

Nutrition, the MDGs, and Food Price Developments

Summary and main messages

Even temporarily high food prices affect the long-term development of children. Conditions of early life (from conception to two years) provide the foundations for adult human capital. Vicious interactions between malnutrition,¹ poor health, and impaired cognitive development set children on lower development paths and lead to irreversible changes.

Seemingly small shocks can exert great damage if they are not dealt with early. The most dramatic effect of the food price crisis is an increase in infant mortality, especially in low-income countries. Other hard-to-reverse impacts include growth faltering (stunting or low height for age) and lower learning abilities. Malnourished young children are also at more risk for chronic diseases such as diabetes, obesity, hypertension, and cardiovascular disease in adulthood. Moreover, declines in human capital in a crisis tend to be more pronounced than the corresponding increases during economic booms.

The most vulnerable bear the brunt of the adverse impacts of high food prices, through malnutrition. Poor households tend to spend a larger share of their income on food and are especially vulnerable to price increases.

The dynamics of intrahousehold distribution combined with biological vulnerability mean that pregnant women and children in these households face higher risks of malnutrition. Impacts such as mortality and school dropout are often sharper for girls than boys.

To build household and individual resilience and mitigate long-term effects, interventions can work through multiple pathways, beyond trying to keep prices low. In the short term, interventions should focus on maintaining household purchasing power and caloric and micronutrient intakes through cash transfers, food and nutrient transfers, and workfare-with-nutrition. To maximize impacts on children and women, interventions should ensure that those transfers are put in the hands of women, if possible. In the longer term, interventions should focus on strengthening the link between smallholder agriculture and nutrition, addressing seasonal deprivation, and promoting women's income and girls' education.

Specific interventions need to target vulnerable children through behavioral changes related to breastfeeding, feeding during illness, hygiene, access to micronutrients, deworming (which increases absorption of micronutrients), and preventive and

therapeutic feeding. Consequently, activities for countries to mitigate the potentially negative impacts of food prices include improving data quality about nutrition status (height for age, weight for age, and micronutrient deficiencies), practices (breastfeeding), and interventions; targeting the period from conception to two years of life (pregnant women and young children); expanding Scaling Up Nutrition interventions; tailoring interventions to country capacity—in the government, civil society, and private sector—and to country nutrition security issues; and incorporating nutrition-sensitive approaches in multisectoral programs (social protection, health, agriculture, and income-generation interventions).

How high food prices affect the MDGs

Higher food prices may make it more difficult to achieve most Millennium Development Goals (MDGs). Food price increases affect food consumption, quality of one's diet, access to social services, and sometimes the quality of care for infants and young children. All these factors may increase undernutrition among children (and decrease their learning capacity and survival rates), adult

women (and if they are pregnant, increase their chances of maternal mortality and affect fetal growth and future outcomes), and adult men (and affect their productive capacity). In addition, undernutrition decreases the efficacy of treatments for HIV/AIDS and other major diseases. Box 2.1 summarizes the combined impact of the food price crisis and malnutrition on the MDGs. Conservative estimates from Grantham-McGregor and others (2007) suggest that over 200 million children under five years of age living in developing countries fail to reach their cognitive development potential because of risks linked to poverty, poor health and undernutrition and lack of stimulation at home. Save the Children (2011) estimates that the recent food price hike put 400,000 children's lives at risk.

How food prices affect nutrition

Food security and nutrition security are different but interlinked concepts. Food security, an important input for improved nutrition outcomes, is concerned with physical and economic access to food of sufficient quality and quantity in a socially and culturally acceptable manner.² Nutrition security is an outcome of good health, a healthy

BOX 2.1 Impact of higher food prices and undernutrition on the MDGs

- As food prices increase, the purchasing power of the poor decreases, the composition of their diet worsens, and their food consumption may decrease. These changes directly affect all targets of MDG 1 on poverty, full and productive employment, and hunger.
- Malnutrition affects early childhood development and makes children more likely to drop out of school (MDG 2).
- An increase in food prices affects women and girls' consumption disproportionately (MDG 3).
- Undernutrition is linked directly to more than one-third of children's deaths each year (MDG 4).
- Pregnant women face heightened maternal mortality, through increased anemia, during a food price crisis (MDG 5).
- The adverse effects of a food crisis on the availability of health services and on health status bear on countries' and individuals' abilities to combat the HIV/AIDS epidemic (MDG 6).
- Undernutrition weakens the immune system and compounds the effect of diarrhea and waterborne diseases (MDG 7).
- Higher food prices have weakened intergovernmental coordination in food markets (MDG 8).

environment, and good caring practices as well as household food security (World Bank 2006). For example, a mother may have reliable access to the components of a healthy diet, but because of poor health or improper care, lack of knowledge, gender, or personal preferences, she may be unable, or choose not, to use the food in a nutritionally sound manner, thereby becoming nutritionally insecure. Nutrition security is achieved for a household when secure access to food is coupled with a sanitary environment, adequate health services, and knowledgeable care to ensure a healthy life for all household members. A household (or country) may be food secure, yet have (many) individuals who are nutritionally insecure.

Food security is therefore a necessary but not sufficient condition for nutrition security. And although households make key decisions that influence the nutritional status of their individual members, government funding and policy decisions determine the environment in which households operate (IFAD, WFP, and FAO 2011).

Nutrition security is multidimensional. Solutions to improve nutrition in a given country environment will require integration among the sectors most relevant to individuals' nutritional status, such as trade and infrastructure, agriculture, and the labor market, as well as the social sectors such as health, education, and social protection (Ecker, Breisinger, and Pauw 2011). A shock such as the food price crisis affects both household and government behavior.

Effects at the household and individual levels

Dietary quality and food quantity may be affected

As prices rise, households will first try to replace pricier foods with cheaper sources of calories, moving from some food categories or shifting to lower-quality foods. When prices increase further and substitution is not enough, households decrease their caloric consumption. In the first adjustment, poor

consumers shift from foods such as meats, fish, vegetables, and fruits to staple foods, such as cereals and tubers, and their protein and micronutrient intake may suffer. Young children—in utero and during their early years—who have high nutrient needs for iron, vitamin A, and zinc, among others, may be particularly at risk and will bear long-term impacts of this “hidden hunger.” In the second adjustment, households decrease their caloric consumption—urban households in Pakistan (Friedman, Hong, and Hou 2011) and poor households in Haiti (World Bank 2010b), for example—and the number of children with low weight for age increases. In Vietnam Gibson and Kim (2011) show that a 10 percent increase in the relative price of rice reduces calories by less than 2 percent, but they estimate that this elasticity would be more than 4 percent if they ignore substitution into lower-quality rice, as households in Vietnam protect calorie consumption by downgrading the quality of their food intake.

In urban areas, street foods are central to food consumption patterns among the urban poor. In Accra and in Latin America, street food may account for nearly 40 percent of the total food budget of the urban poor (Ruel 2000). The risk from higher food prices is an increase in consumption of street foods, which are rich in oil and starch. This results in diets of high energy density (caloric content) and little nutritional value, contributing to already rising obesity rates among the urban poor, as in Mexico (CONEVAL 2009) the United States (Centers for Disease Control and Prevention 2011), and in many middle-income countries undergoing the nutrition transition from high levels of undernutrition to overnutrition.

Women and children may have to increase their workforce participation

Increased women's labor force participation may yield positive results on household income and purchasing power, but it is likely to change childcare arrangements. The effect of mother's increased workforce participation on child welfare depends on children's ages, other household resources, and the education

and knowledge of the person responsible for childcare and feeding. In noncrisis settings, in urban poor communities of Guatemala City and Accra, mothers seemed to be able to manage their childcare responsibilities and their income-generating role efficiently (Levin et al. 1999, Ruel et al. 1999, 2002). But in crisis settings, if women engage in distress work (work in response to an adverse shock to the main earner's income) such as they do in rural India (Bhalotra 2010), time constraints decrease time spent seeking health care, and infant girl mortality may increase. (Rural households where mothers are uneducated or had a first birth as a teenager are driving these results.) Interventions that address women's childcare and pregnancy needs (such as crèches around temporary construction sites in India) can help to protect children's well-being.

The effect of high food prices on children's labor force participation is ambiguous. Children may join in productive agricultural activities if the household feels it cannot afford schooling any more. Children who drop out of school find it difficult to return to school when the crisis is over, and their schooling attainment suffers. Children's income may also become a key contribution to maintaining the household's caloric intake. If, though, the price crisis is also a jobs crisis, as in Europe and Central Asia in 2008 or in Peru in 1988–92 (Schady 2002), children may not increase their workforce participation.

If households seek less health care or the supply of health services decreases, individual members' health may deteriorate and affect their nutritional status

When households feel they cannot afford health care expenses, the health status of adults and children may suffer. Poor health affects nutrition through changes in metabolism, malabsorption of nutrients and appetite loss, and changes in feeding practices. Highly prevalent diseases such as acute respiratory infections and diarrhea reduce the absorption of nutrients such as vitamin A from the small intestine, establishing a vicious cycle because vitamin A deficiency depresses the immune

system and makes the child more susceptible to subsequent infections. Feeding practices, such as decreasing liquid intake of children affected by diarrhea, may also have severe consequences.

The poor bear the brunt of decreases in funding of primary care and community-based nutrition interventions (Alderman 2011b). Latin America's economic crisis of the early 1980s cut public health spending, which had a disproportionate effect on the poorest groups (Musgrove 1987). Ferreira and Schady (2009) contrast the experience of Indonesia and Peru to show the importance of maintaining critical services to avoid increases in child undernutrition during crises. In Peru the crisis caused a collapse in public health expenditures of over 60 percent and declines in health service utilization (including more home births and fewer prenatal checkups). Infant mortality shot up from 50 per 1,000 live births in 1988 to 75 in 1990. In contrast, in Indonesia increased donor aid made up for some of the shortfall in government spending. Infant mortality still spiked from 30 per 1,000 live births in 1996 to 48 in 1998, but nutrition indicators such as wasting, stunting, and anemia did not worsen.

Intrahousehold reallocation and care practices may mitigate or aggravate the effects of food price increases on specific household members

Women often become "shock absorbers of household food insecurity," as they reduce their own consumption to allow for more food for other household members (Quisumbing, Meinzen-Dick, and Bassett 2008). Rural poor women in the United States and Canada (McIntyre et al. 2003) tend to both lower and change their dietary intake in favor of their children (particularly in terms of energy, vitamin A, folate, zinc, calcium, and iron) when they experience food insecurity. In some communities in Bangladesh, Indonesia, Jamaica, Kenya, and Zambia (Holmes, Jones, and Marsden 2009), when choices have to be made, children come first; in other communities, men are favored. In none of the communities, however, were women, including

pregnant women, offered the most nutritious foods. In Indonesia mothers buffered children's caloric intake during the 1997–98 crisis, resulting in increased maternal wasting and anemia (Block et al. 2004).

Women's lack of education and low status in the household contribute to child malnutrition, as do poor care practices. Poor child feeding practices are responsible for high levels of undernutrition and affect girls more than boys in most countries in South Asia. In many countries, mothers do not exclusively breastfeed their children during the first six months of life (see below), and the foods used to complement breast milk are often low in energy and essential micronutrients. The knowledge of a grandmother or an older sibling who cares for the child may even be more limited than the mother's. Women's education and status within the household contributed to more than 50 percent of the reduction in child undernutrition between 1970 and 1995 (Quisumbing et al. 2000). Good care practices can mitigate the effects of poverty and low maternal schooling in child nutrition (Armar Klemesu et al. 2000).

Increasing income is not enough

Among households, undernutrition rates can be high even among the food secure. For example, if the lowest two quintiles by wealth in Pakistan had the same characteristics as the third quintile, poverty would be eliminated, but 38 percent of children would still be malnourished. In Ethiopia 40 percent of children in the wealthiest quintile are stunted. This pattern is consistent across many countries (Haddad et al. 2003) and points to the need for interventions beyond general poverty reduction to address specific nutritional issues. As noted by the World Bank (2006), several reasons explain this pattern:

- Pregnant women eat too few calories and too little protein, and have untreated infections, such as sexually transmitted diseases that lead to low birth weight.
- Mothers have too little time to take care of their young children or themselves.

