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Poverty and Food Price Developments

Summary and main messages

The food price spikes have prevented millions of people from escaping extreme poverty. The record prices in 2008 kept or pushed 105 million people below the poverty line in the short run. They hit urban poor and female-headed households hardest. While food prices dropped sharply in 2009 with the financial crisis, they quickly rebounded and by early 2011 were almost back to 2008 levels. Sudden, unexpected increases in food prices impose particularly severe hardship on many households because they need time to adjust to higher prices. The large, initial impact on poverty of a rise in food prices tends to decline over time as production increases and the income of the poor in rural areas rises, but it is usually not large enough to offset the initial negative impact on poverty in the short run.

The factors that caused the price spikes also have the potential to make prices more volatile and thus less predictable. Biofuel mandates, which have boosted demand for grains, despite slowing demand for food globally, have reduced the price elasticity of demand for grains. Sharp increases in fertilizer prices, linked to energy prices, have made production costs more volatile and, to the extent that higher prices have reduced the use of fertilizers, have made yields less stable. Adverse weather patterns also have become more frequent and more variable. Low global stocks have contributed to price volatility at time of production shortfalls. Moreover, trade interventions meant to stabilize domestic prices often have had the adverse effect and increased price volatility globally.

The challenges differ across countries. Food price increases have different effects on a country's current account depending on whether the country is a net importer or net exporter, while the impact on a country's fiscal position depends on subsidy programs and other market interventions. In addition, the extent and speed of transmission of changes in international food prices during the recent price spikes to domestic prices has varied considerably across countries. Transmission of prices has been limited in countries that impose trade barriers and have poor infrastructure. This isolates domestic from international markets and potentially raises price volatility in domestic markets. Trade restrictions, price controls, and rationing can limit the rise in domestic food prices in response to international price spikes, but at the cost of eroding producer incentives and, in the case of export bans,

perhaps encouraging responses by exporters that could increase international prices. A more efficient and sustainable response to international food price spikes would permit domestic prices to rise while increasing assistance to the poor.

Characteristics of each country determine the most appropriate policy mix for addressing the implications of higher and more volatile food prices, although the content of the chosen policies will not differ greatly among countries. The chosen policy mix at the country level depends critically on how much of a country's food needs to be imported, how much of their income the poor spend on food, the socioeconomic characteristics of the poor affected, and the political environment. It depends equally on a country's integration with regional and world markets, on its level of productivity compared with what is achievable, and on its government's capacity to target the poor and vulnerable through mitigating interventions, which vitally depends on the adoption of such programs before a crisis. In addition, the government's ability to raise public expenditures or provide tax incentives in response to a food price shock without jeopardizing fiscal sustainability depends on initial macroeconomic conditions.

In the long term, the policy mix needs to address the main bottlenecks to the functioning of the domestic food markets and profitability of farmers. This would include the use of technological innovations to improve productivity. Over the long term, policies that would limit the average rise in food prices, without undermining farmer profitability, include promoting increased yields through research, extension, and improved water management; improving the efficiency of land markets and strengthening property rights; using more efficient technologies for producing biofuels; increasing farmers' access to efficient tools to manage risk; and increasing the integration of domestic markets with world markets. Policies that would limit food price volatility include the development of weather-tolerant grain varieties, increases in the size and improvements in the management of stocks, the opening markets to trade, and improvements in market transparency.

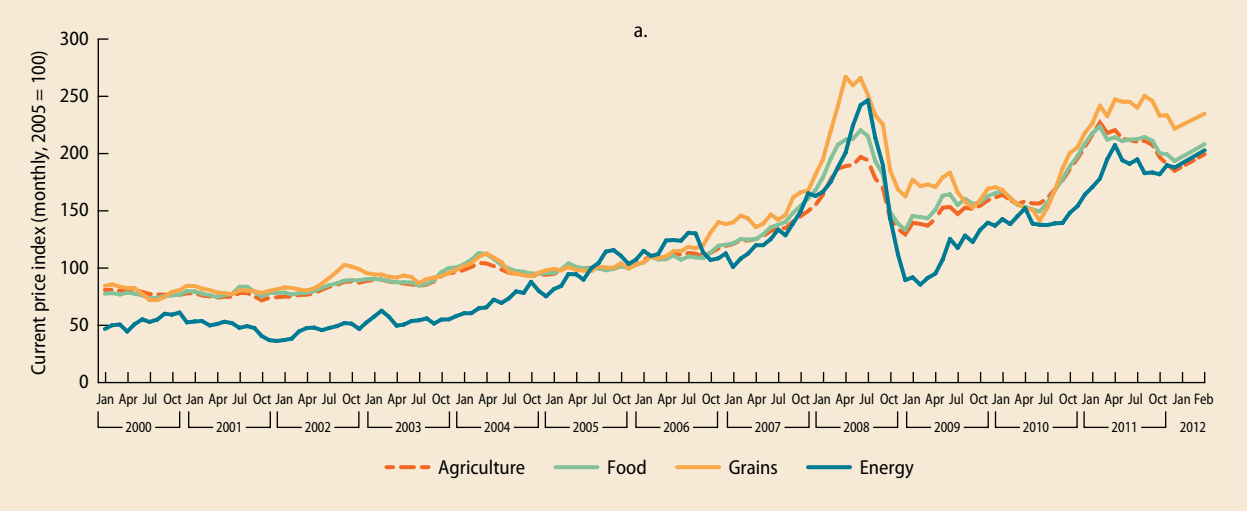
An increase in yields is needed, especially in Sub-Saharan Africa. Yields there are well below levels achieved in other parts of the world and well below what is achievable in Sub-Saharan Africa. At the same time, population growth remains high and Africa has become increasingly dependent on food imports. Increased public and private investment, better water management, and improved farming practices to more fully exploit existing technology, as well as further research, are essential to raise yields. It is also crucial to improve the trade infrastructure, to enable more trade within Africa (World Bank 2009). Raising productivity could have a substantial impact on prices and income of farmers, lowering rural poverty and making food more affordable for the urban vulnerable and poor.

Evidence in the GMR 2011 pointed to the critical role of strong economic growth and a stable macroeconomic environment in progressing toward the MDGs. Seen in this context, the strong economic performance of emerging and developing countries in the past several years and their resilience in the face of the global financial crisis are major accomplishments. However, a weaker, more uncertain global economy in 2012, combined with still-high food prices, may pose new challenges and complicate emerging and developing countries' quest to further reduce poverty and hunger. Developing countries coped well with the recent global downturn but face the current global economic environment with depleted policy buffers. Among possible risks to the outlook is a further sharp slowdown in global growth and a new or extended spike in food prices. Should such risks materialize, possible responses must be directed toward protecting the most vulnerable and poor people within a stable and sustainable macroeconomic framework.

Rising food prices have prevented millions of people from escaping poverty

Agricultural prices in 2011 exceeded their 2008 peaks by 17 percent. Food prices increased 92 percent in nominal terms and

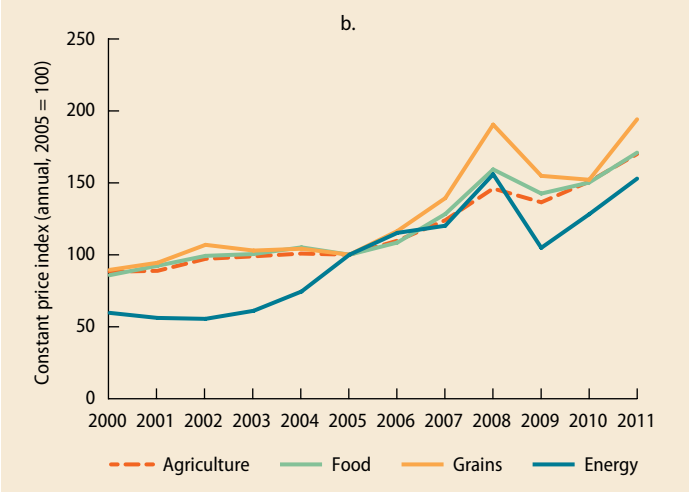
FIGURE 1.1 **Food, grain, agricultural, and energy price developments (in nominal and real terms)**



Source: World Development Indicators database.

57 percent in real terms from December 2005 to January 2012 (figure 1.1). The World Bank Agriculture Price Index peaked in February 2011, exceeding levels reached in 2008. The 2010–11 international price increases were more widespread across agricultural commodities than in 2008, when they were mainly concentrated in grain crops.[1] Since June 2010 agricultural price increases have been broad-based, affecting sugar, edible oils, beverages, animal products, and raw materials such as cotton.

High and volatile food prices can hurt food security. Large, sudden, and particularly unexpected food price increases make it difficult for households to adjust—eroding consumer purchasing power, reducing calorie intake and nutrition, and pushing more people into poverty and hunger. Overall impacts depend on the proportions of households that are net buyers and households that sell surplus production (net sellers). Net buyers will see their purchasing power decrease. Because the poor spend much of their income on food (50–70 percent), they bear a disproportionate burden in adjusting to high food prices. This is especially true for poor urban households and those headed by women, who typically spend more than half their incomes on food and are more likely to curtail consumption in the face of higher prices. At the same time, supply shocks such as droughts can seriously derail food consumption and lead to all-out famine (box 1.1).



Source: World Development Indicators database.

Qualitative survey-based research shows that responses of poor people in 13 countries to global shocks lead to severe indirect impacts.[2] Poor people have experienced a series of global shocks in recent years, from the spikes in fuel and food prices, to the economic contraction that started in 2008, while droughts have exacerbated problems

BOX 1.1 Crisis in the Horn of Africa

Below average rainfall since 2010, compounded by rising and more volatile food and fuel prices, protectionist policies, political instability and conflict, and deteriorating conditions in refugee camps have exacerbated the food crisis in the Horn of Africa. Nearly 13 million people in Djibouti, Ethiopia, Kenya, and Somalia face food insecurity; famine afflicts about 4 million people in Somalia.

Higher food prices and malnutrition remain severe problems in all of these countries

In **Somalia** domestic supply appears to cover only 15–20 percent of demand,[a] local grain prices have more than doubled since June 2010 in some areas, and continued instability is driving refugee flows to neighboring countries. According to the Food Security and Nutrition Analysis Unit-Somalia, recent data suggest that around 34 percent of children under age five are malnourished, of whom 40 percent suffer from severe acute malnutrition.

Food price inflation in **Ethiopia** reached 47 percent in July 2011, and some areas are facing exceptionally harsh conditions: wasting among children under age five in the south and southeast regions ranges from 10 to 22 percent. However, the number of people affected and total economic cost of the current drought are low compared with previous food crises,[b] in part because the most affected areas account for a small share of domestic agricultural production and livestock population. The World Bank and the International Monetary Fund (2010) estimates that the drought could reduce gross domestic product (GDP) by only about 0.5 percent, provided that rainfall conditions improve.

The price of maize in **Kenya** doubled in the year ending October 2011. Livestock is the main source of livelihood in the drought-affected areas and accounts for about 5 percent of total GDP. Estimated livestock mortality as a result of the drought is about 10–15 percent above normal in the affected areas, equivalent to 5 percent of Kenya's livestock population.[c] The Dadaab camp for Somali refugees has faced a difficult security situation. Overall, the direct negative impact of the drought is estimated at approximately 0.2 percent of GDP.

A fifth of **Djibouti's** population is in need of food relief. Low rainfall in the northwest and southeast has kept food prices high and exacerbated food insecurity among pastoralists, while in urban areas high food prices and unemployment have increased poor households' dependence on food aid. Moderate malnutrition among children under five tripled in poor urban areas between May 2010 and May 2011, affecting approximately 26,000 children.[d]

The international development community is responding to the crisis but more funds are needed

As of December 16, 2011, funding coverage for humanitarian assistance in the four drought-affected countries in the Horn of Africa was estimated at 79 percent of need.[e] Increased support is particularly needed for humanitarian assistance in Djibouti and refugee-related requirements in Ethiopia.

