powerlessness.

The different approaches complement each other, and their combination has allowed a deeper understanding of poverty. For example, qualitative participatory poverty assessments that engage in discussions with groups of poor people about their conditions and the unique challenges they face often accompany monetary assessments, and the combination can help in understanding how policies can be formulated to reduce poverty.

Vulnerability: transitory and chronic poverty

Poverty is not a constant state for many developing-country households. Weather, pests, diseases, and policies cause fluctuations in income that translate into movement in and out of poverty – households are vulnerable to becoming poor. This in-and-out of poverty situation is important because different policies may be needed to address transitory compared

to chronic poverty. Evidence shows that transitory poverty – movement in and out of poverty over time – accounts for a substantial portion of overall poverty. As a result, means of protecting people from transitory income shortfalls may substantially improve the global poverty picture. Formal and informal insurance schemes, social safety nets, and other means of reducing or managing risks can help achieve this aim. Rural public work programs, such as dam-building, irrigation and water supply schemes, road construction, and maintenance programs are examples of social safety nets that may reduce vulnerability to poverty and build infrastructure for agricultural development. Pension programs, cash transfers, and feeding programs are examples of social protection schemes that affect food demand.

Chronic poverty is often caused by very different factors: households do not have access to enough human, physical, natural, and other assets to earn sufficient incomes for minimum levels of well-being. Poverty traps caused by insufficient assets, severely degraded natural resources, and other factors are difficult to escape and often require long-term investments in asset building, access to new factors of production, and improved institutions.

Agricultural development and the poor

A common misconception about poverty is that it is largely an urban problem. Pictures of teeming slums with inadequate sanitation and rotting infrastructure help bolster this perception. In contrast, rural residents are thought to live in relatively spacious conditions and to be able to rely on their own production of foods in times of dire need. In fact, on a global level, the rural poor make up about 70 percent of the total poor, and rural poverty is twice as prevalent as urban poverty. Rural poverty is a major problem and, as we will see throughout this book, agricultural development can play a significant role in its reduction, but agricultural development can also alleviate urban poverty.

Agricultural technology has direct impacts on the rural poor by increasing incomes of farmers, many of whom may be poor. Care must be taken during development and subsequent release of new technologies to ensure that they are accessible to poor producers. Indirect benefits to the poor from growth in agriculture come from two primary sources: increased demand for labor on farms and increased supply of food, causing food prices to drop. In many countries, especially in South Asia, landless laborers comprise a large proportion of the rural poor, and increased demand for agricultural labor benefits this group. The latter benefit can be substantial and is an important reason why global poverty

fell from the early 1980s until recently. Food price declines have led to higher levels of living even for people who do not depend directly on agriculture. When global food markets tighten, as they have for brief periods, poverty rises due to the indirect effect of higher food prices.

HUNGER, MALNUTRITION, AND FAMINE

Hunger is a silent crisis in the world. In times of famine, it can tear at the heartstrings as media attention focuses on its dramatic effects. The most extreme type of hunger is severe calorie and protein undernutrition during a famine. However, more pervasive is chronic undernutrition and malnutrition associated with poverty, illness, ignorance, maldistribution of food within the family, and seasonal fluctuations in access to food. Low-quality diets can cause many forms of malnutrition, contributing to cardiovascular and metabolic disease through obesity, diabetes, and other conditions, but in this chapter, we focus on hunger and undernutrition. We begin our discussion with the contrast between famine and chronic malnutrition.

Famine

Famine is marked by an acute decline in access to food that occurs in a definable area and has a finite duration. Access to food usually falls due to crop failures, often in successive years, due to drought, flood, insect infestation, or war. During a famine, food may actually be present in the affected area, but its price is so high that only the wealthy can afford it. Food distribution systems may break down so that food cannot reach those who need it.

Famines have occurred throughout history. In recent years, their prevalence has been highest in sub-Saharan Africa, such as the ones in Yemen in 2019–20, South Sudan in 2017, and Somalia in 2011. All of these were caused to some degree by political problems and conflict. Famines also occurred in North Korea in the mid-1990s, Cambodia in 1979, Bangladesh in 1974, India in 1966 to 1967, and China in 1959 to 1961. The latter was the worst famine of the 20th century and resulted in the deaths of more than 16 million people.

Famine is the extreme on the hunger scale because it causes loss of life and concurrent social and economic chaos over a relatively short period of time. As access to food falls, people begin by borrowing money and then selling their assets to acquire money to purchase foods. Subsistence farmers sell their seed stocks, livestock, plows, and even land. Landless

laborers and other poor groups lose their jobs, or face steeply higher prices for food at constant wages. As the famine intensifies, whole families and villages migrate in search of relief. The telltale signs of acute malnutrition and, eventually, sickness and death appear.