- Mothers of newborns discard colostrum, the first milk, and thus lose the boost to the infant's immune system that colostrum provides.
- Mothers rarely breastfeed infants under six months exclusively, even though breast milk offers the best source of nutrients and protects against many infections.
- Caregivers start introducing complementary solid foods too late. They feed children under age two too little food or foods that are not energy dense.
- Although food is available, intrahousehold food allocation practices may mean that women and young children's energy needs are not met and that their diets are poor in micronutrients or protein.
- Caregivers do not know how to feed children during and following diarrhea or fever.
- Caregivers' poor hygiene contaminates food with bacteria or parasites.

Box 2.2 illustrates some of these effects—on quantity and quality of food consumption, individual workforce participation, intrahousehold allocation, access to services, and other coping mechanisms—in northern Bangladesh during the 2007–08 food price crisis.

Effects at the national level

Increased state spending on food purchases and subsidies can divert resources from health and education (among other sectors), yet these are key sectors for nutritional status, because undernutrition is often linked to preventable diseases (such as diarrhea) and lack of nutrition knowledge (for example, information about optimal feeding practices for infants and young children). As food prices rose, many governments expanded (or set up) food subsidy programs to alleviate economic hardships. In the Middle East and North Africa, for example, spending on these programs reached 5–7 percent of gross domestic product (GDP). But such programs entail trade-offs and may threaten other investments.³ In addition, price subsidies generally target foods

BOX 2.2 The impact of the 2007–08 food price spike on a rural community in northern Bangladesh

Bangladesh has high levels of child undernutrition (36 percent stunting, 16 percent wasting, and 46 percent underweight). Prices of key staples increased by as much as 50 percent from 2007 to 2008. On top of this, the country suffered floods in mid-2007 and a cyclone in November 2007, which reduced the *aman* (or second) rice harvest. Export restrictions by India, one of the country's main rice providers, also raised rice prices.

An assessment of livelihood and nutrition security in Kurigram village (194 households) in 2005 and a follow-up assessment in November 2008 (250 households) shows some of the effects of the price hike. The richest households benefited from the price hike (as rice producers). One-third to one-half of households had lower disposable income after the crisis, mainly because of the rice price hike and, to some minor extent, crop failure in one of the rice harvests. (Disposable income was taken as cash income left, after households had met their food energy requirements per adult equivalent, using a cost-of-diet approach.)

The poorest quartile was no longer able to afford a diet that provided them with their energy and micronutrient needs. Children ate fewer meals, had less diverse diets, and received few nutrient-rich foods. Stunting among children in the poorest households

was twice as high as in the richest households. A 7 percentage point improvement in stunting rates (probably linked to improvements in women's status and better road infrastructure) was lost during the crisis—a loss that will have permanent consequences for the children's mental and physical development.

Families in the community responded to the price hike by sending children to work, taking children out of school, selling productive assets, and reducing their food intake. Poor families took loans to replace lost income, and repayment became a priority over livelihoods and diet investments. Three families moved to Dhaka, the capital.

Even though the richest households benefited, agricultural labor wages did not rise enough to compensate poorer households for the price rise (partly a result of the *aman* crop failure). Only one household benefited from the government's 100-day rural employment program. No household received subsidized rice, although children in school received food-for-education transfers. Some households benefited from the cereal program, some fertilizer stipends, and some stipends for the elderly, widows, and freedom fighters.

Source: Save the Children 2009.

that are low in micronutrients, distort relative prices, and may create negative incentives for people to diversify their diets once the crisis is over. For example, in Morocco, the subsidy on soft wheat flour is supporting most of the milling sector (World Bank 2005). Expenditures on physical infrastructure and especially roads are not generally considered as important for nutritional status, even though they are key both to establish a food supply chain that moves food from consumers to producers through markets and to enable households' access to health, education, and, to a lesser extent, social assistance services.

The connection between economic growth and poverty reduction is well established, but

the correlation between income growth and nutrition gains is much weaker (Ecker, Breisinger, and Pauw 2011; Headey 2011). Undernutrition countrywide (defined as low weight for age) may decline at very roughly half the rate that per capita gross national product increases (Alderman 2011a)—28 percent in India, 67 percent in China, and 76 percent in Bangladesh in the 1990s. Yet, Deaton (2010) reports that in India per capita calorie consumption fell in 1997–2007, despite high rates of per capita income and consumption growth. While some of the calorie reduction may be linked to less physical activity (as people spend less time in agriculture) or to lower morbidity, the puzzle remains.

The interaction of crises and biology

Short-term shocks, long-term effects

The most pernicious effect of the crisis is an increase in infant mortality, especially girl infants in low-income countries. A recent study by Baird, Friedman, and Schady (2011) shows a large, negative association between declines in per capita GDP and mortality of infants between birth and one year of age. The study, which analyzes data from 59 Demographic and Health Surveys and 1.7 million births, also reveals that the mortality of children born to rural and less educated mothers is more sensitive to economic shocks, which suggests again that the poor bear the brunt of crises. In addition, the mortality of infant girls is significantly more sensitive to income shocks than that of boys. In a companion study, Friedman and Schady (2009) estimate that the 2008 crisis probably led to an excess 35,000–50,000 infant deaths in Sub-Saharan Africa in 2009 and that nearly all these excess deaths were among girls.

Interventions that tackle child mortality benefit country's growth overall. Apart from the moral arguments for tackling child mortality, analysis by Baldacci et al. (2004) and Save the Children (2008) showed that a 5 percent improvement in child survival rates raises economic growth by 0.85 to 1.0 percentage point a year over the following decade.

Less dramatic but also severe are the potentially negative effects of economic crises on nutritional and environmental pathways that influence early childhood development and subsequent life opportunities. These arise from interactions between undernutrition, health, and learning, which set children on lower development paths and lead to changes in states that are difficult to reverse—it is easier, for example, to maintain a child in school than to reenroll once she or he has dropped out. The timing of the crisis in the life cycle also matters, with the period from conception to two years of life being one of high risk because of physical and cognitive development. Nutritional deprivation during

that period can cause irreversible setbacks in growth and sociocognitive development (Victora et al. 2008). The accumulation of toxic stress in the first years of life—through decreased care and transitions in and out of poverty—has long-term consequences for an adult's wages and productivity.

Deteriorations of human capital during economic downturns and improvements during booms are asymmetric

The *Global Monitoring Report 2010* reported that human development indicators during downturns tend to worsen more than they improve during economic booms. For example, life expectancy decreases by 6.5 years during decelerations but may increase by only 2.0 years during growth accelerations. Similarly, the increase in infant mortality during deceleration is three times the decrease during accelerations (24 versus 8 per 1,000 live births), and the decrease in primary schooling completion rates during deceleration is six times the increase during acceleration (25 percent versus 4 percent). Undernutrition contributes to more than a third of infant deaths and decreases learning abilities and school attainment (see below).

Economic downturn affects girls more than boys. Life expectancy decreases by seven years for girls and six years for boys during bad times (it increases by two years for both during good times). Primary education completion rates fall by 29 percent for girls and 22 percent for boys during bad times and rise by 5 percent for girls and 3 percent for boys during good times. Female-to-male enrollment ratios fall severely during downturns, with higher drops in tertiary and secondary education than in primary education.

Large scale and extreme shocks cause increases in low birth weight, wasting, and stunting

During Argentina's crisis in 1999–2002, the elasticity of low birth weight to GDP was -0.25 cases per 1,000 births (Cruces, Gluzmann and Lopez Calva 2010). Stunting increases as a result of extreme shocks, such as the drought in Zimbabwe in 1994–95

(Hoddinott and Kinsey 2001), crop damage in Ethiopia in 1995–96 (Yamano, Alderman, and Christiansen 2003), and the very large economic contractions experienced in Peru in 1988–92.

Impacts from more moderate crises are heterogeneous

Such impacts include increased underweight and anemia and decreased access to health services. In Cameroon the share of underweight children under age three increased from 16 percent in 1991 to 23 percent in 1998 as a result of combined economic crises and subsequent government adjustment programs (Pongou, Salomon, and Ezzati 2006). Declines in economic status and health care accessibility were both correlated with an increase in undernutrition in urban areas. In rural areas, reductions in health access were correlated with an increase in undernutrition, especially among children born to little-educated mothers or poor households. It is unclear, however, whether the lower access stemmed from weakened ability to pay or from reduced provision of health services. In Central Java in 1997–98, drought and financial crisis were associated with a decrease in mean iron hemoglobin concentration of 6.1 percent and increasing anemia, with larger effects on children born or conceived during the crisis (Waters, Saadah, and Pradhan 2003). The latter suggests that maternal undernutrition was an additional risk pathway, which is consistent with decreases in consumption of green leafy vegetables, eggs, and cooking oil among households.

The importance of when: window of risk and opportunity from conception to 24 months⁴

Early life conditions have a disproportionate influence on forming adult human capital, understood in terms of height, skills (cognitive and noncognitive) and capabilities (such as health and social functioning) (Victora et al. 2008; Friedman and Sturdy 2011). A particularly critical period for brain development is from the first few weeks in the womb to the second year of life. Early cognitive and sensory-motor development, as

well as socioemotional competence, affect school preparedness and subsequent school performance. This is also a period of intense physical development: children are expected to grow 50 centimeters in utero, 24 centimeters in their first year of life, and 12 in their second year, after which time the pace of growth slows until the rapid growth spurt of adolescence. Figure 2.1 shows how the shortfall between children in different regions remained unchanged after 24 months, when compared with a healthy reference group.

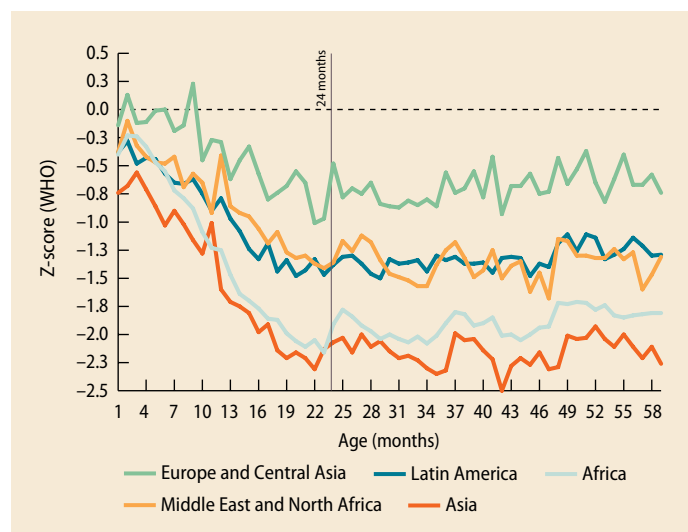
Risk factors that affect children in low-income countries include intrauterine growth restriction (11 percent of births), stunting (around one-third of children under five years), iron deficiency (one-fourth to one-third of children under four years), iodine deficiency (one-third of the population worldwide), maternal depression (one-sixth of postpartum mothers), and inadequate cognitive stimulation (Friedman and Sturdy 2011). Iron deficiency is associated with fetal and child growth failure, lower cognitive development in children, lower physical activity and productivity in adults, and increased maternal mortality. Vitamin A deficiency causes blindness and is a risk factor for increased severity of infections, which leads to increased mortality. Zinc deficiency is associated with stunting and higher incidences of diarrhea and pneumonia. Iodine deficiency affects cognitive development and reduces intelligence (IQ). Lower quantity and quality of nutritional intake, lower household income, lower state resources, and lower quality care would cause increases in the prevalence of low birth weight, childhood wasting, and then stunting, which in turn have significant negative impacts on children's development.

The double burden of malnutrition and chronic disease⁵: Malnourished children may become overweight adults

Many aspects of fetal growth influence long-term health, and children who experienced malnutrition in utero and in their early years are more at risk of chronic diseases such as type 2 diabetes, abdominal obesity, hypertension, and cardiovascular disease. For

example, children in utero during the famine in the Netherlands of 1944–45 show increased risk of chronic disease and mental illness in middle age and greater loss of attention and cognitive ability than the general population as they age further (Alderman 2011a). Similarly in India, children who were thinner in infancy and experienced rapid growth show a higher prevalence of diabetes (box 2.3), giving that country the highest numbers in the world, both of malnourished children and of people with diabetes. Many countries in Latin America face increases in overweight and obesity among adults who were previously undernourished, as well as high numbers of chronically undernourished children (figure 2.2). During the nutritional transition from under- to overnutrition, children who were undernourished face higher risks of overweight and obesity as adults, while at the same time, lack of nutritional knowledge and poverty with micronutrient poor diets still undermine the development of children.