The World Bank's International Development Association, the donor-funded Global Facility for Disaster Reduction and Recovery, and the State and Peace Building Fund are making available $1.88 billion to address short-term crisis mitigation and long-term development objectives. A total of $288 million has been allocated for the rapid response phase, which will provide health services (health screenings and nutrition schemes) and safety net programs (cash for work and cash transfer programs) through early 2012. The economic recovery phase will provide $384 million over a two-year period, to support agriculture and livestock production by improving land management and irrigation. The final, drought resilience phase will allocate $1.2 billion to drought-resilient agriculture, risk financing, resilience planning and strengthening social safety nets.[f]

a. Famine Early Warning System Network. 2011. "Special Brief: Market Functioning in Southern Somalia." U.S. Agency for International Development, Washington, DC (July 28).

b. World Bank. 2011. "Impact of the Drought and the Rise in Food Prices: Ethiopia," Country Assessment, Washington, DC (November).

c. World Bank. 2011. "The Drought and Food Crisis in the Horn of Africa: Impacts and Proposed Policy Responses for Kenya." PREM Economic Premise 71, Washington, DC (November).

d. United Nations Office for the Coordination of Humanitarian Affairs, 2012; UNICEF. 2011. "Feeding Centers Aim to Alleviate Chronic Malnutrition in Drought-Affected Djibouti." *At a Glance: Djibouti,* August 18.

e. United Nations Office for the Coordination of Humanitarian Affairs, 2012, p. 6.

f. World Bank. 2011. "Response Plan, Drought in the Horn of Africa." September 10.

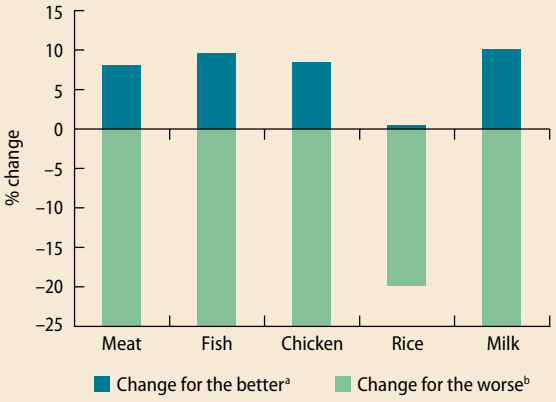
BOX 1.2 How rising food prices affect the citizens of Dar es Salaam

In 2011 Tanzanians were hit by substantial increases in commodity prices. The country's inflation rate rose throughout the year, reaching 18 percent by December. How did rising food prices affect the citizens of Dar es Salaam, and did they change their consumption patterns? The World Bank worked with the NGO Twaweza to use mobile phones to survey households on their perceptions.

The number of low-income households that could afford three meals a day has fallen by about 20 percent since the end of 2010. The reported consumption of a number of food types also decreased for individual households (box figure).

High inflation and rising commodity prices were also reflected in citizens' general assessment of their economic situation. In 2010 about half the respondents (51.3 percent) were negative about their economic situation. In 2011 the proportion rose to nearly three in four (72.5 percent). And the percentage of citizens who thought Tanzania's economic situation was bad or very bad rose from 65.7 percent in 2010 to 85.7 percent in the current study.

Changes in household consumption patterns



a. Percentage of households that reported this type of food as part of a typical family meal in the current study, but not in the baseline.
b. Percentage of households that reported this type of food as part of a typical family meal in the baseline, but not in the current study.

at the local level (Heltberg, Hossain, and Reva 2012, forthcoming). The shocks often resulted in severe hardships, and responses led to second-order impacts. Less nutritious diets caused malnourishment and made people more susceptible to health shocks. The sudden influx of workers into the informal economy lowered earnings. Such extreme hardship can even lead to criminal activities, eroding trust and cohesion in communities (box 1.2).

Reducing the quality of food and the number of meals was one of the most common responses, often the first to be used, in study sites in all countries surveyed (table 1.1). In addition, reducing nonfood consumption, working more hours, and diversifying sources of income (say, by entering a new informal occupation) were common nearly everywhere. Migration, sometimes as reverse migration to the home area, was also a fairly common response to the food price spikes.

Asset sales were common in many sites. Loans from family, friends, and moneylenders were also important in many countries. Inability to service microfinance and moneylender debts was a major source of distress in some East and South Asian countries, where many people had to borrow at very high interest rates to service microfinance debts or live in fear of creditors taking possession of their property. Collecting food and fuel from common property natural resources was important only in some low-income countries.

Some of these hardships (sales of productive assets, forgone education, and health care) will have long-lasting consequences and impede people's ability to recover. And coping with economic crises has eroded the savings and asset base of many households, leaving them with few resources to cope with other shocks. Continuing high and volatile global food prices are thus a major source of concern.

Many parents sought to protect children's food consumption and schooling, with adult household members saving on the quantity

TABLE 1.1 Common coping responses to food, fuel, and financial crises in 13 countries

Behavior-based responses	Number of countries
Reduce the quality and quantity of food	13
Reduce nonfood expenditures	13
Stop primary or secondary education	6
Stop higher education	2
Work more	12
Take up illicit occupations:	
Sex work	2
Drug dealing	2
Crime/theft	10
Income diversification	9
Migration	6

Asset-based responses	Number of countries
Sell assets	8
Loan from formal lender	2
Microfinance loan	2
Loan from family/friends	7
Loan from moneylender	4
Use common property natural resources for fuel and food	4
Assistance-based responses	
Source of assistance:	
Government	4
Nongovernmental organization	4
Religious organization	5
Mutual solidarity group	7
Relatives	13
Friends and neighbors	11

Source: Heltberg, Hossain, and Reva 2012, forthcoming.

and quality of food to ensure that children had proper diets. Yet, there were many instances of erratic attendance and school withdrawals because of the need for children to contribute to household income or because education costs had become prohibitive. But, on the whole, the impacts on schooling were more muted than expected. The cost of education, the distance to schools, and the availability of school feeding influenced whether children stayed in school.

Food price spikes have an immediate impact on progress toward eradicating extreme (income) poverty. The international food price spike of 2007–08 is estimated to have kept or pushed 105 million into poverty, and that of 2010–11 by 48.6 million people in the short run (box 1.3). Poverty typically increases initially with higher food prices, because the supply response to rising prices takes time to materialize and many poor (farm) households are net food buyers, so higher food prices lower their real incomes.

Once farm wages and farm production adjust, the impact of higher food prices on poverty is greatly ameliorated. Higher farm wages and supply responses by both smallholder and large commercial farmers dampen the impact on poverty, but it is usually not sufficient to fully offset the negative short-term impact on poverty. Some net buyers become net sellers, and higher farm wage income can offset some or all of the negative impact of higher food prices on the incomes of net consumers (see box 1.3). For this positive effect to occur, prices need to remain relatively stable and at their elevated levels, so that farmers are comfortable shifting to more profitable crops and expanding production. Hence, increased food price volatility could derail this positive development.

The impact of higher food prices differs across socioeconomic groups. Urban, nonfarm, and female-headed households are affected the most in the short term (see figure 1.2 and box 1.4). In the short term, the poverty impact of a doubling of food prices is on average 16.7 percent larger in female-headed households than in male-headed households. Short-term changes in poverty are likely to be 2.4 times higher for nonfarm households than for farm households, and the poverty impact in urban areas in the short term is likely to be 44.3 percent higher than in rural areas. The short-term effect is reduced when wages increase and farmers switch to those products that increase their profitability the most; this can begin to lift farmers and rural households out of poverty, but on average it becomes more difficult to escape poverty (figure 1.2).

BOX 1.3 How many more are poor because of higher food prices?

Most analyses conclude that in the short term higher food prices raise the poverty headcount in most developing countries because not enough poor farming households benefit from the higher sales prices of their production (De Hoyos and Medvedev 2011, Ivanic and Martin 2008; Ivanic and Martin 2012a) to offset the negative impact of higher food prices on net consumers. This is so despite the well-known fact that three-quarters of the world's poor live in rural areas, and most of them depend on agriculture for their livelihoods.

A key to this apparent contradiction is that many of the poorest farming households are net buyers of staple foods. Over the long run, the negative impact of higher food prices on poverty is ameliorated through wage adjustments and household supply adjustments in response to rising food prices. Even in the long run, however, higher food prices appear to raise poverty in most poor countries and for the world as a whole—but the impact varies among population groups.

The two recent food price crises—in 2007–08 and in 2010—were researched extensively soon after they occurred. The first crisis was estimated to keep or push 105 million people into poverty in low-income countries (Ivanic and Martin 2008), and the second crisis, 44 million people in low- and middle-income countries (Ivanic and Martin 2012a).

Using published information on the observed domestic price changes between June 2010 and March 2011[a] together with the techniques outlined in Ivanic and Martin 2012b, the implied poverty changes of the most recent food crisis was calculated (box table). The new estimates are calculated for the immediate short-run impacts, taking into account demand responses by consumers, medium-run impacts with wage adjustments, and long-run impacts including supply responses. The results suggest that changes in both wages and farmers' output responses reduce the negative impact of higher food prices on extreme poverty. But none of these long-run reductions is large enough to offset the initially large adverse impact on poverty.

Estimated poverty impacts of the 2010–11 food price crisis
Millions of people

Impact	2011 shock[a]
Short-run impact	48.6
Medium-run impact with wage adjustments only	45.5
Long-run impact including supply response	34.1

a. Refers to poverty change among low- and middle-income countries.

a. The calculations in Ivanic and Martin (2012a) used price changes until December 2010. The updated sample used includes more countries, 29, versus 9 than in 2008, and includes a range of household survey updates.

The aggregate impacts vary by region. Large net importers of food, such as those in the Middle East, North Africa, and West Africa, face higher import bills, reduced fiscal space, and greater transmission of world prices to local prices for imported goods such as rice and wheat. Higher prices particularly hurt consumers with high shares of household expenditure on food (as in many African and Asian countries). Large net-exporting countries, as in Latin America, Eastern Europe, and Central Asia, stand to benefit, in part from potential higher tax revenues from (agricultural) commodities (figure 1.3 and box 1.5).

The pass-through of international to domestic prices has varied greatly across regions, with the largest pass-through observed in the countries of Latin America, which are largely open to international trade. In Sub-Saharan Africa the pass-through of rice and wheat prices to countries importing these cereals has been relatively fast. The transmission of international maize prices has

BOX 1.4 Actions by women made the most difference but were invisible to policy makers

Much of the response to a rise in food prices is reflected in additional care work by (mainly) women that is unpaid and not measured. Increases in food prices oblige women to invest greater time and energy to achieve the same level of nourishment and care of children, the sick, and the elderly. Examples of increased effort include more distant travel to hunt for bargains and more frequent shopping to purchase smaller quantities; more time devoted to chop or gather firewood because households can no longer afford other sources of energy; more time required to collect wild foods, and to beg and borrow money; having to undertake jobs considered hard or demeaning; and having to manage more stressful domestic family relationships, including drug or alcohol abuse, as well as violence.

One hopeful note is that across various community sites, parents and schools are working hard to keep children in school and provide essential food. Although teachers in Bangladesh and Zambia reported that local school dropout rates increased when food prices spiked, there was a much stronger emphasis than researchers expected on keeping children in school. In Kenya school feeding programs were often very accommodating of the poorest families, allowing them to bring younger siblings along at mealtimes. Nevertheless, higher food prices affect children's ability to learn. In Bekasi near Jakarta, for example, mothers were concerned that reducing pocket money for snacks was putting their children off going to school; some mothers in Kingston, Jamaica, had to pack children off to school with only a glass of water.

The food price crisis has meant that many poor people have suffered a serious decline in the quality and diversity of food, as well as in caloric intake. Food price increases directly reduced the quantity of food eaten by poor people and often forced them to eat food that was either unpalatable or unsafe. Some families made remarkable efforts to maintain nutritional levels: for example, in rural Zambia women replaced expensive small fish with protein-rich but cheap caterpillars.