Fortunately, progress is being made against famine. Although large variations occur in annual food production in individual countries and world population continues to grow, the frequency and intensity of famines has decreased due to improved information and transportation networks, increased food production and reserves, and dedicated relief organizations. Much of the starvation we see during famines now occurs in areas where transportation systems are deficient and where conflict thwarts relief efforts, such as in Yemen. The relatively recent famines in Yemen, South Sudan, and Somalia were all due to a combination of natural disasters, conflict, and lack of political will to alleviate the problem.

Chronic hunger and malnutrition

As devastating as famines are, they account for only a small fraction of hunger-related deaths. Famines can be attacked in a relatively short period of time if political conflict in the affected country does not hamper relief efforts. Chronic hunger and malnutrition affect a much greater number of people and are more difficult to combat (Table 2.1).

Table 2.1 Estimated Number of People Affected by Preventable Malnutrition Worldwide

Deficiency	*Morbidity*	*Estimated Prevalence*	*Population Group Most Affected*
Protein + energy[1]	Wasting (underweight)	49,500,000	Children under 5
Protein + energy[1]	Stunted growth	149,000,000	Children
Iron[2]	Anemia	613,200,000	Women 15 to 49
Vitamin A[3]	Blindness/ Measles/Diarrhea	105,700 (deaths)	Children under 5
Iodine[4]	Brain damage	18,000,000	Infants

Sources:

1 UNICEF-WHO-World Bank, Joint Child Malnutrition Estimates, regional and global joint estimates, 2019

2 2018 Global Nutrition Report – Chapter 2

3 *Lancet Global Health*, Vol. 3, Issue 9, 528–536

4 WHO, Investing in the future: A united call to action on vitamin and mineral deficiencies, Table 3: Human toll of vitamin and mineral deficiencies. Global Report 2009

According to FAO, nearly 690 million people were undernourished in 2019, or about 8.9 percent of the world population. An estimated 2 billion people did not have regular access to safe and nutritious food that included sufficient intake of macronutrients and micronutrients. Preschool children and pregnant and nursing women are particularly vulnerable to the dangers of malnutrition.

Serious macronutrient malnutrition in developing countries reflects primarily undernourishment – a shortage of food in the diet – not an imbalance between total calories and protein. The availability of calories per capita by country is illustrated in Figure 2.1. Many of the countries with very low per capita calorie availability are found in sub-Saharan Africa. A close, but not perfect, correspondence exists between low calorie availability and the low-income countries identified in the previous chapter. When commonly consumed cereal-based diets meet energy (calorie) requirements, it is likely that most protein needs will also be satisfied for people older than about 2 years of age. Thus, for everyone except infants, the greatest concerns are the total quantity of food available to eat and micronutrient consumption. In settings where overall energy intake meets minimum needs, remaining protein or micronutrient deficiencies can often be improved with rather small investments to improve the quality of the diet. However, for millions of people, especially women and children, these investments are not being made (Table 2.1).

Iodine deficiency is common in regions far from the sea, for example parts of the Andes in South America. Iron deficiency is a particularly serious problem among women of childbearing age all over the world, and vitamin A deficiency is a widespread concern, especially among children.

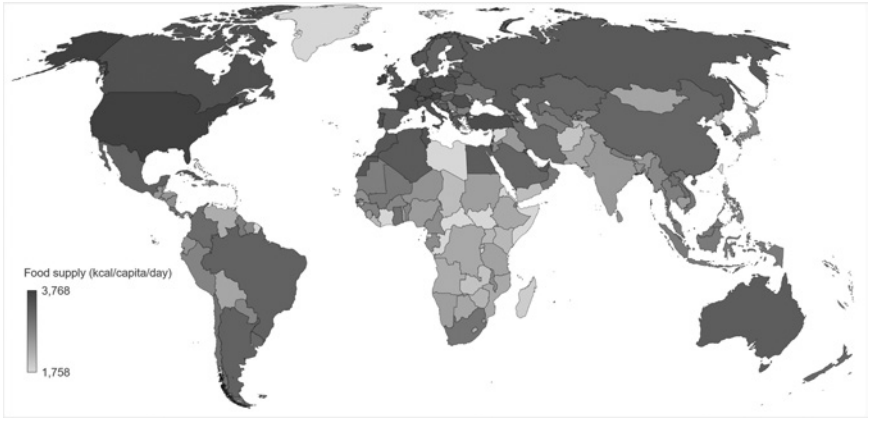


Figure 2.1 Daily calorie availability per capita, 2017
***Source*: FAOSTAT data**