FIGURE 2.1 Mean height for age (Z-scores) by age, relative to WHO standards, by region



Source: Victora et al. 2010.

Note: Europe and Central Asia countries included are Armenia, Kazakhstan, Kyrgyzstan, Moldova, Mongolia, Montenegro, and Turkey. Latin America countries included are Bolivia, Brazil, Colombia, Dominican Republic, Guatemala, Haiti, Honduras, Nicaragua, and Peru. Middle East and North Africa countries included are Arab Republic of Egypt, Jordan, Morocco, and Republic of Yemen. Thirty Sub-Saharan African countries are included. Asia countries included are Bangladesh, Cambodia, India, and Nepal.

BOX 2.3 Malnutrition and chronic disease in India

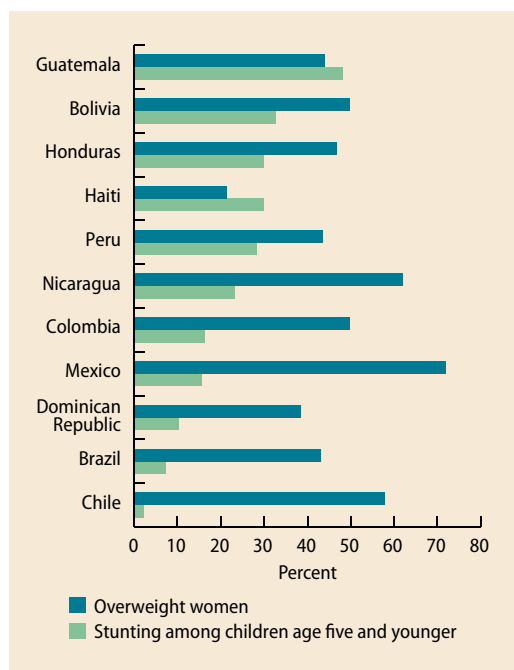
Some 42 percent of the 160 million children in India under the age of five are underweight. Prime Minister Manmohan Singh described the situation as a matter of “national shame” and undernutrition as “unacceptably high” when he announced those numbers in January 2012. There are signs of progress—one in every five children has reached an acceptable healthy weight over the past seven years in 100 focus districts, which were particularly badly off. But the current figures point to the inadequacies and inefficiencies of government initiatives (such as the Integrated Child Development Scheme), the scale of the needs of India’s child population (the largest in the world), and the lack of awareness about nutrition. And those numbers may be only the starting point of a much larger long-term problem.

A longitudinal study of a cohort of births in South Delhi followed to age 32 found that those children who were thinner in infancy—with a body mass

index (BMI) under 15—had an accelerated increase of BMI until adulthood. Although none was classified as obese by age 12, those with the greatest increase in BMI by this age had impaired glucose tolerance or diabetes by the age of 32 (Bhargava et al. 2005, cited in Alderman 2011a). Similar results have been reported using a panel in Pune (Yajnik 2009, cited in Alderman 2011a).

The transition from a resource-poor environment to one that is less constrained may aggravate these risks. India has not only the largest number of undernourished children in the world, it also has the most people with diabetes (Ramachandran and Snehalatha 2010). These two statistics may very well have a common origin. While the Indian population does not have a high rate of obesity relative to the rest of the world, there is a tendency to accumulate adipose tissue around the waist. This pattern is associated with elevated risk of chronic disease.

FIGURE 2.2 Percentage of stunted children and overweight women in selected Latin American countries



Source: World Health Organization global databases on child growth and malnutrition and on body mass index.

Note: Overweight: body mass index greater than 25; stunting: height for age less than two standard deviations using National Center for Health Statistics reference.

In times of high food prices, the double burden increases and obesity and undernutrition may coexist within the same household and the same person. As mentioned, poor families switch away from nutritious food and buy “empty calories,” as is happening in Honduras and Guatemala (Robles and Torero 2010). Combined with the changes in metabolism described in the previous paragraph, these empty calories will increase the rates both of stunting and anemia and of overweight and obesity in many middle-income countries. In the Arab Republic of Egypt, Peru, and Mexico, about half the women with anemia are overweight or obese.

One possible explanation for the impact of fetal growth on disease later in life is linked to adapting to stress in the womb. The signal derived from limited nutrients in utero may lead to an adaptation in which the child

becomes particularly efficient at conserving resources. However, if that individual is subsequently confronted with a resource-rich environment, this maladapted response contributes to overnutrition and increased risk of chronic disease. It may also threaten the welfare of the next generation because hyperglycemia or diabetes in mothers increases the risk of diabetes for their offspring (Delisle 2008).

Crises may be transitory events, but their impacts on young children are not—they continue in the medium term unless stemmed by interventions. Poor children who were under age three during Ecuador’s 1998–2000 crisis showed increased stunting and lower vocabulary test scores (a measure of cognitive development) in 2005 when they were five to seven years old (Hidrobo 2011). This finding suggests that they may have experienced reduced parental time on care, and their households may not have managed to protect them from the general health environment deterioration caused by El Niño and cuts in public services. Rural farming households and households with access to health centers were better able to protect the height of their children but not their vocabulary score.

Where interventions were in place, nutritional status improved. In Senegal, the national nutrition program adopted community-based approaches, targeted the “first 1,000 days,” implemented systematic nutrition screening, and delivered interventions using a network of well-supervised nongovernmental organizations (NGOs) (Alderman et al. 2008). Over the years, the program added bednet distribution, community management of acute undernutrition and food fortification, and, most recently, a cash transfer initiative. Prenatal care increased from one-third to two-thirds, exclusive breastfeeding for the first six months doubled to 58 percent, and correct use of bednets more than doubled to 59 percent. The rate of stunting in 2005 represented just 59 percent of that in 1990. Similarly, the underweight rate in 2005 was 65 percent of that in 1990.

Childhood exposure to adversity (both extreme events such as drought, civil war,

BOX 2.4 Consequences of early childhood growth failure over lifetimes in Guatemala

Growth failure in early life in rural Guatemala, as measured by low height for age (stunting) at 36 months, affects a wide range of adult outcomes: education, choice of marriage partners, fertility, health, wages and income, and poverty and consumption. The data are based on interviews between 2002 and 2004 of participants in a nutrition supplementation trial between 1969 and 1977.

Participants who had received nutritional supplementation (a high-protein energy drink with multiple micronutrients) and free preventive and curative medical care (including the services of community health workers and trained midwives, as well as immunization and deworming) were less likely to become stunted.

Otherwise, participants who were stunted at 36 months of age left school earlier and had significantly worse results on tests of reading and vocabu-

lary and on nonverbal cognitive ability some 35 years later. They also married people with lower schooling attainment. Women had 1.86 more pregnancies and were more likely to experience stillbirths and miscarriages. No link was found with greater risks of cardiovascular or other chronic disease.

Individuals who were not stunted earned higher wages and were more likely to hold higher-paying skilled jobs or white-collar jobs. They were 34 percentage points less likely to live in a poor household. A one standard deviation increase in height for age lifted men's hourly wage by 20 percent, increased women's likelihood of operating their own business by 10 percentage points, and raised the per capita consumption of households where the participants lived by nearly 20 percent.

Source: Hoddinott et al. 2011.

and famine, and more moderate events such as low rainfall) has long-lasting adult life consequences. Exposure to the Chinese Long Walk famine of 1959–62 is associated with higher illiteracy, lack of work, and disability later in life. Findings are similar for the Greek famine of late 1941 and early 1942, with those who were in their first year of life when the famine struck the most affected. Exposure to the famine as a child lowered literacy, upper secondary and technical schooling, and occupational prestige. Even moderate adversity, such as low rainfall during the year of birth, has been associated with reduced child growth and increase child morbidity in India, and decreased adult height and schooling in Indonesia (Maccini and Yang 2009). The clearest pathway through which these impacts occur is nutrition, especially during the critical period of early childhood, from six months of age and beyond when a child transitions to complementary foods in addition to breast milk.

Height for age at two years is the best predictor of human capital, and undernutrition is associated with lower human capital.

Stunted children have poorer performance in school (reduction in test scores equivalent to two years of schooling lost). With the observation that every year of schooling is equivalent to an average increase of 9 percent in adult annual income, Grantham-McGregor et al. (2007) estimate a loss in adult income of between 22 and 30 percent for stunted children. A long-run longitudinal study in Guatemala (Hoddinott et al. 2011) provides additional evidence on long-term impacts of undernutrition, including on body size and adult fitness, and wages and types of employment (box 2.4). While the long-term effects of growth failure are severe, interventions such as nutritional supplementation and basic medical care in the early years have strong potential to improve outcomes over the course of beneficiaries' lives.

Building resilience: interventions to mitigate the effects of the food crisis

Food crises are regular occurrences in developing countries, but interventions to decrease

malnutrition can mitigate their impacts. The many pathways along which food crises affect household and individual welfare also offer multiple entry points for interventions. We discuss these entry points and the associated costs under three headings: consumption and social protection, biology and health, and production and income generation. Intervention packages will of course vary by country development and capacity, as well as by the types of problems faced, but there is a broad consensus on the beneficial impact of proven interventions (World Bank 2012 forthcoming).

Consumption and social safety nets

When food prices increase, and before food-output systems can adapt, some safety net interventions seek to maintain consumption in the short run, especially among more vulnerable groups. These interventions may also have longer-term impacts and can contribute to bridging the twin-track approach to food security, promoted by the Food and Agriculture Organization of the United Nations (FAO): short-term transfers and relief to protect consumption and long-term investments to increase food output.

Cash transfers

One response to rising food prices is to support consumption of the poor through targeted cash transfers. Conditional cash transfers have shown some results on nutritional outcomes (Fiszbein and Schady (2009) provide a review). Fernald, Gertler, and Neufeld (2008) report positive impacts of *Progresa/Oportunidades* on children's height in Mexico,⁶ Attanasio et al. (2005) show similar effects of *Familias in Acción* in Colombia, and Ferreira et al. (2011) for cash transfers in Brazil. Macours, Schady, and Vakis (2008) provide evidence on the nutritional and early childhood development impacts of a conditional cash transfer pilot designed to address crises such as droughts, cyclones, and extreme poverty in Nicaragua. Payments were conditional on school attendance for school-aged children and on preventive care visits for preschool children. Parents also

received information about nutrition and the importance of food choices. The pilot led to significant gains for a variety of cognitive and noncognitive skills (social and personal measures and vocabulary). The program shifted household expenditure toward more diversified diets, more nutrient-rich foods for young children, and materials offering greater stimulation, such as books and paper. In addition, children benefited from an expanded menu of nutrition interventions in health services, including micronutrient supplementation, growth monitoring and promotion, and deworming. Similarly in Malawi, Miller, Tsoka, and Reichert (2011) report that the unconditional M'chinji social cash transfer enabled beneficiary households to avoid food shortages and increase dietary diversity, and that children were more likely to gain height and report better health (Miller et al. 2010). In Indonesia, Skoufias, Tiwari, and Zaman (2011) show that cash transfers helped protect dietary diversity.

Food and nutrient transfers

Another option to maintain consumption is to transfer food directly to vulnerable households. If inflation is high and erodes the value of cash, some potential beneficiaries may prefer food to cash. Such food aid can help maintain adequate intakes of protein and energy but is generally not micronutrient rich. That is changing, however, with the inclusion of more diverse foods in the rations provided by the World Food Program as well as supplementary multinutrient foods (Gentilini and Omamo 2011). Three options include local procurement of food aid, which may help small producers and maintain food markets; increased nutrient-density of the food with ready-to-use supplementary or therapeutic foods;⁷ and sprinkles, powders that provide multiple nutrients and are mixed with staple food within the home.