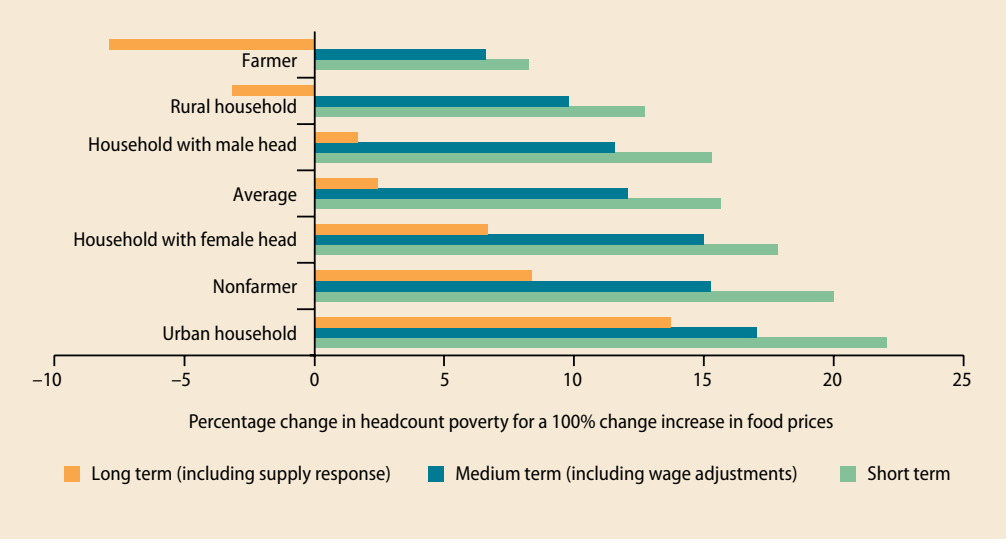
As in previous crises, gender inequality can be expected to have increased in part because women have generally been the first to cut their food and other consumption in the face of falling real incomes. Nevertheless, in several communities a note of gender equality emerged, with young parents (particularly those not in manual jobs) stressing that both parents waited until their children had eaten well before themselves eating.

It is not surprising that the additional effort that (mainly) women have had to expend to cope with the food crisis has gone unnoticed. This phenomenon reflects a more general neglect of women's unpaid care work and the importance of its contribution to social protection and to the achievement of the Millennium Development Goals. A key lesson from this crisis should be that protecting progress toward the MDGs requires protecting caregiving. This should mean more direct support to women in their roles as unpaid caregivers, which entails recognizing and monitoring how their work is affected by food price volatility and other economic shocks.

Source: Oxfam, based on Hossain and Green 2011.

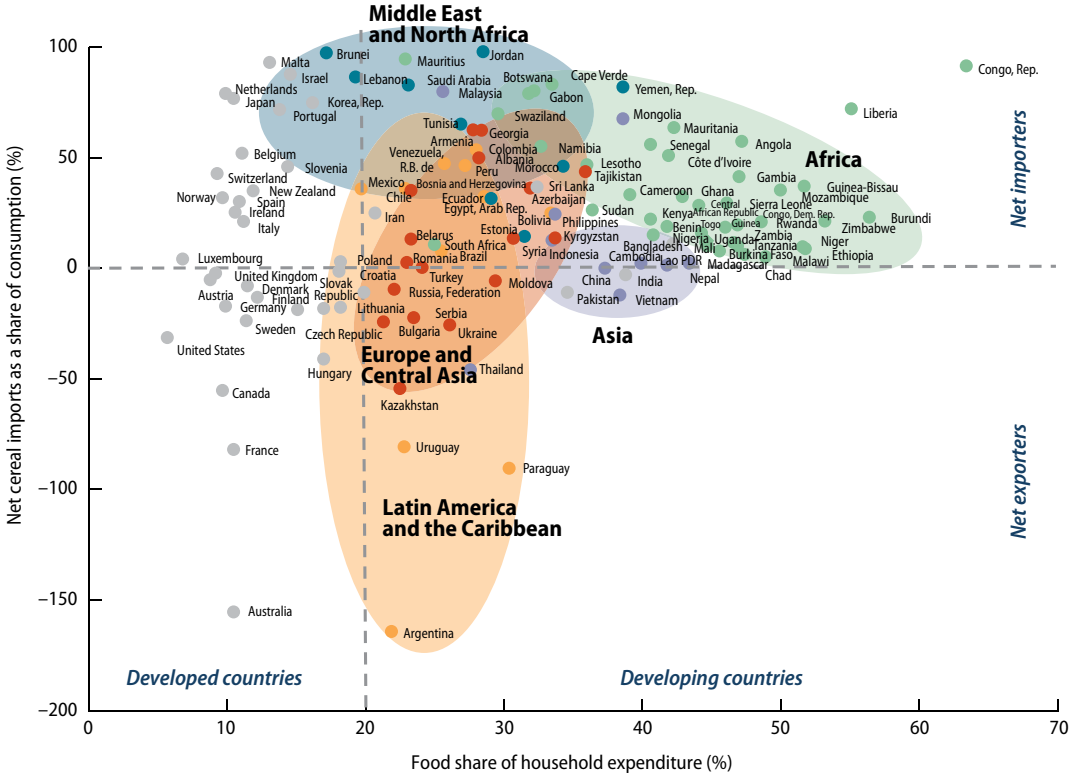
been much weaker, however, because most countries in Eastern and Southern Africa, main producers of white maize, fill their import needs through cross-border trade, not from overseas (Minot 2010). In Asia the transmission of changes of international rice prices to local prices differed significantly by country during the 2007–08 food price spike. In Bangladesh and Cambodia, the countries open to trade, the pass-through was fast and relatively large, both immediately on the rise in the international price and three months afterward (table 1.2). The pass-through in China and India, the countries with high import protection, was small. Overall, for countries more open to trade (Dawe 2008; Robles 2011), and with a larger share of cereals imports in total domestic consumption, the faster and larger is the transmission of the international prices into local prices.

FIGURE 1.2 The impact of higher food prices on poverty differs across socioeconomic groups



Source: Ivanic and Martin 2012b forthcoming.

FIGURE 1.3 Countries' vulnerability to global food price shocks tracked by share of cereal imports in domestic consumption and food share in household expenditure



Source: World Bank 2011d.

BOX 1.5 World price impacts across regions

The spike in food prices in mid-2011 strained fiscal budgets, reduced incomes, and increased the vulnerability of the poor in many food-importing countries.

Sub-Saharan Africa. The region is particularly vulnerable to increases in international food prices, because in most countries some 50–70 percent of household spending is devoted to food, and the region imports about 45 percent of its consumption of rice and 85 percent of its consumption of wheat. High levels of malnutrition result in 38 percent of children being stunted. The situation is most perilous in the drought- and conflict-stricken countries of the Horn of Africa. Nevertheless, increases in cereal production driven by higher yields since the middle of the last decade improved the continent's ability to cope with the food price spike of 2011, compared with the experience in 2008. Governments should increase expenditures to raise the productivity of smallholder agriculture, strengthen trade between food deficit and surplus areas to reduce the volatility of local prices, and support the coping strategies of poor households in the face of continued food price volatility.

South Asia and East Asia and Pacific. South and East Asia are both self-sufficient in rice. Nevertheless, some countries are net food importers, and the share of food in household expenditures remains about 40 percent in South Asia. Despite a mix of trade measures and buffer stock policies designed to slow the transmission of international to local prices (Dawe 2008), the 2008 food price spike significantly reduced household incomes in South Asia. At the same time, higher food prices increased fiscal deficits because of increased expenditures on food subsidy programs and safety nets (Ahmed and Jansen 2010). A dual approach of raising agricultural productivity and earned income, coupled with targeted safety nets, is needed to deal with hunger in South Asia. East Asia presents a different mix of challenges. Thailand and Vietnam provide over 50 percent of global rice exports and thus benefit significantly from rising prices; Indonesia and the Philippines are significant rice importers; and China is largely self-sufficient in rice. East Asia needs to maintain production while shifting to more environmentally sustainable processes in the face of increasing land and water scarcity (Christiaensen 2007).

Latin America and the Caribbean. Large resource endowments and the lower share of household expenditures devoted to food, at least compared with Asia and Africa, make the region as a whole less vulner-

TABLE 1.2 Pass-through of international rice prices to local prices in selected Asian countries

As a share of Thailand price (rice, 5% broken)

	Cambodia	Bangladesh	Philippines	India	China
Q2/07–Q2/08	98	55	63	25	23
Q2/07–Q3/08	79	60	46	37	25

Source: World Bank staff estimates based on FAO's Global Information and Early Warning System.
Note: The international price of rice (Thailand, 5% broken) peaked in April 2008.

High and volatile international food prices continue to be a big concern in the Middle East and North Africa, which is the largest wheat-importing region in the world. Some have even cited the food price developments since 2007 as a contributing factor in the Arab Spring (Breisinger, Ecker, and Al-Riffai 2011; Zurayk 2011). The long-term pass-through coefficients average 20–40 percent of the world food price increase, with the full transmission process taking about one year (World Bank 2011c). The pass-through effects are notably higher for West Bank and Gaza, Djibouti, the Arab Republic of Egypt, Iraq, and the United Arab Emirates. By contrast, in Algeria and Tunisia, the pass-through is small because of high food subsidies and controlled food prices.

Limited participation in international trade has led to higher local food price volatility, particularly in Sub-Saharan Africa. The price volatility of internationally tradable products is lower than that of nontradable commodities and commodities that are tradable

BOX 1.5 World price impacts across regions (continued)

able to volatile international food prices. However, agricultural production has been affected by natural disasters; for example, the January 2011 cold wave in Mexico damaged 1.5 million hectares (or 4 million metric tons) of white corn (for tortillas) and over 80 percent of green vegetable crops for export. And vulnerability differs significantly among countries. El Salvador, Grenada, Haiti, Suriname, and St. Vincent and the Grenadines are particularly vulnerable because of high fiscal deficits, large cereal imports, and low-quality social protection programs, while Argentina, Brazil, and Uruguay are agricultural powerhouses that benefit from higher international food prices. As a relatively urbanized region, a large majority of its population, including in net-exporting countries, are consumers who lose from the direct effects of price spikes (World Bank 2012a).

Europe and Central Asia. The region is quite diverse. Large grain imports and high shares of food in household budgets make Albania, the Kyrgyz Republic, Moldova, and Tajikistan vulnerable to rising food prices. By contrast, Kazakhstan, the Russian Federation, and Ukraine are food exporters that benefit from increased commodity prices. Similar to net-exporting countries in Latin America, net-exporting countries in this region with populations that spend significant shares of household budgets on food face continued political pressure to impose export bans or to fix prices.

Middle East and North Africa. Countries in this region rely on food imports, particularly wheat, for at least 50 percent of domestic consumption. Thus, higher international prices can put considerable pressure on government and household budgets, depending on the level of domestic consumption subsidies and the pass-through from international prices. In the Arab Republic of Egypt, Djibouti, and the United Arab Emirates, more than 40 percent of a rise in international food prices is reflected quickly in domestic food prices, while in Jordan and the Republic of Yemen, countries with weak fiscal positions and a large dependence on food imports, the pass-through is 20–40 percent (World Bank 2011c). Higher domestic food production insulates Algeria and Tunisia from international price shocks. Oil exporters are well placed to cope with higher food prices, because their oil revenues have risen along with their food import bill. Since energy is an important input to agricultural production, increased oil prices have contributed to higher food prices.

Source: Updates by World Bank staff; World Bank 2011c.
Note: See the appendix for the current classification of economies.

only on regional markets. Wheat, rice, and cooking oil, products that are imported on the African continent, exhibit lower price volatility than the prices of domestically produced staples (table 1.3). The prices of maize, beans, and cowpeas, which are mainly traded locally and regionally, are more volatile, on average 20–30 percent above the price volatility of internationally traded commodities. Therefore, many African countries would benefit from reducing their protection levels and infrastructure costs to import from, or export to, international markets when needed to lower their high domestic volatility.