Consequences of hunger and malnutrition

Stunted growth, reduced physical and mental activity, muscle wasting, increased vulnerability to infections and other diseases, and, in severe cases, death are the most common consequences of calorie deficiencies. Death most frequently results from dehydration caused by diarrhea, whose severity is closely linked to malnutrition. Chronic protein malnutrition results in stunted growth, skin rash, edema, and change of hair color. A diet relatively high in calories but low in protein can result in an illness known as kwashiorkor, while a diet low in both calories and protein can result in an illness known as marasmus. People can live about a month with kwashiorkor, three months with marasmus; 7–10 million people die each year from the two diseases.

Iron deficiency anemia affects muscle function and worker productivity. Vitamin A deficiency is a leading cause of childhood blindness and often results in death due to reduced disease resistance. Iodine deficiencies cause goiter and brain damage.

There is little doubt that hunger and malnutrition result in severe physical and mental distress, even for those who survive the infections and diseases. Malnourished children are more likely to not attend school, and when they do, they learn less than their well-nourished counterparts. Malnutrition can affect the ability of a person to work and earn a decent livelihood, as mental development, educational achievement, and physical productivity are reduced. People with smaller bodies because of inadequate childhood nutrition are paid less in agricultural jobs in many countries. Lower earnings perpetuate the problem across generations, leading to a vicious cycle of malnutrition and poverty.

Measuring hunger and malnutrition

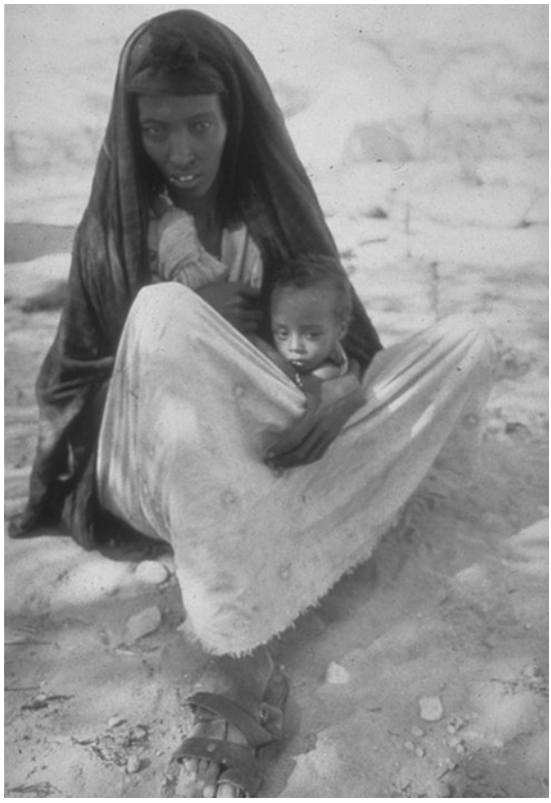
Measuring the extent of hunger and malnutrition in the world is difficult. Disagreement surrounds definitions of adequate caloric and protein requirements, while data on morbidity and mortality reflect the combined effects of sickness and malnutrition.

Nutritional assessments are usually attempted through food balance sheets, dietary surveys, anthropometric (body measurement) surveys, clinical examinations, and administrative records. Food balance sheets place agricultural output, stocks, and imports on the supply side and seed for next year's crops, exports, animal feed, and wastage on the demand side. Demand is subtracted from supply to derive an estimate of the balance of food left for human consumption. That amount left can be balanced against the Food and Agricultural Organization of the United Nations' (FAO) tables of nutritional requirements to estimate

the adequacy of the diet. This method provides rough estimates at best, due to difficulties in estimating agricultural production and wastage in developing countries.

Food balance sheets provide only a picture of average food availability. Malnutrition, like poverty, is better measured if the distribution of food intake or of other indicators is also considered. Average national food availability can be adequate, while malnutrition is common in certain areas, or among particular population groups. Even within families, some members may be malnourished while others are not. To measure malnutrition accurately, information on households or individuals is required.