School feeding

The 2008–09 crisis and the ongoing one have seen enhanced demand for school feeding programs in low-income countries, despite questions on their cost-effectiveness (Alderman and Bundy 2011). School feeding should

be considered as a conditional in-kind transfer to assist low-income households (reducing current poverty) with a complementary benefit of promoting the accumulation of human capital by jointly influencing health and education. It takes two main forms: meals at school and take-home rations. In most middle-income countries, school feeding costs per child represent 10–20 percent of per child costs of basic education, but in some low-income African countries, these feeding costs are as high as the cost of basic education for average students (Bundy et al. 2009).

Programs may yield nutritional benefits for younger siblings of beneficiary children. In Burkina Faso, for example, the weight for age of children aged 12–60 months, whose sister received take-home rations, increased by 0.38 standard deviation. In Uganda younger siblings of beneficiaries of school meals showed improvements in height for age of 0.36 standard deviation, but children in families that took home rations saw no improvement.

School feeding programs can be a vehicle for improved micronutrient status if the foods are fortified, but local procurement issues make fortified foods difficult to obtain. Implementation issues may also affect the overall effectiveness of the program, especially in remote areas where transport and storage costs may be prohibitive for communities. However, school feeding is easy to scale up during a crisis. More evidence is needed on the costs of delivery and sustainability.

Workfare-with-nutrition

Food or cash-for-work programs may provide immediate consumption relief in a crisis. The transfer selection (food or cash) depends on local capacity, market conditions, and cultural acceptability. Some evidence is available from Ethiopia on improved food security and child weight for height from a food-for-work program, but targeting needs to improve. In Indonesia, however, transfer of rice, cooking oil, and legumes had no effect on child growth or on maternal anemia rates (Wodon and Zaman 2008).

A promising new design complements workfare with nutrition interventions.

Self-targeting in workfare is relatively effective, because it attracts workers from very poor households where children face a high risk of undernutrition. The approach in Djibouti (and Niger) is to add a nutrition promotion component to the traditional cash-for-work program to leverage the effect of the additional income on the family's nutritional status.⁸ In Djibouti (Silva 2010), the workfare component offers community work (for all able-bodied adults) in projects chosen and built by the community and services work (for women only) including collecting, recycling, and transforming plastic bags into pavement blocks. The nutrition component targets vulnerable nonworking members of participating households. It includes monthly community meetings on nutrition-relevant topics, biweekly home visits by a community worker, and distribution of food supplements during the lean season.

Biology and health

There are known evidence-based, effective solutions to undernutrition. Inadequate dietary intake causes weight loss (acute undernutrition), growth faltering (chronic undernutrition), decreased immunity, and increased morbidity and severity of diseases. The Scaling Up Nutrition (SUN) framework (World Bank 2010a; box 2.5) identifies a package of 13 key interventions in three main areas, selected for their efficacy and readiness for scaling up:

- *Behavior change interventions* include. Breastfeeding promotion and support; complementary feeding promotion through counseling and nutrition education (but excluding provision of food), and hand-washing with soap and promotion of hygiene behavior. The majority of these services are delivered through community-based health and nutrition programs.
- *Micronutrient and deworming interventions* include vitamin A supplementation; therapeutic zinc supplements for management of diarrhea; multiple micronutrient powders; deworming; iron-folic acid supplements for pregnant women; iron

BOX 2.5 The global SUN movement

One platform for increased support to nutrition is the global Scale Up Nutrition (SUN) movement. In 2010 more than 100 organizations including governments, civil society, the private sector, research institutions, and the United Nations system committed to work together to fight hunger and undernutrition, developing a Framework to Scale Up Nutrition (launched at the World Bank/International Monetary Fund Spring Meetings in April 2010) and a road map that lays out the operational approach for increased action. SUN is a movement that brings

organizations together to support national plans to scale up nutrition. It helps ensure that financial and technical resources are accessible, coordinated, predictable, and ready to go to scale. Twenty-six countries have joined the movement as of early 2010, and the World Bank has agreed to be the donor convenor or co-convenor in 7 of the 26 countries, liaising between the national nutrition focal point and the community donor partners in each of the SUN countries for which it has taken on the coordinating role.

fortification of staple foods; salt iodization; and iodine supplements for pregnant women if iodized salt is not available. These services are delivered through child-health days, community nutrition programs, the primary health care system and market systems (fortification).

- *Therapeutic feeding interventions* include prevention and treatment of moderate undernutrition among children 6–23 months of age, and treatment of severe acute undernutrition with ready-to-use therapeutic foods. These services are delivered through community nutrition programs and the primary health care system.

Community growth monitoring and promotion programs offer a common platform for delivery of multiple services and have been successful in various countries (box 2.6). The community basis allows programs to tackle a wide variety of causes of undernutrition, often with a focus on women and children under age two. The programs have contributed to changing norms about nutritional status and children's growth. Peru has built a local information campaign (RECURSO) to show parents that short stature is a sign of undernutrition and to increase their "demand for good nutrition" (Walker 2008). New tools for measuring, for

instance, mid-arm circumference or for visually tracking growth in height are important to raise parental awareness of the dangers of excessive thinness, overweight, and short stature.

Health interventions can also help improve nutrition outcomes through specific services to young children and pregnant and lactating women, including preventing and treating all causes of anemia, promoting good feeding and nutritional care practices, preventing and treating illnesses (especially diarrhea, acute respiratory infections, measles, malaria, and HIV/AIDS), and improving reproductive health and family planning (World Bank 2012 forthcoming).⁹ Provision of these services requires that basic health funding be protected during crises, which can be a challenge for countries.

Production and agriculture

There is considerable momentum, including that catalyzed by the global SUN framework, to better link the food security (mainly agriculture) and nutrition security agendas so that countries can benefit from potential synergies. Some SUN interventions have a strong gender component because women face barriers to access inputs and productive assets in many countries, and increasing women's

BOX 2.6 Community-based growth promotion programs

Honduras, Jamaica, Madagascar, Nigeria, Senegal, Tanzania, and some states in India use a strategy of community-based growth promotion, which incorporates some of the key Scaling Up Nutrition interventions and strengthens knowledge and capacity at the community level.

Such strategies have proven effective in improving mothers' child-nutrition knowledge, attitudes, and practices; in boosting family demand for health care; and in reducing undernutrition. Successful, large-scale child growth promotion programs in these countries have achieved sharp declines in child malnutrition in the first five years, with a more gradual rate of decline in moderate and mild undernutrition after that. The community basis allows practitioners to address multiple causes of malnutrition, with a focus on women and on children under age two.

Leading interventions include nutrition education or counseling. These interventions often accompany child growth monitoring, offer advice on maternal care services during pregnancy, promote exclusive

breastfeeding and appropriate and timely complementary feeding, encourage health and care practices, and make referrals to health centers. Some programs have provided micronutrient supplements for pregnant mothers and children, as well as immunization and related services.

Program experiences highlight the importance of three elements: female community workers as service delivery agents; regular child growth monitoring (weight), paired with counseling and communication with the mother by a well-trained agent who benefits from regular supervision in weighing, recording, and counseling; and well-designed, culturally appropriate, and consistent nutrition education to promote specific nutrition practices. The challenges relate to agent training, support, and motivation; barriers faced by beneficiary mothers in implementing recommended behavioral changes; and high costs of food-supplementation programs for mothers and children.

Source: World Bank 2012 forthcoming.

access to human capital is critical to reducing poverty and undernutrition. Changes in agriculture affect health and nutrition through several levers (Hoddinott 2011; World Bank and IFPRI 2008):

- Increased agricultural production may increase household income, which can be used to purchase goods that affect health and nutrition or can be saved in the form of assets, such as improved shelter and access to sanitation, that improve health.
- Changes in agricultural production may result in improvements in household diets, especially through diet diversification and potentially through biofortification of crops (such as vitamin A-rich rice and sweet potatoes).
- Changes in crops or in production processes may make agricultural work more or less physically demanding and may change exposure to pesticides, animal diseases

that can be transmitted to humans, and work-related accidents.

- When returns to agriculture rise, households may increase the labor they devote to agriculture through hiring, decreasing leisure, or increasing child labor.
- Changes in production may result in changes in the intrahousehold resource allocation. Higher earned incomes for women, for example, may affect how money is spent, food is allocated, and the types of assets held, which may improve health and nutrition.

Evidence on these levers is scarce because very few agricultural projects or studies include nutrition in their outcomes, and because agricultural interventions may look less cost-effective than targeted interventions for nutrition alone. The knowledge gap is large, but some studies point to positive impacts of higher income, changes in diet composition, and provision of biofortified

foods on nutritional status (Masset et al. 2011).

Strengthening the link between agriculture and nutrition

Some agricultural strategies have strong potential to strengthen the links between agriculture and nutrition. The most promising ones aim to increase the focus on vulnerable groups (like smallholder farmers—particularly women); diversify production (including homestead food production) to increase the availability of legumes, vegetables, and animal-source foods; reduce the impact of waterborne diseases and diseases transmitted from animals; and combine nutrition education with agricultural activities (Pinstrup-Andersen 2010; World Bank 2007; World Bank and IFPRI 2008; World Bank 2012 forthcoming). Dietary diversification is one of the key results for improving diets through own production.

Women as producers are critical to household food and nutrition security in many smallholder economies, especially in Africa. Agriculture interventions need to address the potential negative consequences on household nutrition from increased labor by women. Technology to counteract these effects is often available, but it is rarely accessible to women. In Sub-Saharan Africa, women have less access to fertilizer, labor, and other inputs than men do. But when women secured the same level of inputs as men, they increased their yields for maize, beans, and cowpeas by 22 percent (Quisumbing 1996).

Increasing production of nutrient-dense foods will improve access to diverse diets. Those households producing horticultural crops and raising small animals (poultry, guinea pigs, aquaculture, and the like) will show the greatest improvement in nutritional status. This type of production positively affects the quality of the diet and micronutrient intake. In addition, better preservation of nutrient content or post-harvest fortification can also improve food nutrient content.

A promising range of interventions involves biofortification. The promotion of the orange-fleshed sweet potato (rich in

vitamin A) has a direct effect on the vitamin A status of young children and women in Mozambique (Low et al. 2007) and contributes to energy consumption, women's nutritional knowledge and empowerment, and household income. Work by Harvest Plus seeks to strengthen biofortification in iron (effects on anemia), zinc (effects on growth), and vitamin A (night blindness, immune response, and mortality) to address micronutrient deficiencies. Some of the crops that are close to rollout include iron- and zinc-rich pearl millet in India, iron-rich rice in Bangladesh and India, iron-rich wheat in India and Pakistan, iron-rich beans in Rwanda, vitamin A-rich cassava in Nigeria and the Democratic Republic of Congo, and vitamin A-rich maize in Zambia. The 2008 Copenhagen Consensus concluded that biofortification was the fifth most cost-effective intervention to address hunger and undernutrition outside direct nutritional intervention.

Addressing weather variability and seasonal food shortages

Addressing seasonal food shortages through changes in agricultural practices, food preservation, and safety nets can have long-term effects. As noted, the period between conception and two years of age is critical to human development. Because that period covers several agricultural seasons, where seasonal food shortages are typical, children are likely to suffer from some deprivation at some point. With climate change, these seasonal shortages are likely to increase in both frequency and severity. Low-input food preservation technologies (such as solar drying) may increase access to diverse diets for a longer period during the year. Adoption of early or late-season crops, or crops that consume less water, may also help improve diets. Improved water management systems to increase efficient use may improve productivity and also decrease the incidence of waterborne diseases and reduce women's burden of collecting water (Pinstrup-Andersen, Herforth, and Jones 2012 forthcoming). These interventions may be complemented by the provision of social safety nets in the

short run. Studies of such interventions in northwest Bangladesh (Khandker, Khaleque, and Samad 2011) show that they are helpful in mitigating seasonal deprivation during the pre-harvest hunger season, especially those administered by NGOs.

Decreasing post-harvest losses

Decreasing post-harvest losses of nutrient-dense foods provides gains to agricultural income and nutrition. Post-harvest loss is especially a challenge for perishable fruits and vegetables (Pinstrup-Andersen, Herforth, and Jones 2012 forthcoming), which have high micronutrient content. Access to markets through investment in roads and post-harvest facilities (storage and basic processing) are key for reducing these losses. Farmers' marketing organizations, offering access to price information for example, are also important.