Higher food prices provide an opportunity for the private sector to produce and invest more and to improve productivity at

TABLE 1.3 Price volatility across products in the countries of Sub-Saharan Africa

Product	Number of observations	Number of price series	Volatility (%)
Tradable on international markets			
Wheat	224	3	9.4
Rice	2,202	30	10.8
Cooking oil	592	8	10.1
Nontradable or tradable only on regional markets			
Beans	878	12	13.3
Maize	3,450	47	14.4
Millet	2,224	30	10.5
Sorghum	1,914	26	12.4
Cowpeas	369	5	23.0

Source: Minot 2011, based on price data from the U.S. Agency for International Development's Famine Early Warning Systems Network.
Note: The local prices were analyzed from January 2005 to March 2011. Price volatility is defined as a standard deviation of logarithms of first price differences.

the same time. Higher food prices hurt poor net buyers, but increase agricultural incomes, and this in turn should provide incentives to expand production of the most profitable crops. Smallholder farmers in developing countries produce more when output prices improve (World Bank 2007). Higher staple crop prices in developing countries (25–35 percent higher in 2009 compared with 2006), and favorable weather contributed to higher production (5.2 percent), higher stocks (3.8 percent), and more trade (19.9 percent) in 2010–11 (FAO 2011a). High food prices offer opportunities for many poor countries to develop their agricultural sectors, which can help link local farmers to regional and global supply chains, increase local consumer access to competitively priced food products, and create new export sectors.

Agricultural productivity varies significantly across regions, indicating that improved use of existing technologies can lead to significant yield gains. For example, a comparison of current productivity with what is potentially achievable (demonstrated through on-farm research trials), assuming that inputs and management are optimized in relation to soil and water conditions, shows that the yield gap in maize production is greatest in Sub-Saharan Africa and lowest in East Asia. Yields in Sub-Saharan Africa are only 24 percent of what could be produced, while the gap is only 11 percent in East Asia (FAO 2011a). Better use of existing crop and nutrient management practices alone could increase rice yields in East Asian countries by at least 25 percent (Christiaensen 2011). About 15 percent of the value of the total rice crop in South East Asia could be saved through better post-harvest technology (especially drying and milling). A shift from area-based to volume-based charges for irrigation water in the Tarim Basin in China resulted in a 17 percent decrease in water use, while addressing poor land layout through adequate leveling and higher bunds to retain wet season water has been shown to increase yields in Cambodia by 27 percent.

Local conditions will determine the most effective mix of government policies in the face of food price spikes. In general, governments have a toolkit of various policy instruments to respond to food price spikes, and which combination to use depends critically on the initial conditions the country finds itself in, including its social and political environment. A major challenge has been to strike a balance between benefiting producers, and thus improving incentives for increased production, and protecting consumers within a macroeconomic framework that does not jeopardize fiscal and external sustainability.

Drivers of food price changes

Changes in world food prices reflect changes in food supply and demand and the corresponding responsiveness of the food system. World food price levels are driven over the long term by changes in demand from population and income growth, agricultural productivity outcomes, and secular changes in the prices of inputs, complements, and substitutes. Short-term shocks such as droughts, floods, changes in trade restrictions, volatile demand for associated inputs and outputs (such as oil and ethanol), and market expectations sharpened by low stock levels tend to drive food price volatility. The corresponding impacts on food prices are conditioned by the responsiveness of the food system, that is, the elasticities of supply and demand (table 1.4). The analysis focuses on cereals particularly because they are the most important staples for food security. The more responsive the system, the lower the corresponding impact on food price changes.

Longer-term trends in demand and supply

Recent growth of supply has outpaced growth in demand for main food crops (table 1.5). Increases in global demand for food are driven by population and income growth and by an accelerated use of food crops for industrial purposes, such as biofuels. Global food consumption growth over the past 50 years averaged 2.5 percent a year, or 1.4 times the average increase in population of 1.6 percent. Supply growth increased from an average 2.3 percent between 1960 and 2003 to

TABLE 1.4 Major drivers of world cereal prices

Average price levels		Price volatility	
Dependent on:		Dependent on:	
Long-term change in demand • Population • Income • Biofuels	*Long-term demand responsiveness/ elasticity to prices* • Share of food in consumption • Biofuels mandates • Oil/maize price ratio	*Short-term change in demand* • Oil prices volatility • Exchange rate volatility • Precautionary hoarding • Food reserves	*Short-term demand responsiveness/ elasticity to prices* • Stock release policies • Oil/maize price ratio
Long-term change in supply • Area planted • Yield changes	*Long-term supply responsiveness/ elasticity to prices* • Output and input market integration • Price risk management	*Short-term change in supply* • Droughts and floods • Share of production in more volatile production regions • Trade policy responses (export bans and sharp reductions in import tariffs)	*Short-term supply responsiveness/ elasticity to prices* • Trade openness

Source: World Bank 2012b, forthcoming.

TABLE 1.5 Higher consumption growth of corn has offset slowing growth in rice and wheat, while increases in area planted to food offset slowing yield growth

	Growth rate (%)					
	Demand			Supply		
Crop	1960–2011	1960–2003	2003–11	1960–2011	1960–2003	2003–11
Total (rice, corn, wheat)	2.5	2.5	2.5	2.4	2.3	2.8
Area				0.5	0.4	1.1
Yield				1.9	1.9	1.7
Rice	2.1	2.3	1.3	2.2	2.3	2.0
Area				0.6	0.5	0.9
Yield				1.7	1.7	1.1
Corn	3.0	2.8	3.7	2.9	2.7	3.8
Feed, residual	2.7	2.9	1.4			
Food, seed, industrial, including biofuels	3.4	2.8	7.7			
Area				0.9	0.8	1.8
Yield				1.9	1.9	2.0
Wheat	2.1	2.2	1.9	2.1	2.0	2.2
Area				0.2	0.1	0.8
Yield				1.9	1.9	1.4
Population growth	1.6	1.7	1.2			
Per capita income growth	1.4	1.4	1.5			

Source: U.S. Department of Agriculture; World Development Indicators database.

an average of 2.8 percent for 2003–11. More rapid growth in food demand than in population reflects higher demand for grain as animal feed (rising incomes increases the demand for meat) and the use of agricultural commodities in the production of biofuels. Future increases in demand will depend on changes in these three areas—food, feed, and industrial uses (biofuels). Population growth is now slowing, but demand for biofuels is rising.

There are significant differences in population growth across the globe. Sub-Saharan

Africa has the highest population growth (2.5 percent growth during the last decade), and Europe and Central Asia has the lowest (a mere 0.2 percent growth during the same period). Even though population growth might ease in Sub-Saharan Africa, current levels of population growth point to the need for this region, with its fragmented trade, weak infrastructure, low yields, and underdeveloped social safety nets, to address the bottlenecks of food security in an integrated but prioritized manner.

Increases in world food supplies depend on land area planted for food crops and subsequent yields. Average growth in grains supply over the past 50 years has been similar to growth in grain consumption (2.4 versus 2.5 percent a year, see table 1.5). Over this period 21 percent of the growth in grain production was from area expansion, while 79 percent was from yield improvements. However, during 2003–11, area expansion contributed 39 percent of supply growth while yield growth accounted for 61 percent; this shift is largely a reflection of a deceleration of yields and shifts of land away from the production of other crops to grains. Yield growth rates for rice and wheat have declined consistently with slowed development of higher yielding varieties and with an increase in production on more marginal land.

Land has become an increasingly limited resource, and the remaining arable land is almost by definition either less productive (inherently or requiring significant investment to raise yields) or, particularly in Africa, more difficult to exploit because it is located far from infrastructure. In the five years since 2005–06, land area for 13 major world crops increased by 27 million hectares, a rate that cannot be sustained indefinitely at the estimated supply of available land. Moreover, most of the expansion in land cultivation since 2005–06 (24 million of the 27 million increase) is located in only six countries or regions: China, Sub-Saharan Africa, former Soviet Union (Kazakhstan, the Russia Federation, and Ukraine), Argentina, India, and Brazil.

Future yield improvements may be harder to achieve than in the past. More binding land and water constraints, rising inputs costs, and lags in development of improved varieties may make yields gains harder to achieve. World yield growth rates have declined somewhat from 1.9 percent for the period 1960–2003 to 1.7 percent in 2003–11. Water constraints limit the future expansion of irrigated agriculture. Approximately 1.2 billion people live in river basins with absolute water scarcity, with the Middle East and North Africa and Asia facing the greatest water shortages and some greater scope for the expansion of irrigation in Africa.[3] Given continuing demographic pressures, particularly in Sub-Saharan Africa, it is important to increase land productivity, manage land sustainably, and improve the efficiency of water use. Rising populations mean that increasing food security to achieve reductions in poverty (MDG 1) may eventually conflict with ensuring the sustainability of development (MDG 7) (box 1.6) and the need for "green growth" (World Bank 2012d, forthcoming).

Short-term shocks in demand and supply

Food price uncertainty is rising. The uncertainty of food prices is driven by changes in both demand, including closer links to oil prices, exchange rate changes, and lower stock-to-use ratios, and supply, including weather, expansion of export crop production to areas where yields are less stable, switching of production to biofuels, and trade interventions affecting global supply.

Higher oil price volatility is contributing to higher food price volatility. The links between crude oil and agricultural markets have strengthened considerably since 2005, with the pass-through elasticity from crude oil prices to agricultural prices increasing from 0.22 in the pre-2005 period to 0.28 through 2009 (Baffes 2010). Crude oil prices increased sharply from early 2002 to mid-2008, more than doubling from early 2007. Crude oil prices have historically been more volatile than agricultural commodity prices, and the greater link between oil and agricultural markets will likely contribute to short-term food price volatility.

BOX 1.6 Sustainable increase in food production is required to simultaneously fight global hunger and reduce the pressure on biodiversity

The core of sustainable development is the challenge of fulfilling human needs and aspirations within the carrying capacity of our planet. This twin challenge is also reflected within the MDGs, with MDG 1—eradicating hunger—being part of a social floor, and MDG 7—ensuring environmental sustainability—addressing an environmental ceiling.

Failing to sufficiently increase production will have a backlash on the affordability of food and increase the risk of price volatility, thus reducing the stability of food supply. Agricultural area expansion to facilitate increased food production, together with other environmental pressures such as climate change and nitrogen deposition, results in further declining global biodiversity (PBL 2012). Having a long-term supply of food at reasonable and stable prices while at the same time halting global biodiversity loss requires that anthropogenic pressures on the environment be reduced. Measures include more efficient and better ecologically integrated farming, mitigation of climate change, improved land management, altered consumption habits—specifically a transition to low-meat diets in western countries—and reduced losses in the production chain, while increasing agricultural productivity (PBL 2010, 2012).

Two stylized strategies for increasing agricultural productivity within ecological limits could be followed: sharing or sparing. The first strategy focuses on mixing natural elements in existing and new agricultural areas and making optimal use of ecosystem services in agricultural production. Biodiversity impacts of expanded agricultural areas will be mitigated and reduced in existing agricultural areas, for example through edge effects and reduced fragmentation. The second strategy focuses on intensifying agricultural production in highly productive, already existing agricultural areas. Land conversion will be avoided as much as possible, settling for accelerated biodiversity loss in current agricultural areas while keeping a larger area of the world in its natural state.

The Netherlands environmental assessment agency (PBL) projects the required yield increase to address the twin challenge of eradicating global hunger while halting global biodiversity loss, by adopting a pure sharing or sparing strategy. The two strategies show different spatial patterns of biodiversity loss in 2050. For the sparing strategy, strict protection of natural areas is needed alongside a major effort to increase yields by approximately 1.3 percent a year globally. For the sharing strategy, intensive management of ecosystem services and landscapes is required, alongside investment in knowledge and practices on sustainable farming, to increase yields in a sustainable way by approximately 1.1 percent a year globally. These yield increases are comparable to those achieved in the 1970s and late 1990s but have to be maintained for a longer time period and in areas that did not have significant yield increases in the past.