Household and individual information can be obtained from dietary or expenditure surveys and from clinical or field measurements of height, weight, body fat, and blood tests. These methods are expensive and seldom administered on a consistent and widespread basis for an



Women and child in Ethiopia
Source: **Photo by Mesfin Bezuneh**

entire country. They can be effective, however, in estimating malnutrition among population sub-groups. Since preschool children are most vulnerable to nutritional deficiencies, random surveys to measure either their food intakes or anthropometry can provide a good picture of the extent of malnutrition. Another means of estimating the extent of malnutrition is to utilize existing data in hospital, health service, and school records. Unfortunately, these statistics can be biased because the records for rural areas are scarce, the poor are the least likely to have sought medical attention, and the quality of the information in the records is uneven. For example, many countries record the heights, weights, and ages of first-year elementary school children. Unfortunately, some members of the poorest population groups do not attend school. Because of these biases, estimates of malnutrition among school-aged children generally understate the true problem. One reason why malnutrition is misunderstood is that its measurement is so difficult.

CAUSES OF POVERTY, HUNGER, AND MALNUTRITION

A variety of factors contribute to poverty, hunger, and malnutrition, but inadequate income is certainly the most important underlying cause. If people, for whatever reason, produce too few goods and services and lack income to buy food, they go hungry. Even in times of famine, decreased purchasing power rather than absolute food shortage is often the major problem, as food may be available in nearby regions. Incomes in the affected area have declined so that people cannot afford to buy food from unaffected areas.

Figure 2.2 contains a schematic diagram of the determinants of household well-being and individual nutritional status. Access to productive assets such as land, labor, natural resources, and the policy regime (prices and other factors) determine household income and well-being. Income, including the value of own production and in-kind transfers determine how much food can be purchased or consumed by the family. Total food purchases and consumption do not, however, tell the entire story. Health status and family food preparation, along with how food is distributed among members of the family, help determine how food available to a family is related to individual nutritional status.

Health and malnutrition

Poverty's interaction with malnutrition is often compounded by infectious diseases and parasites that reduce appetites, cause malabsorption

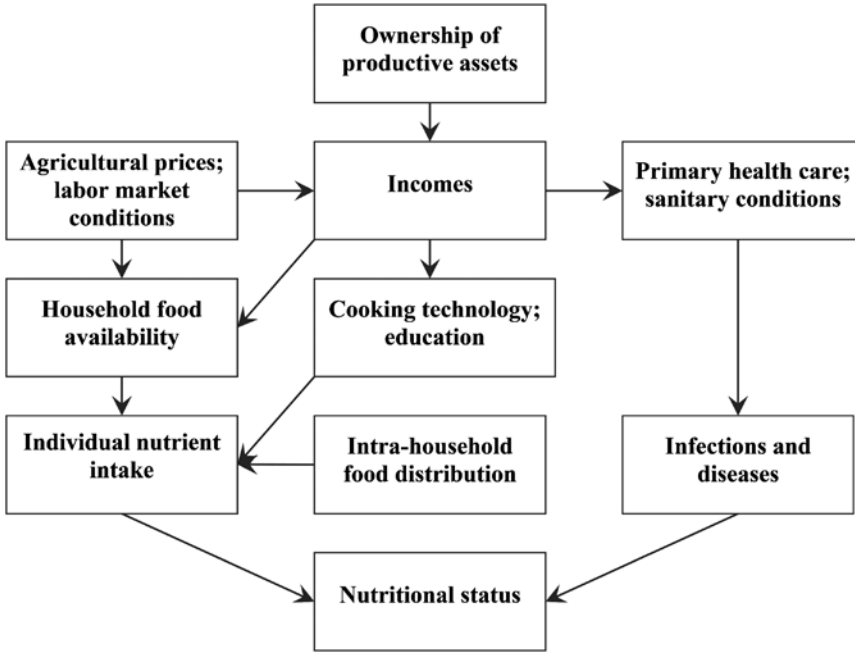


Figure 2.2 Determinants of household well-being and individual nutritional status

of food, or result in nutrient wastage due to fever and other metabolic processes. Health problems and malnutrition exhibit a synergistic relationship: infections and parasites lead to malnutrition while malnutrition can impair the immune system, increasing the risk of infection and the severity of illness. Measles, parasites, intestinal infections, and numerous other health problems are prevalent in developing countries. Many health and sanitation problems lead to diarrhea, which in turn can cause dehydration and death. Health is determined by, among other things, household sanitary conditions, which are influenced by household assets and income, and by government programs. There is room for optimism related to many childhood diseases. The World Health Organization reports that because of sustained efforts to vaccinate children, the majority of the world's children under 1 year old are now vaccinated against six common childhood diseases. However, the last 30 years has seen HIV/AIDS become a persistent problem, especially in Africa and Asia. Thirty-eight million people were HIV positive in 2018 and about 770,000 people died from AIDS-related illnesses. Malaria also remains a serious problem in many countries, with more than 200 million cases per year and 435,000 deaths. Seventeen countries, mostly in Africa, account