Targeted subsidies

Governments often use agricultural input subsidies to promote food output, but these subsidies generate much controversy because of their fiscal costs, generally poor targeting, possible undermining of local markets, and lackluster results for rural poverty reduction. Simulations based on the Malawi Agricultural Input Support Program, which provides fertilizer and maize seeds, show that results depend crucially on how the subsidies are financed, on the return on public investments that compete for scarce government funds, and on the size of the productivity gains that smallholders reap from increased application of seeds and fertilizer (Buffie and Atolia 2009). The results are much less favorable when input subsidies crowd out infrastructure investment, which in the long term may enable rural households to diversify their livelihood strategy from staple food production and help them reach food security. Simulations based on comparisons between subsidy programs and social cash transfers in Ghana and Malawi (Taylor and Filipiski 2012 forthcoming) show that the cash transfers obtained better outcomes for children's undernutrition.

Women's income and girls' education

Women's education (43 percent) contributed more than food availability (26 percent) to decreases in child undernutrition between 1970 and 1995 (Smith and Haddad 2000). Some of the higher undernutrition rates in South Asia may be related to the lower status of women there. Increased women's income, through access to better jobs as a benefit of the provision of child care in urban poor communities in Guatemala (Ruel et al. 2002), through access to alternative income-generation strategies and credit in Bangladesh, India, and Senegal (World Bank 2011a), and through targeting cash transfers and workfare to women, yield better nutritional outcomes for their children through increased consumption, more diverse diets, and better quality of care.

Increasing women's human capital is one of the most effective ways to reduce poverty and to decrease children's undernutrition. Research in Bangladesh, Ethiopia, Indonesia, and South Africa shows that assets that women bring to marriage play a significant role in how the household makes its decisions. Higher women's assets are associated with a higher share of household spending going to education—especially girls'—and a lower rate of illnesses in girls (Quisumbing and Maluccio 2000; Quisumbing and de la Brière 2000). Because mothers' education is a critical input in the care and nutrition of infants, investments in girls' education will benefit their adult incomes and capabilities—and the welfare of their children.

How much would it cost?

The cost of inaction

Undernutrition causes productivity losses to individuals and GDP losses to countries. In India productivity losses to individuals are estimated at more than 10 percent of lifetime earnings, and GDP loss to undernutrition runs as high as 3–4 percent (World Bank 2009). In Tajikistan undernutrition costs an estimated \$41 million annually. Workforce lost to deaths from undernutrition costs the

country \$12.3 million a year, while productivity lost to stunting, iodine deficiency, childhood anemia, and low birth weight costs \$28.6 million.

Nutrition interventions

Horton et al. (2010) put the costs of scaling up the minimum package of the 13 interventions in the SUN package at \$11.8 billion a year, of which \$1.5 billion is expected to be available from wealthier household resources to cover costs for complementary and fortified foods. The total financing gap is therefore \$10.3 billion. Such increases in the resources devoted to nutrition interventions would achieve full coverage of the target population in the 36 countries responsible for 90 percent of the world's stunting. Adding 32 smaller high-burden countries would increase costs by 6 percent. The funds would be raised in two steps.¹⁰

- Step 1. \$5.5 billion a year would be raised, including \$1.5 billion for micronutrients and deworming, \$2.9 billion for behavioral change, and \$1.0 billion to build capacities to start scaling up more complex and targeted food-based programs.
- Step 2. \$6.3 billion a year would be raised to scale up complementary and therapeutic feeding in resource-poor environments—\$3.6 billion on complementary food to treat and prevent moderate undernutrition and \$2.6 billion on treatment of severe acute undernutrition.

The set of interventions and steps will not of course be identical in each country and will reflect the national nutrition issues (seasonal variations, rural/urban distribution, protein-energy shortages, and micronutrient deficiencies), the trade position (importer/exporter), and their administrative capacity—those countries with stronger capacity are likely to move faster to the second step.

No one has conducted a global cost-benefit analysis of nutrition interventions (World Bank 2010a), but individual interventions have consistently shown benefit-cost ratios greater than 2:1 (table 2.1 and figure

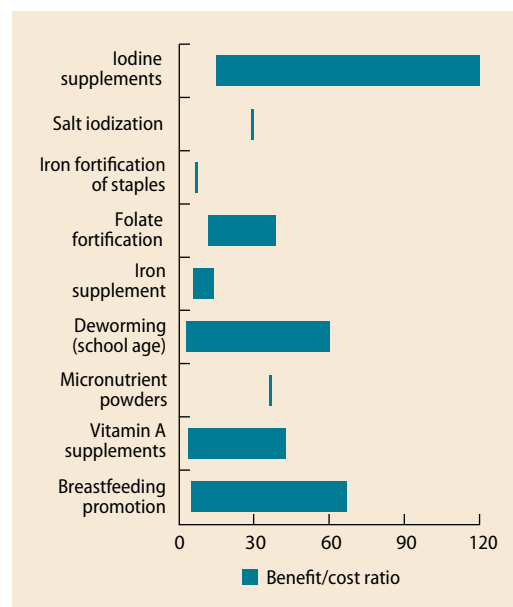
TABLE 2.1 The annual per capita cost of various nutrition interventions is very low

Interventions	Annual per capita cost
Breastfeeding promotion	\$0.30–4.00
Vitamin A supplements	\$0.20
Therapeutic zinc supplements	\$0.47 (10 days)
Deworming (school age)	\$0.32–0.49
Iron supplement	\$10–50
Folate fortification	\$0.01
Iron fortification of staples	\$0.10–0.12
Salt iodization	\$0.05

Source: Horton, Alderman, and Rivera 2008.

2.3). Rates of return for behavioral interventions, such as promotion of breastfeeding, range from 5:1 to 67:1, vitamin A supplementation from 4:1 to 43:1; salt iodization, 30:1, and deworming from 3:1 to 60:1. The newer evidence on long-term benefits of improved nutrition in utero and in the first two years of life may mean that the returns are larger still. New approaches such as multi-micronutrient powders (sprinkles), therapeutic foods, and cash transfers through electronic media also make it easier to implement some of these interventions.

FIGURE 2.3 Benefit-cost ratios of various interventions



Source: Horton, Alderman, and Rivera 2008.

The global costs of scaling up nutrition interventions are lower than the aid commitments for rural development and agriculture and agro-industries (\$14 billion in 2010, see chapter 5) and social safety nets, but they are a big leap from commitments of official development assistance in basic nutrition interventions of \$0.3 billion a year during the period 1995–2007. Not all agricultural, health, and social protection interventions are geared to reducing malnutrition, but some interventions in these sectors could bring important nutritional gains, at marginally increased cost. At the country level, spending on safety nets accounted for 1.9 percent of GDP on average before the recent global economic crisis (Grosh et al. 2008; Marzo and Mori 2012). During the crisis, a total of \$600 billion was spent on support for safety nets (Zhang, Thelen, and Rao 2010). As noted, some of these interventions can provide platforms to support better nutrition outcomes (World Bank 2012 forthcoming).

Comprehensive, consolidated scaling up of multisectoral nutrition programs implies the need for institutional and policy reforms

Challenges to ramping up investment in nutrition include their multisectoral basis, which requires strengthening coordination between ministries in social sectors, agriculture, rural development, and trade; lack of up-to-date national data on malnutrition, particularly anthropometric data (especially for height),¹¹ micronutrient adequacy data (blood tests), and behavioral practices such as breastfeeding and hand washing; lack of voice of potential direct beneficiaries (young children and vulnerable pregnant women); and lack of political commitment.

A series of case studies of nutrition policies and programs in countries at differing levels of policy development and program coverage and results have shed light on the process of breaking out of the “low priority cycle.”¹² Several factors associated with change were identified, the three most common ones being the coming together of key people who engender confidence about the issue and develop the risk-taking attitude to push for change (the

champions); formation of (broad-based) coalitions and alliances (which often include one or more development partners) that rally behind a common narrative and are able to influence decision makers and decision-making processes; and political “windows of opportunity” that can be seized by the champions and coalitions to push for change (box 2.7).

Sometimes one of the factors may give rise to the emergence of another factor; for example, champions may be able to create political windows of opportunity, or the formation of a coalition may give rise to champions who come forward. In countries, where one or more of the three factors was absent, the push for change generally failed. Conversely, when the three factors became a force for change, it was common to see the development of a shared policy narrative for nutrition, leading to the identification of and focus on selected strategic priorities and the use of strategic communication using data and results to push for institutional development, more resources, or both.

Policy responses and their expected impacts on the nutrition related MDGs

The impact of higher food prices on the MDGs varies across countries and socio-economic groups (see also chapter 1). Is the country a net exporter or a net importer of the food items for which world prices change? What is the importance (in trade, production and consumption) of the food items for which world prices change? Similarly, the impact of policy responses to world price changes is likely to vary depending on country and policy specifics, including the source of any additional financing that is needed to cover increases in government spending. To explore the impact of expenditure and financing decisions during crises on the MDGs, we extended the MAMS model, a computable general equilibrium model developed at the World Bank for the analysis of country strategies, to cover undernutrition. In this exercise, we assume that food prices double between now and 2015 (and remain

BOX 2.7 Breaking the low-priority cycle: how nutrition can become a public sector priority for Sub-Saharan African governments

In many countries in Africa, the fight against undernutrition has remained a low government priority for decades, and only recently have some countries begun taking steps to eliminate it.

Political economy factors are important in understanding why, in many countries, nutrition is not recognized as an important priority for human and economic development. Nutrition in many countries is trapped in a “low-priority cycle”—a vicious circle that starts with low demand for nutrition services, followed by a weak response by governments that commit little or no resources and end up with ineffective implementation and poor results, which in turn feed into low demand for nutrition, thus perpetuating its low priority.^a The accumulation of new scientific evidence on the magnitude of undernutrition and its impact on human and economic development is gradually influencing international donor configurations toward a unified call for scaling up nutrition^b and the necessary repositioning of nutrition as central to development.^c

In Sub-Saharan Africa, Senegal is an example of a country that has made significant strides in the fight against undernutrition, where nutrition has broken

out of the low-priority cycle, and where the change factors mentioned in the text were prominent. Senegal now has a Multisectoral Forum for the Fight against Malnutrition under the Prime Minister’s Office; a national nutritional policy and a National Executive Office that ensures the day-to-day management, coordination, and monitoring of the policy; periodically updated, costed strategic plans for nutrition; multiple programs with multiple stakeholders from all sectors; a budget line currently equivalent to \$0.20 per capita per year (compared to \$0.03 per capita per year in 2002–06) and projected to grow to \$0.65 per capita per year by 2016; donor contributions that average between \$0.65–0.70 per capita per year; national program coverage; and, importantly, a reduction in chronic undernutrition that is 16 times above the average reduction in Africa as a whole.

a. See <http://go.worldbank.org/NGZM0XHLM1> for published country studies on Benin, Ghana, Madagascar, and Senegal.

b. Scaling Up Nutrition (SUN) is an international movement launched in September 2010; see www.scalingupnutrition.org and box 2.5.

c. World Bank 2006.

constant thereafter) and analyze the implications for two archetype low-income countries. The two archetypes represent a median low-income country along several dimensions; their differences are primarily related to different trade structures, representing medians for net food exporters and net food importers in low-income countries (box 2.8).

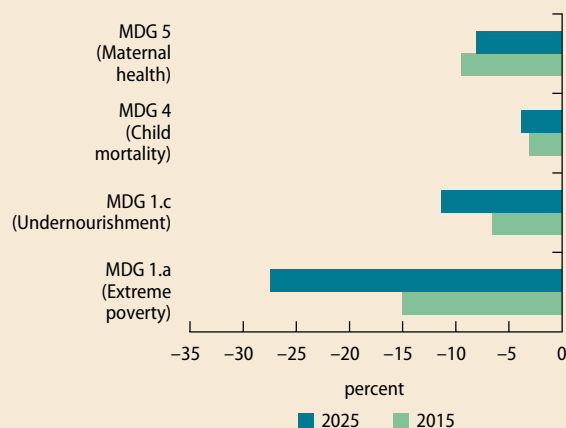
At the micro level, there may be strong reasons for policy interventions in both country types. While the aggregate impact of rising food prices is positive for the net exporter, specific household groups may be hurt, especially in the short run. For example, households that are net food purchasers may experience a decline in real incomes, particularly if their incomes are not very responsive to the rise in growth (for example, households that rely on remittances from abroad, for which the domestic purchasing

power is undermined by currency appreciation) with potential negative impacts on food and nutrition security. Nevertheless, the need for broader interventions is more evident for the net food importer.