Sustainable increase in food production to fight global hunger requires many simultaneous interventions, emphasizing the need for policy coherence. Creation of enabling conditions, knowledge transfer, and planning in accordance with physical potential are key. Areas where land management can be improved are tenure rights, regulatory institutions, and integrated planning. Furthermore, acknowledging the value and contributions of ecosystems and their services, especially to the livelihoods of poor people, is important.

Source: PBL 2012.

Declines in global stock-to-use ratios may be contributing to higher volatility. Historical evidence suggests that the likelihood of grain price spikes is higher when global stock-to-use ratios, a measure of physical liquidity of grain markets,[4] decline to low levels (Wright 2009; Stigler and Prakash 2011). Weather-related production disruptions reduced cereal stocks in developed countries by an estimated 28 percent between 2009–10 and 2010–11, in contrast to a 4 percent increase in stocks in developing countries. According to the Food and Agriculture Organization (FAO 2011a), the stocks of major grain exporters in 2011–12 are projected to decline further, reducing the global stocks-to-use ratio by 2.2 percent compared with 2010–11. Added to this is global uncertainty on the exact size and

quality of stocks, uncertainty on the triggers for their release or buildup, and measurement revisions that can have significant market impacts. These concerns are particularly relevant for those countries that are highly dependent on food grain imports, as in the Middle East and North Africa region.

Adverse weather has played a significant role in the recent price spikes. Weather was an important factor in reducing production and stocks in 2010. The number of reported droughts, floods, and extreme temperatures seems to be increasing; in 2010 alone, a record number of 19 nations set temperature records. Recent extreme weather events include the Russian heat wave, dry weather in Brazil, and flooding in Australia, Pakistan, and West Africa. Floods are especially damaging, as they often require large reconstructions of irrigation systems and other infrastructure, and their frequency has increased along with the number of droughts. Overall, weather variability, possibly resulting from climate change, is having a significant impact on international food prices.

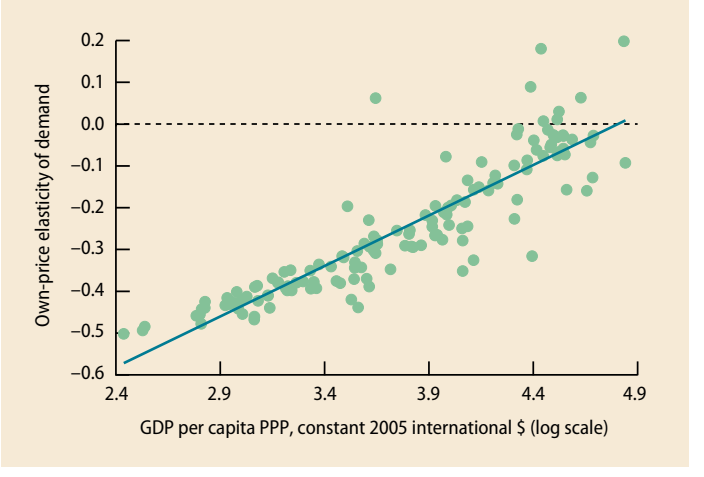
A larger share of world exports is being produced in more variable growing conditions. The major expansion of world grain exports in the last twenty years is in large part due to rapid increases in production for export in the Southern Cone of Latin America. More recently, world markets have also become more dependent on supplies from the Black Sea region (Kazakhstan, Russia, and Ukraine).[5] The share of the Black Sea region and Latin America in global wheat exports doubled from 14 percent in 1990–95 to 28 percent in 2006–10. For maize, the share more than tripled, from 9 percent to 29 percent, over the same period. Yields in these newer export regions are less stable and overall supply and exports more variable, in part because of the willingness to use trade restrictions to ensure domestic supply, than in the traditional breadbasket areas of the developed world. Thus global supply of these crops is likely to become more variable over time, contributing to potentially higher volatility in world food export volumes and prices.

Insulating policies reduce the role that trade between nations can play in bringing stability to the world's food markets.[6] Open trade policies are essential to provide positive incentives to national producers of food and to attract investment from all sources. Although exporters and importers have possibly been more restrained than in 2008, insulating trade interventions was nevertheless still widespread and even rose in 2011 (versus 2010), continuing to contribute to price instability.

The inelastic nature of world food demand and supply lead to large price increases from shocks to the system (that it, the system has limited flexibility to respond, at least in the short term). Over time, world food demand will become more price inelastic as incomes rise, and, if not offset by a more elastic supply response, price increases per demand and supply shock will be higher in the future than in the past.

World price elasticities of food demand are low and tend to decline with increases in per capita income (figure 1.4). The increased demand for biofuels can influence this long-term trend in two ways. First, biofuels mandates act to fix demand for corn-based ethanol (at any price), thereby further reducing overall demand responsiveness to price changes. Second, if long-term oil prices

FIGURE 1.4 Demand responsiveness to food price declines as per capita income increases



Source: U.S. Department of Agriculture and World Bank.

rise dramatically, making corn-based ethanol profitable beyond the mandates, then the overall demand responsiveness to price changes could increase (oil prices relative to corn have been higher). The net effect on price responsiveness depends on which of these two effects dominates.

Long-term supply responsiveness to price changes is influenced by output and input market integration and price volatility impacts on production decisions. The world food-supply response is estimated to be low (with estimated price elasticities of 0.1 percent). Price elasticities tend to be higher in developed than in developing countries, in part because of more developed and integrated input and output markets. In addition, higher price volatility in food markets increases risk and likely lowers the production response to higher prices (as it does for other crops in developing countries; see Subervie 2008). While the longer-term supply response may rise as countries develop (with greater output and input market integration), this may be offset by lower supply response induced by higher price volatility (and more constrained land).

Recent policy responses

Some responses taken by developing-country governments have not been conducive to longer-term growth. An FAO review of policy responses by 81 developing countries to the 2006–08 price spike showed that a large majority of countries used distortionary measures that could undermine agricultural productivity over the long term (table 1.6). Nearly 70 percent of countries used trade policy instruments, such as reductions in import tariffs and export taxes or bans, to reduce domestic prices. Many combined trade policy instruments with domestic measures, such as reductions in food taxes, release of stocks at subsidized prices, and price administration, to lower food prices for all consumers at the expense of producers. Half of the country sample used safety nets to mitigate the impact of rising food prices on the most poor and vulnerable, while allowing domestic prices to rise to induce a food supply response. Where local prices were reduced, governments often provided support to producers in compensation for the lower output price, but production support rarely

TABLE 1.6 Policy measures adopted in 81 selected countries in response to 2006–08 price spike

	Regions (number of countries surveyed)			
Policy measures	Africa (33)	Asia (26)	Latin America (22)	Overall (81)
Trade policy				
Reductions of tariffs and customs fees on imports	18	13	12	43
Restricted or banned export	8	13	4	25
Domestic market measures				
Suspension/reduction of value added or other taxes	14	5	4	23
Released stocks at subsidized prices	13	15	7	35
Administered prices	10	6	5	21
Production support				
Production support	12	11	12	35
Production safety nets	6	4	5	15
Fertilizers and seeds programs	4	2	3	9
Market interventions	4	9	2	15
Consumer safety nets				
Cash transfers	6	8	8	23
Food assistance	5	9	5	19
Increase of disposal income	4	8	4	16

Source: Demeke, Pangrazio, and Maetz 2009.

TABLE 1.7 Fiscal implications of policy responses to 2006–08 price spike, selected countries

Fiscal costs	Year	Argentina	Brazil	Chile	China	India	Indonesia	Russian Federation	South Africa	Ukraine	Vietnam
Total fiscal costs	2007	49	743	0	436	5,273	644	–32	786	79	48
(US$, millions)	2008	–122	2,394	56	7,813	24,000	2,095	2,309	1,849	246	242
Share of fiscal	2007	0.1	0.2	0.0	0.1	3.8	0.8	0.0	0.9	0.2	0.3
revenue (%)	2008	–0.1	0.6	0.1	1.7	19.1	2.1	0.6	2.4	0.6	1.0
Fiscal cost per person	2007	3	5	0	1	12	6	0	27	4	2
(international $, PPP)	2008	–5	16	5	11	55	16	22	67	10	7

Source: Jones and Kwiecinski 2010.
Note: PPP = purchasing power parity.

has been large enough to fully make up the loss from lower output prices.

The fiscal costs of policy responses have varied, depending on the mix of instruments used. Brazil and Chile, for example, focused on safety nets to protect vulnerable consumers. The additional fiscal cost involved was 0.1 percent of total fiscal revenue in Chile and 0.6 percent in Brazil in 2008 (table 1.7). In South Africa, which followed similar policies, the fiscal bill of 2.4 percent of revenues was larger because of smaller total fiscal revenues and the larger number of beneficiaries. India, which provided short-term stimulus to food and fuel price spikes, incurred the largest fiscal response cost. In most other emerging economies, the fiscal cost of response was about 0.5 percent of total budget revenues.

Sustainable policy responses

The most appropriate policy mix to address the implications of higher and more volatile food prices is determined by the characteristics of each individual country. The chosen policy mix at the country level depends critically on how much of a country's food needs to be imported, how much of their income the poor spend on food, and the socioeconomic characteristics of the poor affected. It depends equally on a country's integration with regional and world markets, its level of productivity compared with what is achievable, and its government's capacity to target the poor and vulnerable through mitigating interventions. In addition, much is contingent on a county's initial macroeconomic condition and thus its ability to expand public expenditure programs or provide tax incentives without jeopardizing fiscal sustainability. Hence, the content of the policy interventions chosen will be roughly the same from country to country, but the sequencing and priority given to each intervention and its magnitude will differ.

A policy mix should contain a combination of short-term measures to alleviate the immediate hardship on the poor and vulnerable and long-term measures that address the main bottlenecks to the functioning of the domestic food markets and profitability of farmers. In the short term, much depends on the ability to alleviate immediate poverty implications of higher food prices through social safety nets and efforts to increase agricultural production quickly. Over the long term, policies should focus on limiting the average rise in food prices and food price volatility.

Measures to reduce the negative impacts on food security in the short term

Governments will need to consider the different implications for the various socioeconomic groups when designing an effective policy response. While various policy actions can be instigated to prevent future food price spikes, measures to mitigate the immediate adverse impacts can and should be taken to protect the poor and vulnerable. However,

various socioeconomic groups are affected differently, and any policy actions taken should be informed to the extent possible by information about the groups most affected. Even though lower taxes can lower food costs to consumers, they are often not well targeted, and consequently large amounts of scare public resources flow to higher-income consumers. In addition, the choice of actions in the short term should not undermine longer-term farm incentives to invest and produce more; both export bans and ad hoc provision of inputs can have deleterious effects on farm incentives.

The urban poor are usually net consumers of food and have little opportunity to increase subsistence food production. Hence, assisting the urban poor depends almost entirely on social safety net programs. However, national programs are often oriented to rural areas, where the share of the poor in the population is commonly higher (Baker 2008). At the same time, the urban poor often live in informal settlements and are more transient than the rural population, and therefore expected economies of scale with urban social safety net programs are not always realized.

Female-headed households are more vulnerable. Women are in general more vulnerable to economic shocks, and various gender-based vulnerabilities, including extensive time burdens, limited legal benefits and protection, and limited access to financial resources (World Bank 2011e), make female-headed households even more vulnerable. Policies to help female-headed households and women in general weather a food price crisis must be tailored to the specific socioeconomic and cultural context in which gender relations unfold. For example, food-for-work programs could scale up lighter tasks suitable for women, and conditional cash transfers could provide higher benefits to girls, who are more likely to be kept out of schools.

Social safety nets have a vital role to play in coping with food price shocks. Social safety nets can be used to protect the poor by providing conditional or unconditional cash transfers, offering short-term employment, and discouraging negative mechanisms for coping with the setbacks caused by a food price crisis. Where markets are functioning well, cash may be more effective than food in providing assistance but may leave poor people exposed to price risks. When food markets are functioning poorly, or where prices are increasing rapidly, food transfers may be a more effective means of assisting the poor and vulnerable (WFP 2008). Cash or food-for-work programs that develop infrastructure should consider implications for future maintenance, and opportunities to develop skills in the types of work selected (such as road paving). Countries that had prepared permanent social safety programs and institutions during good times were better positioned to scale up as needed than those that had not (box 1.7). Thus middle-income countries, where social safety net programs are relatively common, were often better placed to support the poor during a food price shock than low-income countries (although such programs are increasingly being adopted by more low-income countries).

Using an effective social safety net program to address a food price crisis depends on the programs that already exist and the capacity on the ground. Establishing a single social safety net program may be a priority in a low-capacity setting, while in a middle-income country the priority may be ensuring that different programs coordinate well with each other and target the identified and intended beneficiaries, particularly female-headed households and the urban poor (box 1.8 and World Bank 2011b). The various food, fuel, and financial crises over the past decade have underlined remaining weaknesses in the effectiveness of social safety nets, which differ by countries' income level. Middle-income countries had trouble with increasing coverage or benefits as needed, while low-income countries often lacked poverty data and systems to inform the choice of a particular social safety net program and of ways to target and deliver benefits. Programs that deal with chronic poverty are not

BOX 1.7 Ethiopia's food security programs

Home to 79.1 million people, Ethiopia has achieved steady, two-digit economic growth in the past few years, lifting many out of poverty. However, with a growing population, inadequate infrastructure, low agricultural productivity and recurring droughts, floods, and land degradation, 15 million people remain poor and vulnerable to food insecurity. In the past two decades, emergency food aid dominated responses to food insecurity in Ethiopia. Yet such aid was often unreliable, arrived late at a daunting cost, and focused on immediate relief assistance at the cost of improving overall livelihoods. In response to the growing consensus on the need for reform, the government decided to launch the Food Security Program in 2003, composed in part of a Productive Safety Net Program (PSNP) and a Household Asset Building Program (HABP).

The Productive Safety Net Program (PSNP)

The PSNP aims to improve food security by providing short-term transfers that help prevent asset depletion at the household level and by creating assets at the community level to ensure against unpredictable shocks. The program consists of two components: direct transfer support and labor-based public works. The direct support program provides predictable and timely cash and food transfers to chronically food-insecure households and extends the option of participating in community work (in child-care centers and nutrition education). The public works program is focused on creating sustainable community assets, mainly aimed at rehabilitating environmentally degraded areas and developing watersheds, with the core objective of increasing productivity and providing sustainable livelihoods.

The PSNP was launched by integrating existing government agencies and entrusting them with program implementation. Importance was placed on capacity-building initiatives within the agencies, in addition to creating horizontal links to avoid forming parallel structures. At the same time, 10 donor organizations agreed on a harmonized government-engagement model, by forming a joint coordination committee to oversee the programs' implementation. Soon after, the donors adopted both financial management and procurement frameworks, on top of the single monitoring system, to ensure that the programs are kept on track. To date, with the help of the donor organizations, the PSNP covers 8.3 million people across 318 districts.

Achievement and lessons. Since the beginning, the PSNP has proved to be instrumental in supporting beneficiary consumption, protecting household assets, and building community resources. From 2005 to 2009, PSNP interventions enabled 75 percent of targeted households to consume more or better quality food; 62 percent to avoid selling assets; 23 percent to acquire new assets; 46 percent to use more health care; and 39 percent to send more children to school. Overall, the PSNP experience proves that a safety net program in a low-income setting can be implemented by multiple organizations and have multiple funding streams. The PSNP also demonstrated that predictable cash transfers are key determinants of a cash transfer program's impact; that the sustainability of public works programs depends on local management; and, above all, that there is political will and capacity to move away from one-time humanitarian response programs, to more sustainable development-oriented interventions.

The Household Asset Building Program (HABP)

The HABP aims to help households graduate from the PNSP and to assist recent graduates. Within the HABP, a household is considered to have graduated when it becomes food sufficient; that is, when, in the absence of receiving transfers, the household is able to meet its food needs for 12 months and withstand modest shocks. Overall, the HABP program seeks to diversify income sources and increase productive assets of food-insecure households that are, or have been, PSNP beneficiaries. It focuses on facilitating the beneficiary households' access to on- and off-farm inputs, technology, and financial services in order to graduate from the program.

Source: World Bank country teams.

BOX 1.8 Building foundations for social safety net systems

While many of the initial experiences with safety nets involved ad hoc responses to crisis, it has become clear that building effective safety nets within a broader social protection system is essential. Critical building blocks for an effective system include:

- Identification: Mechanisms to identify eligible beneficiaries and promote empowerment should be established.
- Targeting and eligibility: Simplified approaches drawing on available information, bearing in mind costs, should be used.
- Enrollment: Either a census-style survey or an on-demand system may be used effectively. Each can be appropriate at different stages of program development, or they can be used simultaneously.
- Timely payments: New technologies can help, but simple, traditional systems can also work.
- Monitoring and evaluation: Basic monitoring systems should be established, as a foundation for immediate impact evaluation and to establish the database required for future evaluation.

Financial sustainability is a key issue, because programs usually have external financing for only a short period of time without a guaranteed government budget for the longer term. The high level of fragmentation of sources of financing and programs make planning and budgeting more complicated, and hinders domestic ownership of social protection programs. Donors have attempted to address these challenges through new aid modalities that move away from fragmented project aid toward general budget support and sectorwide approaches. However, examples of successful coordination and pooling of resources are not very common, especially in low-income settings.

Successful coordination depends on countries themselves taking the lead in creating joint processes for developing strategies and programs, as well as encouraging donors to harmonize their policies. Sound public financial management systems, periodic reviews with performance indicators, independent procurement audits, targeting and process evaluations, appeal mechanisms, community monitoring, and perception surveys are all tools that can be used to strengthen mutual confidence between government and donors.

Credible and transparent systems help ensure program effectiveness and sustainability. The rapid expansion of safety nets has spurred the need to ensure efficient and effective use of public funds. It is important to define clear roles for each institution (including public, private, and donors) in coordination and execution of social protection reform, taking into consideration capacity levels and political weight. Critical ingredients for promoting transparency and accountability are:

- Strong controls: Accountability measures are required from top down and bottom up.
- Clear roles: All actors should understand how they fit into the system and their responsibilities. Local community, private organizations, and social funds can all be used to enhance strong governance.
- Well-communicated rules: Clear operational guidelines should be disseminated to all actors.

Source: World Bank 2011a.

necessarily well suited to address the transient impact of shocks on the poor (Alderman and Haque 2006). Existing social safety nets provide a basis to scale up implementation and coverage in the event of excess need. Relatively small-scale programs may provide the administrative infrastructure, including the rules of operation and eligibility, that can be adapted to a major crisis without costly implementation bottlenecks.

Actions to increase the agricultural supply response in the upcoming season can help reduce interseasonal impacts of price spikes on food security. Targeted input support can enhance the ability of smallholders to respond. Provision of inputs works best

when it mobilizes the private sector (through vouchers, for example) and is complemented by reductions in logistical overheads, especially in ports and on roads. Anticipating and enlisting policy support for dealing with potential bottlenecks that restrict delivery of inputs to national borders are essential. In addition, demand estimates for fertilizer and seeds need to be periodically reviewed in an environment of rapidly changing inputs prices to prevent waste from overestimates and constrained impacts from underestimates. Meeting these requirements is key to generating value for money from public expenditures on inputs.

Agriculture can contribute to gender equality by improving access to economic opportunities for women, which also would increase agriculture productivity. Women now represent 40 percent of the global labor force and 43 percent of the world's agricultural labor force. Productivity will be raised if their skills and talents are used more fully and through projects that are gender sensitive in both design and implementation. The FAO estimates that equalizing access to productive resources between female and male farmers could increase agricultural output in developing countries by as much as 2.5 to 4 percent. For example, if women farmers were to have the same access as men to fertilizers and other inputs, maize yields would increase by almost one-sixth in Malawi and Ghana (World Bank 2011e).

Measures to address the drivers of higher and more volatile world food prices in the long term

Demand- and supply-side responses can help to reduce future food price escalation. Responses are needed today at global, regional, and local levels to have the anticipated impact in the long term. While the global supply of cereals has outgrown aggregate demand during the past eight years (see table 1.5), and while a few of the large and technology-intensive exporters, such as the United States, retain significant capacity to expand production in the near- to mid-term, ensuring sustainable supplies of food at the local level requires improvements in agricultural productivity and facilitation of trade in and among developing and developed countries (table 1.8). Measures include promoting increased yields through research, extension, and improved water management; improving the efficiency of land markets and strengthening property rights; addressing biofuel mandates and improving cost-efficiency of biofuels technologies; increasing farmers' access to efficient tools to manage risk; and increasing the integration of domestic with world markets. Policies that would limit

TABLE 1.8 Main measures to limit the growth and volatility of world cereal prices

Measures to reduce price volatility		Measures to reduce average price escalation	
Short-term changes in supply • Development of more weather-tolerant varieties	*Short-term change in supply responsiveness to prices* • Trade openness	*Long-term change in supply* • Raised crop yields • Improved water management • Improved (rural) investment climate including through: – Improving access to finance – Facilitating land markets	*Long-term supply responsiveness to prices* • Better use of price risk management tools • Strengthened market integration, including infrastructure and private-sector development
Short-term changes in demand • Increased transparency of agricultural markets	*Short-term demand responsiveness to prices* • Efficient food reserve management	*Long-term change in demand* • Shifts to market-based biofuels policies and promotion of more efficient technologies	*Long-term demand responsiveness to prices* • Shifts to market-based biofuels policies and promotion of more efficient technologies

Source: World Bank 2012b, forthcoming.

food price volatility include the development of weather-tolerant price varieties, increasing the size and improving the management of stocks, opening markets to trade, and improving market transparency.

Several actions can directly address volatility

Public investment to develop more weather-tolerant varieties can be increased. Weather-tolerant crop varieties can reduce food production and price shocks. Many studies have found that use of drought-resistant maize varieties can increase yield by as much as 40 percent under drought conditions in Sub-Saharan Africa. Similarly, breeding millet and sorghum for drought resistance has produced yield improvements of as much as 50 percent. Substantial room also remains for research on transgenic methods to improve the drought resistance of crops in semi-arid regions. Transgenic drought-resistant maize varieties are found to yield up to 20 percent more than nontransgenic drought-resistant varieties (Kostandini, Mills, and Mykerezi 2011). Transgenics is indeed an underutilized technology for poverty reduction. Because of the potential risks involved, however, it should be implemented only in situations where international biosafety standards are in place.

Public food grain stocks can be used effectively to reduce domestic and world food price volatility. Sufficient stock levels can reduce the likelihood of price spikes, and good management, particularly of purchases and releases, can reduce rather than amplify volatility. But stocks always cost money, which can be as high as 15–20 percent annually of the stocks. Costs are high, while benefits in terms of price stability and economic growth are realized only when stocks are well managed (World Bank, 2012c, forthcoming). Further technical and consistent guidance to national governments on costs and benefits, levels, and use of food stocks is needed.

Small emergency public food grain reserves, at the national and regional levels, related to the consumption needs of the most vulnerable, have an important role to play in alleviating the consequences of high and volatile prices, if they are well targeted to the most vulnerable people. In contrast, using stocks as an instrument of domestic price stabilization has proven difficult because of their high costs—both financial costs (implicit interest, hidden quality losses, physical storage losses, and transaction costs of stock rotation) and efficiency costs through disincentives to (generally more efficient) private-sector storage and trade (Dorosh 2009).