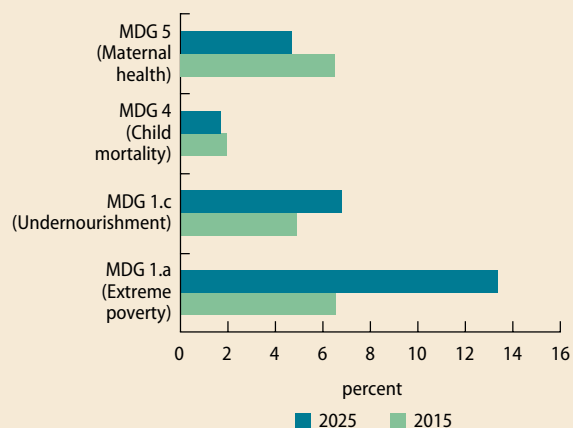
Both the type of intervention and the financing have important implications for the success of nutrition interventions in improving MDG indicators. To illustrate some of the issues involved, we constructed six scenarios, each of which involves a policy response by the net food importer to the rise in the price of food. We then compared their impact on MDG indicators with the scenario of a rise in food prices with no policy adjustment. Four of the scenarios (*sub+tax*, *sub+aid*, *sub+bor*, and *sub+spnd*) involve the introduction of untargeted food subsidies sufficient to keep domestic processed food prices constant through 2025 (as in the baseline).

BOX 2.8 The implications of various spending and financing decisions on the MDGs of a low-income country using MAMS

a. Higher export prices for net exporter: Relative changes in MDG indicators compared to baseline of no price increase in 2015 and 2025



b. Higher import prices for net importer: Relative changes in MDG indicators compared to baseline of no price increase in 2015 and 2025



The left panel of the box figure shows the impact on selected MDG indicators for a low-income country that is in the fortunate position of being a net exporter of food items during a period of rising food prices. We compare two scenarios, one where world food prices are constant through 2025, and a scenario in which world prices gradually are doubled during the period 2012–15, after which they stay at this high level until 2025, the last simulation year. The box figures show the changes in selected MDG indicators in 2015 and 2025 compared with the baseline. The rise in food prices drives increased private demand and government services in response to higher growth, resulting in substantial improvements in the MDG indicators compared with the baseline.

Not surprisingly, as shown in the right panel, the evolution of the same indicators for a less fortunate archetype country—a net importer facing increased prices for its food imports—is the direct opposite. The wide variance in the relative sizes of the gains and the losses for the two archetypes reflects the impact of economic flexibility: both archetypes adjust production and consumption, for the net exporter with the aim of raising exports and for the net importer with the aim of reducing imports.

Source: For more on MAMS, visit www.worldbank.org/mams. For more on the analysis summarized here, see Lofgren (2012 forthcoming).

The source of required additional financing (around 5 percent of GDP) is domestic taxes for *sub+tax*, foreign grant aid for *sub+aid*, domestic borrowing for *sub+bor*, and domestic spending cuts for *sub+spnd* (exempting only transfers to households and spending on agriculture). The last two scenarios (*trn+tax* and *trn+tax2*) impose the same, higher tax rates as *sub+tax* but, instead of subsidizing food, the fiscal space is used for targeted transfers to the bottom halves of the population in rural and urban areas as measured

by per-capita income. *Ttn+tax* assumes that this transfer scheme can be handled by the government administration that already is in place, while *trn+tax2* initially imposes additional hiring and other costs amounting to 15–25 percent of the total program cost, declining over time.

The impacts of these policy responses reveal intriguing patterns. The transfer scheme without additional administrative costs (*trn+tax*) achieves the largest reduction in extreme poverty (MDG 1.a) of the

six scenarios, followed by transfers with such costs added (*trn+tax2*) and aid-financed food subsidies (*sub+aid*); in this and other respects, the aid-financed food subsidies leave the economy relatively untouched by the import price increase (figure 2.4a). Untargeted food subsidies that are financed domestically are relatively less effective in reducing poverty. Financing via spending cuts (*sub+spnd*) leads to outcomes that are similar to those of tax financing (*sub+tax*); in the real world, the details would depend on the extent to which the spending cuts affect wasteful spending and whether the tax increases distort allocative efficiency or penalize investments. Untargeted food subsidies financed through domestic borrowing (*sub+bor*) do relatively well initially but end up as the only intervention that raises the poverty rate compared with the baseline scenario of no policy action. The primary reason is that increased domestic borrowing reduces domestic private investment and growth in capital stocks and GDP. Initially, this negative impact is relatively minor but over time it becomes important, not unlike undernutrition impacts on a child.

The subsidy schemes are mostly more successful in keeping the rate of undernourishment in check (figure 2.4b), because processed food prices do not increase. Aid financing (*sub+aid*) is preferable, followed by spending (*sub+spnd*) and tax (*sub+tax*) financing, respectively. By 2025 the changes in undernourishment are minor for the remaining scenarios. However, for the two transfer schemes, this limited reduction in undernourishment comes in the context of an increase in real incomes and decisions to reduce food consumption and raise consumption of other items in response to relative price changes. For the case of borrowing-financed subsidies, the main reason that undernourishment does not improve is lower real household incomes.¹³ One important dimension to keep in mind is that subsidies in general cover staple foods that are high in calories and low in micronutrients. Even if underweight improves, stunting and micronutrient deficiencies may increase, which has happened in Honduras.

Finally, the impact on MDG 4 (under-five mortality) and MDG 5 (maternal mortality) depends on the impact on growth in real consumption and investment, including private consumption and government health consumption (which translates into government health services; figures 2.4c and 2.4d). Aid-financed subsidies (*sub+aid*) achieve the largest reduction in under-five and maternal mortality rates, because there is no need to make domestic adjustments and the purchasing power of the private sector is boosted by currency appreciation. At the other extreme, subsidies that are financed through government spending cuts (*sub+spnd*) and, to a lesser extent, through domestic borrowing (*sub+bor*) actually raise under-five and maternal mortality rates compared with the baseline scenario of no policy response. These results reflect the negative impact of cuts in government spending on both government health services and the importance of protecting private consumption. The scenarios with tax increases (*sub+tax*, *trn+tax* and *trn+tax2*) have less effect because government services are protected, the decline in private consumption is smaller, or both.

In sum, this analysis suggests that, if administrative costs can be contained, countries should embark on the difficult task of introducing targeted measures, including transfers. If not, untargeted food subsidies may be effective in reducing undernourishment, especially if they are aid financed, because aid has the advantage of making it possible to avoid difficult domestic resource reallocations. However, this does not address stunting and micronutrient deficiencies. In addition, if the subsidies are financed by measures that relatively indiscriminately reduce the resources available for domestic final demands with high payoffs (including private consumption, private investment, and government demand for human development services), then difficult trade-offs emerge and the country may be better off maintaining the status quo. Another important lesson of this analysis is that, to understand the medium- to long-run impact of higher international food prices, it is necessary

FIGURE 2.4 Impact of policy responses to food import price shock for food net importer



Source: Lofgren 2012 forthcoming.

to consider domestic adjustments and the role of international trade in food for each economy; it would be misleading to assume that food prices change for consumers while everything else remains the same.

Policy Recommendations

Improve the information about nutrition status, practices, and interventions

A basic problem in designing interventions to mitigate the effects of food price hikes is the lack of quality data on basic nutrition

indicators and on the effects of both the price rise and some of the interventions to mitigate them. Appropriate responses can be put in place only if countries have a good understanding of who is affected and how. However, few national surveys collect full food consumption data at the household and individual levels with the needed periodicity. Measurement of length or height and weight is difficult, and lack of reliable birth data in some countries makes collecting anthropometric data and computing indexes a challenge. Measurements of micronutrient status often require blood collection, a logistical challenge in many cases, although innovative

techniques based on biomarkers may make this information more readily available. Disaggregated data on costs and impacts, especially in multisectoral interventions, also remain scarce. The MDG indicator (indicator 1.b) is child underweight. However, recent findings confirm that stunting is the most appropriate measure for undernutrition. A multipurpose, nationally representative household survey with information on food consumption, nutritional status (including some micronutrient information), and market exposure would increase countries' ability to monitor nutritional status and to design appropriate targeted interventions.

Investing in nutrition offers high returns

The global costs of scaling up nutrition may seem high initially, but the costs of inaction are also high, the unit costs (set out in table 2.1) are low, and estimated returns are very high—and probably lower-bound estimates. Yet funding remains low. One issue is capacity—these interventions typically require collaboration among ministries and in the field. Basic nutrition capacity is also scarce. However, renewed interest is appearing from multilateral donors such as the World Bank; bilateral donors such as Canada, Denmark, France, Japan, Norway, and the United Kingdom; and NGOs such as Save the Children. Increased action may also come through the SUN framework to scale up nutrition (see box 2.5).

Target the period from conception to two years of life

Many interventions have indirect effects on nutrition, but specific interventions for young children and their caregivers and for pregnant and lactating women are crucial, given the importance of that window as a foundation of human capital (see figure 2.1). The earlier evidence about the intensity of physical and sociocognitive development and the negative short-, medium-, and long-term impacts of

undernutrition in utero and in the first two years of life underline this point. Most interventions during the early window of opportunity have very high rates of return, and the trade-offs between equity and efficiency are minimal at this stage.

A holistic approach to optimal young child growth and development should include nutrition, health, young child stimulation including play, and positive discipline. High-quality care is important in nutritional status and sociocognitive development. Some of the behavioral changes will require adaptation to local cultural contexts and a shift of focus of the health system from curative to preventive interventions.

Tailor the intervention package to country implementation capacity and issues

While acute undernutrition triggers funding and relief interventions, countries also need to tackle chronic undernutrition. Very few countries experience acute protein-energy undernutrition except in famines (the Horn of Africa), seasonally (the hungry season in Bangladesh and in Sahel countries), and in specific areas of the country (hunger and thirst zone in Djibouti, northern Kenya, and northeast Brazil). Community-based interventions (see box 2.6) can address acute severe undernutrition, and when food shortages are acute and markets do not function well, food transfers are an important response in the short term but they do not address the prevention of longer-term chronic undernutrition.

“Hidden hunger”—or micronutrient deficiencies—require a different set of interventions. The main micronutrient deficiencies that affect high shares of populations include iron, vitamin A, zinc, and iodine. The package of measures, recommended in SUN, include supplementation to vulnerable groups in high prevalence areas (vitamin A and iron for pregnant women and children, zinc tablets for children with diarrhea), and fortification including iodized salt

and fortified flour and sugar. Fortification of staple foods requires collaboration with the private sector. In the future, biofortified crops may contribute to population-level efforts to prevent micronutrient deficiencies. Deworming is also important in settings where women and children have high worm burdens and develop anemia. The ministry of health is commonly the agency responsible for the delivery of deworming, infant and young child feeding programs, and micronutrient supplementation efforts. Community-based programs are frequently the platform for behavior change interventions and nutrition surveillance.

Importers and exporters of food would use slightly different packages to address increases in food prices. However, all countries should build a safety net that can be expanded in a crisis. While general food subsidies are important political tools to maintain food prices at acceptable levels, their fiscal costs and paltry nutritional gains make them less appealing than targeted subsidies or cash transfers to the poor and vulnerable. Computable general equilibrium analysis suggests that, if administrative costs can be contained, countries should embark on the difficult task of introducing targeted measures, including transfers. If not, untargeted aid-financed food subsidies may be effective in reducing undernourishment. However, if untargeted subsidies are financed by measures that reduce the resources for other human development services, then the country may be better off refraining from engaging in untargeted subsidies.

Targeting poor households with young children is one way to improve nutrition outcomes among the groups at highest risks for irreversible negative impacts of undernutrition. A point of entry on nutrition is a comprehensive growth monitoring and promotion program for children, whether at the community level or through the health sector. This program would include information campaigns (such as the one used by RECURSO in Peru) to help mobilize the population and raise awareness about the

long-term consequences of undernutrition and the need to shield children and pregnant women from its effects. Box 2.9 describes Haiti's strategy to restore nutrition security after the 2010 earthquake and the first programmatic steps the country contemplates for each priority.