Open trade across all markets can diversify short-term production shocks, thus dissipating the associated price effects. Price insulation reduces the ability of world markets to dissipate shocks, and trade barriers imposed in 2007–08 acted to amplify the food price spike rather than reduce it. Trade is even more important when food stocks are low, because more countries need to enter markets as net buyers. Improved social protection policies in net-food-exporting countries (particularly for large exporters like Argentina, Kazakhstan, Russia, and Ukraine) would reduce pressures for export restrictions when food prices rise. Continued analysis of the likely gainers and losers from trade policy changes would help guide government policies and trade negotiations.

Greater market transparency would reduce market uncertainty and the associated large price corrections following revisions to market information (production, stocks, and trade). Clearer and more accurate monitoring can help to reduce food price spikes. The capacity of international and national providers of food market information, public as well as private, to monitor market developments and disseminate timely and accurate information on food prices and food security should be strengthened.[7] A good step in this direction is the establishment of the Agricultural Market Information System (AMIS).[8] AMIS is a major partnership effort of multilateral international organizations to leverage their scarce resources and to use the comparative advantage and expertise of different organizations to improve global short-term agricultural forecasts and policy analyses of global

production, trade, stocks, and price developments; and to promote early information exchange and discussion on crisis prevention and responses among policy makers through a Rapid Response Forum. More efforts are needed to ensure that better market information is shared and used for agricultural policy decisions. Initial commodities to be tracked are wheat, rice, maize, and soybeans.

Measures to reduce average world food price escalation

A broad range of actions is needed across both developed and developing countries to reduce pressures on food prices. Developed-country policy reforms would likely reduce average world food price increases (with higher world food prices from tariff and subsidy reforms (World Bank 2007) being offset by lower prices from biofuel policy reforms). Middle- and low-income countries can play a significant role in the supply response, enhanced by improved policies and investment in productivity growth. Middle-income countries including Argentina, Brazil, Uruguay, Kazakhstan, Russia, and Ukraine have significant potential for productivity gains and have accounted for a larger share of recent global food exports. With macroeconomic stability, lower conflict, and lower agricultural taxation, agricultural growth itself and its potential growth in Africa is also improving. But more is needed, particularly through more and better public and private investments.

Closing the gap between average farm and experimental food crop yields can greatly contribute to a solution to regional and global food security. More and better public and private investments are needed to increase adoption of improved technology, to generate new and improved technologies, to improve agricultural water management and the efficiency of irrigated areas, and to increase economies of scale in farm production and processing though private-public partnerships. This agenda is particularly relevant for countries and regions, such as Sub-Saharan Africa where yield gaps are large and adaptation of new technologies has been lagging. An important part of this agenda includes adaptation of high-yielding varieties with resistance to biotic (pest and disease) and abiotic (climate change) stresses; improved soil fertility through crop rotations and judicious use of organic and inorganic fertilizer; and better integrated management of pests, diseases, and weeds in conjunction with more efficient water management (FAO 2011c). Complementary investments will be needed to better align extension services with farmers' needs, supplemented with better use of information and communication technologies, increased use of matching grants for technology adoption, and strengthened seeds and fertilizer markets.

Investments in improved and sustained water management can enhance the returns to investments in other soil and crop management practices. Greater attention is needed to ensure sustainable water management practices through water use associations; incorporation of broader river basin management aspects; and improved use of shared watercourses, including support for cooperation between different riparian states on the use of scarce resources. Expanded irrigated areas and improved water use efficiency of existing schemes are both needed, as is better water control and erosion prevention at both field and river basin levels. In Africa, a lower share of cultivated land is irrigated, leaving its food system more vulnerable to climate risks. With climate risks expected to increase, it is important to take advantage of higher food prices and thus improved profitability of irrigated agriculture, to attain better water management in food production through investment in irrigation, and thus the higher productivity and reduced variability that irrigated production systems enable.

Public actions to induce a private-sector-led supply response may need improvement in the investment climate. To orchestrate a supply response, each country will need to ensure that the private sector can take advantage of the higher prices. Issues that often affect a (rural) investment climate include access to finance, (land) property rights, various licensing and registration requirements,

sector specific regulations, and taxes and tax administration. Addressing these potential bottlenecks will reduce the cost of doing business and increase competition.

Access to finance can greatly improve farmers' ability to take advantage of higher prices and improvements in the country's economic policy environment and economic infrastructure. However, because most rural households lack access to reliable and affordable finance for agriculture, the improved economic environment does not automatically translate into higher private investment. Many small farmers live in remote areas where retail banking is limited and production risks are high. The recent financial crisis has made the provision of credit even tighter and the need to explore innovative approaches to rural and agricultural finance even more urgent.

Facilitating land markets can expand the areas sown to food crops and improve yields. Land sales, more efficient rental markets, and strengthened property rights can improve the productive efficiency of existing land areas and make better use of remaining areas available for crop production. Secure property rights are also a prerequisite for land consolidation where it is needed. Attention is needed to ensure responsible agro-investment from foreign investors and to secure the land rights of poor farmers. Increased foreign investments may spur agricultural productivity growth, fiscal revenue, employment, and local incomes, but may also result in local people losing land on which their livelihoods depend (Deininger et al. 2011). Capacity strengthening is needed to ensure that the terms and conditions of land deals enable local (farming) communities to seize opportunities and mitigate risk.

Strengthening property rights, particularly for poor farmers can improve the use of existing cropped areas. Making land rights more transferable increases investment incentives and allows access to land through sales, rental markets, or public transfers. In some countries, particularly in Latin America and southern Africa, inequality in land ownership often leads to underuse and deep-rooted rural poverty. In such cases, increased access through targeted programs of financial assistance to enter land markets can potentially increase productivity and promote equality. Land programs also help agricultural regions to rebuild after conflicts and natural disasters, such as in Sri Lanka and Aceh, Indonesia. Significant gains can therefore be generated from land policy and legal reforms; increased security of existing customary or informal land tenure; modernized land administration; land redistribution through socially manageable processes; and prevention and reduction of land conflicts through dispute resolution mechanisms among other means.

Reducing biofuels mandates and promoting more efficient technologies can reduce escalation in food demand for industrial purposes. The six largest producers account for about 95 percent of world biofuels production. In 2010–11 an estimated 37 percent of all maize used in the United States, the largest user of maize for biofuels, went into making ethanol (Trostle et al. 2011).[9] Policies to promote biofuels have included crop production subsidies, infrastructure for biofuels storage, blending and production mandates, import duties, and tax incentives. These policies have provided overall support for ethanol worth $0.28 a liter in the United States and $0.60 a liter in Switzerland, and for biodiesel, $0.20 a liter in Canada and $1.00 a liter in Switzerland (Steenblik 2007).[10] While biofuels offer a source of renewable energy and possible large new markets for agricultural producers, current biofuels programs have a mixed record of financial viability without subsidies.[11] Because ethanol demand and corresponding prices have been raised by government regulation, deregulation is part of the solution to reducing food price escalation. Removing both nonmarket actions to raise demand for biofuels and subsidies for its production can reduce competition for grains among fuel, food, and feed. Open international markets should be encouraged so that production of biofuels occurs where it is economically, environmentally, and socially sustainable to do so (G-20 2011). At the same time, countries should focus on generating new technologies

that need fewer agricultural commodities to produce biofuels.

Ensuring a food supply response to higher prices, and greater participation of smallholder farmers in this supply, requires better use of price risk management tools to reduce uncertainty. Earlier analysis showed that developing-country crop supply response declined significantly when price instability doubled, but that use of risk management tools (such as precautionary savings and access to financial services) reduced the negative impact of price volatility on production decisions. Improved farmer access to price risk management tools can help ensure supply response to higher prices (help prevent a decline in the price elasticity of supply) (box 1.9). Improving access of smallholder farmer and microenterprises to financial services for agriculture and food retail through direct service provision, market facilitation, and an improved enabling environment will likely have a broader impact than would improving access to more formal price-hedging instruments (such as commodity exchanges or warehouse receipts). Traders have typically used formal hedging instruments more than farmers, although basis risks (price correlation between domestic markets and the closest futures market) are often too high to justify their use. These risks can be lowered, but doing so often requires complementary long-term investment in transport infrastructure.

Better market integration ensures that world price signals reach more producers and thus induce a supply response, thereby increasing the responsiveness of the food system to price increases. By linking farmers more closely to consumers, marketing systems can transmit signals to farmers on new marketing opportunities and guide their production to meet consumers' preferences. Strengthening the links between local suppliers and food retailers can help to provide locally produced goods at more competitive prices. Consequently, public and private investments are needed to expand the reach and quality of rural roads, improve the collection and dissemination of market information, including through information and communication technologies, and improve technologies for post-harvest storage to reduce product losses. In addition, investing in agribusiness logistics and distribution infrastructure through private-public partnerships can facilitate trade, lower costs, and reduce post-harvest waste. Strengthening the bargaining power of smallholder farmers—especially women—through their producer organizations can help further reduce transaction costs, improve economies of scale, and hence better link them to markets.

These measures will help both small and large farms. However, the sector dominated by smallholders will require more public goods from the government than the sector dominated by larger farms. This is because the provision of agricultural services to small farmers presents significant coordination challenges and thus high transaction costs for the private sector. While large farms need a basic enabling environment to facilitate access to the most important production and marketing support services (capital, inputs, technical and market knowledge, marketing contacts) on their own, various public interventions are still required to ensure that these services are provided to smallholders, including through public-private partnerships. This task is more challenging but has high pay-offs.

Poverty implications of higher agricultural productivity in developing world

Agricultural prices and price volatility are likely to remain high. Official forecasts suggest that fundamental factors will keep global prices higher than pre-2007 levels over the medium term (G-20 2011; World Bank 2011b). Accelerated use of food crops for industrial purposes (biofuels) continues to offset the effect of slowing population growth on food demand. And production gains may be harder to achieve in the future, with more limited space for area expansion, declining yield growth, and increased weather variability. High price volatility will likely continue because world stocks remain low and the low responsiveness of the food system amplifies

BOX 1.9 Managing supply and price risks for maize in Malawi

High international and regional prices have created an export opportunity for Malawi. But these higher prices can also translate into higher risks if the country experiences grain shortages. One strategy to cope with these risks is to strengthen domestic market demand and stockholding with a repurchase option (REPO) deal. REPOs involve agreements between government and banks or grain traders for the bank or trader to purchase maize during the harvest season (June/July), hold stocks in the country, and later sell these stocks to the government at a pre-agreed price on a stipulated date in the future (such as January/February) if the grain is needed. If the grain is not needed, the bank or trader would expect to export it to neighboring countries.

The REPO contract offers Malawi several advantages that contribute to price and supply stabilization.

- The contract has a stipulated grain purchase price that can be used as a reference point for any purchases by Malawi's agricultural marketing agency. The additional demand for grain created by this deal would help support a floor price at harvest time.
- Malawi could more readily take advantage of regional grain demand by encouraging exports—with the knowledge that the country would maintain adequate stocks for its own requirements. This, again, would contribute to the strengthening of producer prices.
- The REPO would create a second layer of grain stocks in the country held in complement to the holdings of the Malawi's National Food Reserve Agency. Depending on how the deal was managed, this could encourage a broader range of traders to hold grain stocks in rural areas. The stipulations of the contract would ensure these stocks were maintained in good condition.
- Finally, the grain would be readily available in the country if the next cropping season started poorly. If stocks appear adequate in the country, and the next season starts well, this grain can then be exported.

As an example, in May 2007 a repurchase option (REPO) deal would have provided financing for a purchase of up to 150,000 metric tons of maize in July at a price of MK 18–19 a kilogram. The government would have had to pay a premium of MK 3.4 a kilogram for a bank or trader to hold these stocks in Malawi for up to seven months—for example, until January 2008. The government would then have had the right to repurchase the maize at an agreed price of MK 25 a kilogram and to use this maize to resolve any localized supply shortages. Such as step would have helped limit any rise in retail grain prices during the lean season. It also would have contributed to reducing the price volatility seen that season (MK 14 a kilogram in July, but MK 35 in January and February). Alternatively, the government could have simply allowed the grain to be exported.