Incorporate nutrition-sensitive approaches in multisectoral interventions

In developing a twin-track approach to nutrition and food security, countries need to weigh the benefits and costs of short-term relief and longer-term investments to raise productivity, especially for smallholder farms, and to work across sectors, especially to link nutrition to health, agriculture, and social protection. A variety of approaches can make interventions in health, agriculture, and social protection—including food aid—more nutrition sensitive (World Bank 2012 forthcoming; see also <http://www.securenutritionplatform.org/Pages/Home.aspx>). Global measures on food trade shape the environment in which decisions are made and have important consequences for national policy options (chapter 4). National markets also matter and need improved functioning (better price information and fewer distortions) and more involvement of the private sector.

Locally, successful implementation will require an alliance of governments with the private sector, NGOs, and communities, especially because an increase in food prices will have disparate impacts depending on markets and production potential. In many cases, behavior and social norms may have to change, with targeted awareness-raising campaigns. Large-scale community nutrition programs have been successful in several low-income countries (see box 2.6). And sometimes NGOs can help expand awareness and coverage. The private sector has a key role in fortification and sometimes in supplementation as well as in improving the availability, accessibility, and affordability of highly nutritious foods.

BOX 2.9 Nutrition security in Haiti after the earthquake of 2010: Priorities and first steps

Nutrition security encompasses access to a nutritious diet, a safe environment, adequate health care, and proper child care practices.

Priorities	First steps
Reduce chronic undernutrition through improved exclusive breastfeeding and complementary feeding practices	Promote behavior change through community education- and household-level outreach
Reduce anemia among pregnant and lactating women and children by providing iron supplements iron and deworming treatments	Provide routine micronutrient supplements (iron, iodine, and vitamin A) to pregnant and lactating women and children under two years
Reduce vitamin A deficiency through supplementation	
Reduce iodine deficiency through supplementation and salt iodization	Reestablish salt iodization
Reduce chronic food insecurity through improved agriculture, investment in agribusinesses, and multisectoral collaboration	Invest in agriculture and agribusiness to increase access to nutrient-rich foods and promote the production of fortified complementary food for children 6–24 months
Improve the coverage of basic health and nutrition services by ensuring proper attention to pregnant and lactating women and children under two years	Invest in basic health services to expand access and quality and include a basic nutrition package for the most vulnerable
Support government capacity and leadership to set, promote and implement nutrition security programs and policies	

Source: World Bank 2010b.

Notes

1. The term *malnutrition* refers to undernutrition (the outcome of insufficient food intake and repeated infectious diseases, including being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (wasted), and deficient in vitamins and minerals resulting in micronutrient malnutrition) and overnutrition (overweight and obesity). Prevalence of undernourishment refers to the proportion of a population whose dietary energy consumption is less than a pre-determined threshold. This threshold is country specific and is measured by the number of kilocalories required to conduct sedentary or light activities.
2. According to the Food and Agriculture Organization, food security is a situation where "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."
3. Morocco's Targeting and Social Protection Strategy (World Bank 2011b) delineates some of the trade-offs and calls for targeting and a different set of interventions to tackle the risks facing the most vulnerable population groups.
4. This section draws heavily on World Bank (2006).
5. This section draws on Alderman (2011a).
6. Gertler (2004) also show results on child health through increased access to preventive health services.
7. Supplementary food contains all the recommended daily allowance of micronutrients along with energy; typically it is a fortified cereal and legume blended flour and is used to address moderate acute malnutrition. Therapeutic food contains all nutrients for children to reverse growth failure and achieve catch-up

(it addresses severe acute and chronic malnutrition). The lipid-rich food is ready-to-eat from its container, requires no water for preparation, is good for 24 months after manufacture and 24 hours after opening.

8. Evaluations are under way in both countries.
9. Birth spacing, adolescent pregnancies when the mother is still growing herself, and sexually transmitted infections all affect fetal growth and infant nutritional status. The longer the interval between birth and the next conception, the more time the mother has to recover nutritionally from her previous birth.
10. In both steps, \$0.1 billion is included for rigorous monitoring and evaluation.
11. These data are improving with the implementation of the Living Standards Measurement Study (LSMS) household surveys, as well Demographic and Health Surveys and Multiple Indicator Cluster Surveys in some countries, but sustained funding for regular national-level household surveys is still a challenge. In addition, apart from the LSMS, while the surveys include anthropometric data, they contain very little information on consumption. All these surveys also lack details on household status with respect to food markets (net buyer or seller of the products affected by price hikes).
12. This is based on a comparative study of nutrition policies and programs in Benin, Burkina Faso, Ethiopia, The Gambia, Ghana, Madagascar, Senegal, and Tanzania (led by Marcela Natalicchio and Menno Mulder-Sibanda).
13. In reality, the impact on undernourishment would be more positive than indicated for the two transfer schemes because the inequality of calorie consumption declines; however, in the absence of any data on the distribution of calories per capita other than national Gini coefficients, the analysis could not account for this and assumed instead that this national Gini coefficient did not change.

References

- Alderman, H. 2011a. "The Response of Child Nutrition to Changes in Incomes: Linking Biology with Economics." Paper prepared for the CESifo workshop on Malnutrition in South Asia. Venice International University, San Servolo, July 20–21.
- Alderman, H., ed. 2011b. *No Small Matter. The Impact of Poverty, Shocks, and Human Capital Investments in Early Childhood Development*. Washington, DC: World Bank.
- Alderman, H., and D. Bundy. 2011. "School Feeding Programs and Development: Are We Framing the Question Correctly?" *World Bank Research Observer*.
- Alderman, H., B. Ndiaye, S. Linnemayr, A. Ka, C. Rokx, K. Dieng, and M. Mulder-Sibanda. 2008. "Effectiveness of a Community-Based Intervention to Improve Nutrition in Young Children in Senegal: A Difference in Difference Analysis." *Public Health Nutrition* 12, no. 5: 667–73; doi:10.1017/S1368980008002619.
- Armar-Klemesu, M., M. Ruel, D. Maxwell, C. Levin, and S. Morris. 2000. "Poor Maternal Schooling Is the Main Constraint to Good Childcare Practices in Accra." *Journal of Nutrition* 130, no. 6: 1597–607.
- Atanasio, O., E. Battistin, E. Fitzsimons, and M. Vera-Hernandez. 2005. "How Effective Are Conditional Cash Transfers? Evidence from Colombia." IFS Briefing Notes BN54, Institute for Fiscal Studies, London.
- Baird, S., J. Friedman, and N. Schady. 2011. "Aggregate Income Shocks and Infant Mortality in the Developing World." *Review of Economics and Statistics* 93, no. 3: 847–56.
- Baldacci, E., B. Clements, Q. Cui, and S. Gupta. 2004. "Social Spending, Human Capital and Growth in Developing Countries: Implications for Achieving the MDGs." Working paper 04/217, International Monetary Fund, Washington, DC.
- Bhalotra, S. 2010. "Fatal Fluctuations? Cyclical-ity in Infant Mortality in India." *Journal of Development Economics* 93, no. 1: 7–19.
- Block, S.A., L. Kiess, P. Webb, S. Kosen, R. Moench-Pfanner, M. Bloem, and C. P. Timmer. 2004. "Macro Shocks and Micro Outcomes: Child Nutrition during Indonesia's Crisis." *Economics and Human Biology* 2, no. 4: 21–44.
- Buffie, E. F., and M. Atolia. 2009. "Agricultural Input Subsidies in Malawi. Good, Bad or Hard to Tell?" FAO Commodity and Trade Policy Research Working Paper 28, Food and Agriculture Organization, Rome.

- Bundy, D., C. Burbano, M. Grosh, A. Gelli, M. Jukes, and L. Drake. 2009. *Rethinking School Feeding. Social Safety Nets, Child Development and the Education Sector*. Washington, DC: World Bank.
- Centers for Disease Control and Prevention. 2011. *Children's Food Environment State Indicator Report*. U.S. Department of Health and Human Services, Washington, DC.
- CONEVAL. 2009. Informe de evolución histórica de la situación nutricional de la población y los programas de alimentación, nutrición, y abasto en México.
- Cruces, G., P. Gluzmann, and L. F. Lopez Calva. 2010. "Permanent Effects of Economic Crisis on Household Welfare: Evidence and Projections from Argentina's Downturn." Paper prepared for UNDP-RB-LAC project "The Effects of the Economic Crisis on the Well-Being of Households in Latin America and the Caribbean."
- Deaton, A. 2010. "Understanding the Mechanisms of Economic Development." Working Paper 15891. National Bureau of Economic Research, Cambridge, MA.
- Delisle, H. F. 2008. "Poverty: The Double Burden of Malnutrition in Mothers and the Intergenerational Impact." *Annals of the New York Academy of Science* 1136: 172–84.
- Ecker, O., C. Beisinger, and K. Pauw. 2011. "Growth Is Good, but Is Not Enough to Improve Nutrition." Paper prepared for the IFPRI 2020 Conference on Leveraging Agriculture for Improving Nutrition and Health, Delhi, February.
- Fernald, L. C. H., P. J. Gertler, and L. M. Neufeld. 2008. "Role of Cash in Conditional Cash Transfer Programmes for Child Health, Growth, and Development: An Analysis of Mexico's Oportunidades." *Lancet* 374, no. 9706: 1997–2005.
- Ferreira, F. H. G., A. Fruttero, P. Leite, and L. Lucchetti. 2011. "Rising Food Prices and Household Welfare. Evidence from Brazil in 2008." Policy Research Working Paper 5652, World Bank, Washington, DC.
- Ferreira, F. H. G., and N. Schady. 2009. "Aggregate Economic Shocks, Child Schooling and Child Health." *World Bank Research Observer* 24, no. 2: 147–81.
- Fiszbein, A., and N. Schady. 2009. *Conditional Cash Transfers: Reducing Present and Future Poverty*. Washington, DC: World Bank.
- Friedman, J., S. Y. Hong, and X. Hou. 2011. "The Impact of the Food Price Crisis on Consumption and Caloric Availability in Pakistan: Evidence from Repeated Cross-Sectional and Panel Data." HNP Discussion Paper, World Bank, Washington, DC.
- Friedman, J. and N. Schady. 2009. "How Many More Infants Are Likely to Die in Africa as a Result of the Global Financial Crisis?" Policy Research Working Paper 5023, World Bank, Washington, DC.
- Friedman, J., and J. Sturdy. 2011. "The Influence of Economic Crisis on Early Childhood Development: A Review of Pathways and Measured Impact." In *No Small Matter: The Impact of Poverty, Shocks and Human Capital Investments in Early Childhood Development*, ed. H. Alderman. Washington, DC, World Bank.
- Gentilini, U., and S. W. Omamo. 2011. "Social Protection 2.0: Exploring Issues, Evidence and Debate in a Globalizing World." *Food Policy* 36 (2011): 329–40.
- Gertler, P. 2004. "Do Conditional Cash Transfers Improve Child Health? Evidence from PROGRESA's Controlled Randomized Experiment." *American Economic Review* 94, no. 2: 331–36.
- Gibson, J., and B. Kim. 2011. "Quality, Quantity, and Nutritional Impacts of Rice Price Changes in Vietnam." Paper presented at the World Bank Poverty and Applied Micro Seminar, September 7.
- Graham-McGregor S., Y. B. Cheung, S. Cueto, P. Glewwe, L. Richter and B. Strupp. 2007. "Development Potential in the First Five Years for Children in Developing Countries." *Lancet* 369, no. 9555: 60–70.
- Grosh, M., C. del Ninno, E. Tesliuc, and A. Ouerghi. 2008. *For Protection and Promotion: The Design and Implementation of Effective Safety Nets*. Washington, DC: World Bank.
- Haddad, L., H. Alderman, S. Appleton, L. Song, and Y. Yohannes. 2003. "Reducing Child Malnutrition: How Far Does Income Growth Takes Us?" *World Bank Economic Review* 17, no. 1: 107–31.