The REPO deal and similar supply/price management contracts fit into a toolbox of complementary risk management strategies designed to reduce price variability and strengthen domestic markets. Other tools include the following.

- *Weather insurance* can provide funding for imports in the event of severe production shortfalls associated with drought. Index-based weather insurance can be used to insure individual farmers, guaranteeing them an income in the event of a drought.
- A *warehouse receipts initiative* can improve the availability and quality of warehouse facilities for grain trade, reduce grain storage losses, and improve the availability of finance for the market.
- A strengthened *market information system* can improve price transparency and alert traders to opportunities for moving grain from surplus to deficit regions.

Ongoing Bank work has yielded valuable lessons about constraints to hedging food prices. Lessons include the following.

- Many governments are not focused on ex ante management of food price shocks and are not assessing the risk as a contingent liability with fiscal implications.
- Governments may not have funds to cover hedging costs, which can range from 7 to 12 percent of the price level protected.
- Governments are often reluctant to make hedging decisions, because they are vulnerable to ex post criticism (and associated political risk).
- There is a lack of technical capacity to manage hedging programs in many countries.

Source: Dana, Rohrbach, and Syroka 2007.

BOX 1.10 Linking changes in productivity and climate to poverty: the use of Envisage and GIDD for long-term scenario building

The long-term scenarios described in this chapter are based on the World Bank's Envisage model with a dynamic core that is essentially a neoclassical growth model. Aggregate growth is driven by assumptions regarding the growth of the labor force, savings and investment decisions (and therefore capital accumulation), and productivity.

The Envisage model has a considerably developed structure (see van der Mensbrugghe 2010 for a detailed description of the model). First, it is multisectoral, which allows for complex productivity dynamics including differentiating productivity growth between agriculture, manufacturing, and services and picking up the changing structure of demand (and therefore output) as growth in incomes leads to a relative shift into manufactures and services. Second, it is linked multiregionally, allowing for the influence of openness—through trade and finance—on domestic variables such as output and wages. The model is also global, with global clearing markets for goods and services and balanced financial flows. Third, the Envisage model has a diverse set of productive factors, including land and natural resources (in the fossil fuel sectors), and a split between unskilled and skilled workers.

Finally, the Envisage model has been developed into an integrated assessment model with a fully closed loop between economics and climate change. Economic activity generates greenhouse gas emissions. The Envisage model accounts for the so-called Kyoto gases—carbon (C or CO_2), methane (CH_4), nitrous oxide (N_2O), and the fluoridated gases (F-gases). Greenhouse gas emissions are added to the existing stock of atmospheric gases, which also interact with terrestrial and oceanic stocks, leading to changes in atmospheric concentration. The changes in atmospheric concentration convert into changes in radiative forcing that in turn drive changes in atmospheric temperature. The Envisage model closes the loop between the climate and the economy by converting the climate signal as summarized by the global mean temperature into an economic impact.

The Envisage model has a 2004 base year and relies on the Global Trade Analysis Project (GTAP)

price spikes. If the declining responsiveness of demand with per capita income growth is not offset by higher supply responsiveness, than the amplitude of a price spike during a shock will likely be higher. Policy responses matter; they can either amplify or dampen price spikes and either prevent or increase the likelihood of price spikes.

Increases in yields and improved climate resilience, particularly in low-income countries, would reduce the average increase in food prices, the likelihood of price spikes, and the poverty impact of shocks that do happen. Improved agricultural productivity is critically dependent on government support for infrastructure, research that leads to improved climate resilience, and extension, as well as on the establishment of an incentive framework that encourages private investment and facilitates access to finance for agriculture. To illustrate the potential impact of these improved policies, we develop two scenarios: a baseline scenario consistent with official forecasts; and an alternative scenario that involves a doubling of agricultural productivity growth in developing countries relative to the base line, to about 2 percent annually (as estimated by Martin and Mitra 1999). Both scenarios take into account the consequences of growth and productivity enhancements on climate change and vice versa. The rise in productivity in the alternative scenario reduces international cereal prices by an average of 4 percentage points below base-case levels. As compared to the base line, global agricultural output would increase by another 7 percentage points and global cereal production by also an additional

BOX 1.10 Linking changes in productivity and climate to poverty: the use of Envisage and GIDD for long-term scenario building (continued)

database to calibrate initial parameters. Productivity is derived by a combination of factors. First, agricultural productivity is aligned with the International Food Policy Research Institute's model assumptions of agricultural productivity, that are based on country- and crop-specific crop modeling using the IMPACT model. At the world level, the average growth in productivity over the next 15 years is projected to be around 1 percent a year, about half the long-run recent historical average (see Martin and Mitra 1999). The regional variation is somewhat narrower than in the past, with the highest productivity growth in the Middle East and North Africa followed by Sub-Saharan Africa. Productivity growth in manufacturing and services is labor-augmenting only (both unskilled and skilled). The two are linked with productivity in manufacturing, which is assumed to be higher than in services. The Envisage model assumes that energy efficiency improves autonomously by 1 percent a year in all regions and that international trade costs decline by 1 percent a year.

The Global Income Distribution Dynamics (GIDD), a global computable general equilibrium microsimulation model, takes into account the macroeconomic nature of growth and of economic policies and adds a microeconomic—that is, a household and individual—dimension. The GIDD includes distributional data for 121 countries and covers 90 percent of the world population. It is used to assess growth and distribution effects of global policies such as multilateral trade liberalization, changes in agricultural productivity, and policies dealing with climate change, among others. The GIDD also allows an analysis of the impact on global income distribution of different global growth scenarios and distinguishes changes resulting from shifts in average income between countries from changes attributable to widening disparities within countries.

The macro-micro modeling framework described here, that is, the combination of Envisage and GIDD, takes into account the consequences of the policy simulations with Envisage on the global income distribution with GIDD, so as to estimate their impact on global poverty.

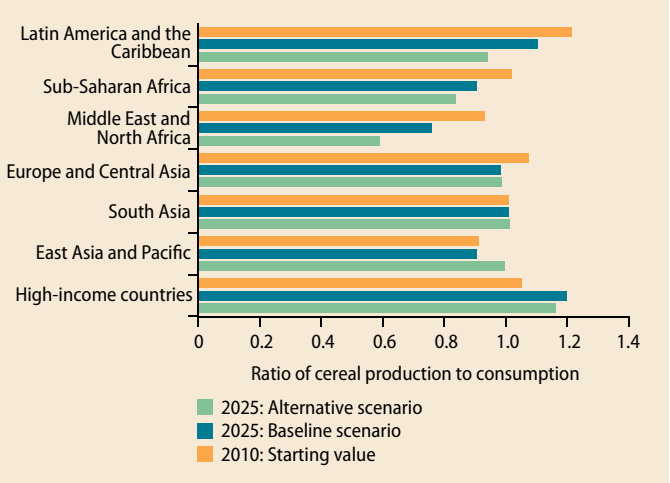
Source: van der Mensbrugghe 2010.

2 percentage points, relative to their respective 2025 outcomes in the base line (box 1.10 provides a description of the model used).

Faster productivity growth in developing countries helps many net food importers.[12] For example, in the alternative scenario, Sub-Saharan Africa would become self-sufficient in cereals production by 2025, as would Latin America and the Caribbean and Europe and Central Asia (figure 1.5). The Middle East and North Africa region would decrease its dependence on imports of cereals. Only East Asia and the Pacific and high-income countries would experience a drop in self-sufficiency in cereals production.

Higher productivity in agriculture in conjunction with climate change reduces overall poverty further but not in all regions (table 1.9). Given the larger percentage of

FIGURE 1.5 Ratio of cereal production to consumption in 2010 and 2025



Source: World Bank Envisage model.

TABLE 1.9 Poverty forecast, 2015–25
Percent of population living on less than $1.25 a day, 2005 PPP

Region	2015	2025 Baseline, including climate change	2025 Doubling of productivity in developing countries
East Asia and Pacific	7.7	3.0	3.1
Eastern Europe and Central Asia	0.3	0.2	0.1
Latin America and the Caribbean	5.5	5.3	5.4
Middle East and North Africa	2.7	2.3	2.1
South Asia	23.9	14.8	11.8
Sub-Saharan Africa	41.2	34.8	33.2
Total	16.3	12.1	10.8

Source: Up to 2015: World Bank staff calculations from PovcalNet database; for 2025: Envisage and GIDD.

population active in agriculture in Africa and South Asia, the poverty headcount is reduced in these regions by 1.6 and 3.0 percentage points, respectively, taking possible adverse effects of increased agricultural productivity on climate change into account. Poverty increases marginally in East Asia and Pacific and in Latin America and the Caribbean because fewer people are dependent on agriculture, so increases in productivity do little to reduce poverty, and the adverse implications of climate change affect these regions more than elsewhere. Latin America and the Caribbean is expected to be affected by a reduction in tourism revenues, while East Asia and the Pacific could face additional water stress (van der Mensbrugghe 2010).

These scenarios are intended to illustrate the central role of increasing productivity in limiting food price increases. The projected productivity growth may not be achieved for numerous reasons, such as more-stringent-than-expected limits on the availability of productive land, the uncertainty concerning the impact of climate change, and the potential lack of public investment and incentive framework that encourages private investments. Nevertheless, the scenarios do serve to underline the importance of government policies that support increased productivity, both in establishing an appropriate framework to encourage private investment and in providing direct support to the agricultural sector.

Notes

1. The World Bank Agriculture Price Index includes the food price index, plus cocoa, coffee, tea, cotton, jute, rubber, tobacco, and wood.
2. Focus groups and interviews were carried out in 17 countries with respondents representing groups exposed to economic shocks, such as workers in export-oriented sectors, informal sector workers, and farmers. The research explored to what extent and by what means people were able to remain resilient against the recent economic shocks. The data is based on 13 countries for which the qualitative data permitted the authors to determine the importance of these coping responses. The countries were Bangladesh, Cambodia, Central African Republic, Ghana, Kazakhstan, Kenya, Mongolia, Philippines, Serbia, Thailand, Ukraine, Vietnam, and Zambia. See Heltberg, Hossain, and Reva forthcoming.
3. Water use projections to 2050 suggest that the water supply to some 47 percent of the world's population, mostly in developing countries, will be under severe stress, largely because of developments outside of agriculture (OECD-FAO 2011).
4. Both the FAO and the U.S. Department of Agriculture publish stock-to-use estimates. They reflect the difference between estimated production and carry-over stocks on the one hand, and estimated consumption and trade on the other. The stock-to-use measure thus includes (conceptually) all commercial, public, and household stocks, whether or not the stocks in question are actually available for international sale.
5. Although Kazakhstan is located in Central Asia, for grain exports it is often said to belong to the Black Sea region because it uses the seaport facilities in Russia and Ukraine for overseas exports.
6. While export bans imposed by larger exporting countries with a readily available surplus have a greater impact on global prices than export bans imposed by small producers, all export bans can affect markets by leading to a perception of larger-than-actual shortages

and could result in beggar-thy-neighbor actions.

7. Synergies should be explored with the monitoring of the social and poverty impacts of crisis in real time that serves social assistance provision and other support.
8. The AMIS and the associated Rapid Response Forum were launched by the French Presidency of the G-20 in Rome on September 15–16, 2011. The Secretariat is housed at the FAO in Rome. The participants of AMIS are the G-20 countries, Spain, and seven developing countries, which together account for more than 90 percent of world food production and consumption.
9. Biofuel production through crops, like sugar cane, that do not directly compete with food consumption, is likely to have hardly any (or no) impact on food prices.
10. The United States abolished tax credits and import duties for ethanol in December 2011.
11. The promotion of the use of biofuels by some governments has been driven in part by the intention to reduce dependence on fuel imports and generate environmental benefits by replacing oil-based fuel with biofuels.
12. The impact on agricultural productivity of climate change has been widely studied and debated, and the results presented are surrounded by a significant amount of uncertainty.

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