- Headey, D. 2011. "Turning Economic Growth into Nutrition-Sensitive Growth." Paper prepared for the IFPRI 2020 Conference on Leveraging Agriculture for Improving Nutrition and Health, Delhi, February.
- Hidrobo, M. 2011. "The Effects of Ecuador's 1998–2000 Economic Crisis on Child Health and Cognitive Development." Department of Agricultural and Resource Economics, University of California at Berkeley. http://ecnr.berkeley.edu/vfs/PPs/Hidrobo-Mel/web/Hidrobo_JMP_1.16.11.pdf.
- Hoddinott, J. 2011. "Agriculture, Health and Nutrition: Towards Conceptualizing the Linkages." Paper prepared for the IFPRI 2020 Conference on Leveraging Agriculture for Improving Nutrition and Health, Delhi (February).
- Hoddinott, J. and B. Kinsey. 2001. "Child Growth in the Time of Drought." *Oxford Bulletin of Economics and Statistics* 63, no. 4: 409–36 (Also in Alderman 2011b).
- Hoddinott, J., J. Maluccio, J. R. Behrman, R. Martorell, P. Melgar, A. R. Quisumbing, M. Ramirez-Zea, A. D. Stein, and K.M. Yount. 2011. "The Consequences of Early Childhood Growth Failure over the Life Course." Discussion Paper 01073, International Food Policy Research Institute, Washington, DC.
- Holmes, R., N. Jones, and H. Marsden. 2009. "Gender Vulnerabilities, Food Price Shocks and Social Protection Responses." Background Note, Overseas Development Institute, London (October).
- Horton, S., H. Alderman, and J. Rivera. 2008. "Hunger and Malnutrition." Copenhagen Consensus 2008 Challenge Paper. Copenhagen Consensus Center.
- Horton, S., M. Shekar, C. McDonald, A. Mahal, and J.K. Brooks. 2010. "Scaling Up Nutrition What Will It Cost?" World Bank, Washington, DC.
- IFAD (International Fund for Agricultural Development), WFP (World Food Programme), and FAO (Food and Agriculture Organization). 2011. "The State of Food Insecurity in the World: How Does International Food Price Volatility Affect Domestic Economies and Food Security?" Rome.
- Khandker, S. R., M. A. Khaleque, and H. A. Samad. 2011. "Can Social Safety Nets Alleviate Seasonal Deprivation? Evidence from Northwest Bangladesh." Policy Research Working Paper 5865, World Bank, Washington, DC.
- Levin, C., M. Ruel, S. Morris, D. Maxwell, M. Armar-Klemesu, and C. Ahiadeke. 1999. "Working Women in an Urban Setting: Traders, Vendors, and Food Security in Accra." *World Development* 27, no. 11: 1977–91.
- Lofgren, Hans. 2012 forthcoming. "World Food Prices and Human Development: Policy Simulations for Archetype Low-Income Countries." Background paper for *Global Monitoring Report 2012*, World Bank, Washington, DC.
- Low, J. W., M. Arimond, N. Osman, B. Cunga, F. Zano, and D. Tschirley. 2007. "A Food-Based Approach Introducing Orange-Fleshed Sweet Potatoes Increased Vitamin A Intake and Serum Retinol Concentrations in Young Children in Rural Mozambique." *Journal of Nutrition* 137, no. 5: 1320–27.
- Maccini, S., and D. Yang. 2009. "Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall." *American Economic Review* 99, no. 3: 1006–26.
- Macours, K., N. Schady, and R. Vakis. 2008. "Cash Transfers, Behavioral Changes, and Cognitive Development in Early Childhood: Evidence from a Randomized Experiment." Policy Research Working Paper 4759, World Bank, Washington, DC.
- Marzo, F., and H. Mori. 2012. "Crisis Response in Social Protection." Draft background paper for the Social Protection and Labor Strategy, World Bank, Washington, DC.
- Masset, E., L. Haddad, A. Cornelius, and J. Isaza Castro. 2011. "A Systematic Review of Agricultural Interventions That Aim to Improve the Nutritional Status of Children." University of London, Social Science Research Unit.
- McIntyre, L., N. Glanville, K. Raine, J. Dayle, B. Anderson, and N. Battaglia. 2003. "Do Low-Income Mothers Compromise Their Nutrition to Feed Their Children." *Canadian Medical Association Journal* 168, no. 6: 686–91.
- Miller, C. M., M. Tsoka, and K. Reichert. 2011. "The Impact of the Social Cash Transfer Scheme on Food Security in Malawi." *Food Policy* 36, no. 2: 230–38.

- Miller, C. M., M. Tsoka, K. Reichert, and A. Hussaini. 2010. "Interrupting the Intergenerational Cycle of Poverty with the Malawi Social Cash Transfer." *Vulnerable Children and Youth Studies* 5, no. 2: 108–21.
- Musgrove, P. 1987. "The Economic Crisis and Its Impact on Health and Health Care in Latin America and the Caribbean." *International Journal of Health Care Services* 17, no. 3: 411–41.
- Pinstrup-Andersen, P., ed. 2010. *The African Food System and Its Interaction with Human Health and Nutrition*. Ithaca, NY: Cornell University Press.
- Pinstrup-Andersen, P., A. Herforth and A. Jones. 2012 forthcoming. "Prioritizing Nutrition in Agriculture and Rural Development Projects: Guiding Principles for Operational Investments."
- Pongou, R., J. A. Salomon, and M. Ezzati. 2006. "Health Impacts of Macroeconomic Crises and Policies: Determinants of Variation in Childhood Malnutrition Trends in Cameroon." *International Journal of Epidemiology* 35, no. 3: 648–56.
- Quisumbing, A. 1996. "Male-Female Differences in Agricultural Productivity." *World Development* 24: 1579–95.
- Quisumbing, A., L. R. Brown, H. S. Feldstein, L. Haddad, and C. Peña. 2000. "Women: The Key to Food Security." International Food Policy Research Institute, Washington, DC.
- Quisumbing, A., and B. de la Brière. 2000. "Women's Assets and Intra-household Allocation in Bangladesh: Testing Measures of Bargaining Power." FCND Discussion Paper 86, International Food Policy Research Institute, Washington, DC.
- Quisumbing, A., and J. Maluccio. 2000. "Intra-household Allocation and Gender Relations: New Empirical Evidence from Four Developing Countries." FCND Discussion Paper 84, International Food Policy Research Institute, Washington, DC.
- Quisumbing, A., R. Meinzen-Dick, and L. Bassett. 2008. "Helping Women Respond to the Global Food Price Crisis." Policy Brief 7, International Food Policy Research Institute, Washington, DC.
- Ramachandran, A. and C. Snehalatha. 2010. "Rising Burden of Obesity in Asia." *Journal of Obesity*. Article ID 868573; doi:10.1155/2010/868573.
- Robles, M., and M. Torero. 2010. "Understanding the Impact of High Food Prices in Latin America." *Economia* 10, no. 2: 117–64.
- Ruel, M. T. 2000. "Urbanization in Latin America: Constraints and Opportunities for Child Feeding and Care." *Food and Nutrition Bulletin* 21 (1): 12–24.
- Ruel, M. T., B. de la Brière, K. Hallman, A. Quisumbing, and N. Coj. 2002. "Does Subsidized Childcare Help Poor Working Women in Urban Areas? Evaluation of a Government-Sponsored Program in Guatemala City." World Bank, Washington, DC.
- Ruel, M. T., C. E. Levin, M. Armar-Klemesu, D. G. Maxwell and S. S. Morris. 1999. "Good Care Practices Mitigate the Negative Effects of Poverty and Low Maternal Schooling on Children's Nutritional Status: Evidence from Accra." *World Development* 27 (11): 1993–2009.
- Save the Children. 2008. *Saving Children's Lives. Why Equity Matters*. London.
- . 2009. "How the Global Food Crisis is Hurting Children. The Impact of the Food Price Hike on a Rural Community in Northern Bangladesh." London.
- . 2011. "Costing Lives. The Devastating Impact of Rising and Volatile Food Prices." Briefing.
- Schady, N. 2002. "The (Positive) Effect of Macroeconomic Crises on the Schooling and Employment Decisions of Children in a Middle-Income Country." Policy Research Working Paper 2762, World Bank, Washington, DC.
- Silva, J. 2010. "Djibouti Crisis Response Employment and Human Capital Social Safety Net." Proposal to the Japan Social Development Fund. Middle East and North Africa Human Development Department, World Bank, Washington, DC.
- Skoufias, E., S. Tiwari, and H. Zaman. 2011. "Can We Rely on Cash Transfers to Protect Dietary Diversity during Food Crises? Estimates from Indonesia." Policy Research Working Paper 5548, World Bank, Washington, DC.
- Smith, L. and L. Haddad. 2000. "Explaining Child Malnutrition in Developing Countries:

- A Cross-Country Analysis.” Research Report 111, International Food Policy Research Institute, Washington, DC.
- Taylor, J. E., and M. Filipowski. 2012 forthcoming. “A Simulation Impact Evaluation of Rural Income Transfers in Malawi and Ghana.” *Journal of Development Effectiveness*.
- Victora, C. G., L. Adair, C. Fall, P. C. Hallal, R. Martorell, L. Richter, and H. S. Sachdev. 2008. “Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital.” *Lancet* 371 (9609): 340–57. DOI: 10.1016/S0140-6736(07)61692-4.
- Victora, C. G., M. De Onis, P. C. Hallal, M. Blossner, and R. Shrimpton. 2010. “Worldwide Timing of Growth Faltering: Revisiting Implications for Interventions.” *Pediatrics* 125: e473–e480.
- Walker, I. 2008. “RECURSO-Perú. La rendición de cuentas a nivel local para mejorar los resultados en servicios básicos.” Presentation to International Seminar about Decentralization and Social Inclusion in the Process of Regional Integration. Lima, February 7.
- Waters, H., F. Saadah, and M. Pradhan. 2003. “The Impact of the 1997–98 East Asian Economic Crisis on Health and Health Care in Indonesia.” *Health Policy and Planning* 18 (2): 172–81.
- Wodon, Q., and H. Zaman. 2008. “Rising Food Prices in Sub-Saharan Africa: Poverty Impact and Policy Responses.” Policy Research Working Paper 4738, World Bank, Washington, DC.
- World Bank. 2005. “Maroc. Réforme du Système de Compensation à la Farine Nationale de Blé Tendre.” Report 34454-MA, Washington, DC.
- . 2006. *Repositioning Nutrition as Central to Development. A Strategy for Large-Scale Action*. Washington, DC: World Bank.
- . 2007. *World Development Report 2008. Agriculture for Development*. Washington DC, World Bank.
- . 2009. “République de Djibouti. Options d’Assistance Sociale pour la Lutte Contre la Malnutrition.” Note de politique. Région Moyen-Orient et Afrique du Nord, Groupe des Secteurs Sociaux (MNSHD), World Bank, Washington, DC.
- . 2010a. “What Can We Learn from Nutrition Impact Evaluations? Lessons from a Review of Interventions to Reduce Child Malnutrition in Developing Countries.” World Bank, Independent Evaluation Group, Washington, DC.
- . 2010b. “Promoting Nutrition Security in Haiti. An Assessment of Pre- and Post-Earthquake Conditions and Recommendations for the Way Forward.” World Bank, Washington, DC.
- . 2011a. *World Development Report 2012: Gender Equality and Development*. Washington, DC: World bank.
- . 2011b. “Royaume du Maroc. Note d’Orientation Stratégique sur le Ciblage et la Protection Sociale.” Région Moyen-Orient et Afrique du Nord, Groupe des Secteurs Sociaux (MNSHD), World Bank, Washington, DC.
- . 2012 forthcoming. “Addressing Nutrition through Multi-Sectoral Approaches: Guidance Notes for World Bank Task Team Leaders.” World Bank, Washington, DC.
- World Bank and IFPRI (International Food Policy and Research Institute). 2008. *From Agriculture to Nutrition: Pathways, Synergies and Outcomes*. Washington, DC.
- Yamano, T., H. Alderman, and L. Christiansen. 2003. “Child Growth, Shocks and Food Aid in Rural Ethiopia.” Policy Research Working Paper 3128, World Bank, Washington, DC.
- Zhang, Y., N. Thelen, and A. Rao. 2010. “Social Protection in Fiscal Stimulus Packages: Some Evidence.” A UNDP/ODS Working Paper (March).

