

Working Paper

Food Security Challenges in Asia



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October 2013

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NOTE

In this report, "\$" refers to US dollars.

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Abbreviations

ADB	–	Asian Development Bank
AER	–	Annual Evaluation Review
AfDB	–	African Development Bank
AMIS	–	Agricultural Market Information System
ANR	–	agriculture and natural resources
APSIM	–	Agricultural Production Systems Simulator
CGIAR	–	Consultative Group on International Agricultural Research
CIMMYT	–	International Maize and Wheat Improvement Center
CO ₂	–	carbon dioxide
DAC	–	Development Assistance Committee
DDA	–	Doha Development Agenda
DMC	–	developing member country
FAO	–	Food and Agriculture Organization
G20	–	Group of Twenty
GAFFSP	–	Global Agricultural and Food Security Program
GDP	–	gross domestic product
GFCRP	–	Global Food Crisis Response Program
GHG	–	greenhouse gas
ha	–	hectare
HLPE	–	United Nations High Level Panel of Experts
HLTF	–	United Nations High Level Task Force
IADB	–	Inter-American Development Bank
IED	–	Independent Evaluation Department
IFAD	–	International Fund for Agricultural Development
IFC	–	International Finance Corporation
IFPRI	–	International Food Policy Research Institute
IRRI	–	International Rice Research Institute
O ₃	–	ozone
ODA	–	official development assistance
OECD	–	Organisation for Economic Co-operation and Development
PRC	–	People's Republic of China
UNICEF	–	United Nations Children's Fund
US	–	United States
USDA	–	United States Department of Agriculture
WTO	–	World Trade Organization
TA	–	technical assistance

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Acknowledgments

This paper is a product of the Independent Evaluation Department (IED) of the Asian Development Bank (ADB). The subject matter for this report, food security and the food price crisis, was chosen as one of the topical papers to be undertaken by IED in 2013.¹ Food security has re-emerged as a concern in the region. Despite the region's rapid growth, hundreds of millions of people suffer from malnutrition. High food prices significantly reduce the real income of the poor and constitute a setback in Asia's achievement of poverty reduction. The 2012 IED Annual Evaluation Review (AER)² noted that, in spite of unprecedented growth during the last 30 years, the region faces huge challenges and risks. The three major risks are (i) the impact of the global financial crisis, (ii) the region's vulnerability to natural disasters and the effects of climate change, and (iii) the impact of the recent escalation and volatility of world food prices. IED recently addressed the first two issues through a paper entitled "The Implications of the Global Financial Crisis for Asia and the ADB,"³ and through the Special Evaluation Study on ADB's Response to Natural Disasters and Disaster Risks.⁴ The present report examines the causes and consequences of the recent food price crisis, and implications for Asia and for ADB. This report builds upon the 2012 AER's initial evaluation of ADB's agriculture and natural resources portfolio.

Director General Vinod Thomas initiated the paper. It was prepared under the overall guidance of Director General Thomas and Walter Kolkma, Director, Division 1, IED. Andrew Brubaker organized and managed the process and Fred Roche (consultant) drafted this paper. Joanne Asquith and Hyun Son peer reviewed the document from within IED.

We gratefully acknowledge comments received from external peer reviewers C. Peter Timmer (Harvard University emeritus) and David Lobell (Stanford University). Their comments and suggestions have greatly improved the report and are appreciated, but IED must still claim responsibility for remaining errors and omissions. The constructive feedback and inputs of ADB's Community of Practice for Agriculture, Rural Development, and Food Security are also appreciated.

¹ IED prepares one or two topical papers a year. The purpose is to undertake a rapid assessment and synthesis of available literature and evaluative evidence in order to produce a timely paper that is informative and useful for the region and ADB on a subject of current interest.

² IED. 2012. *2012 Annual Evaluation Review*. Manila: ADB.

³ IED. 2012. *The Implications of a Global Financial Crisis for Asia and the ADB: Lessons from Evaluation*. Working paper. Manila: ADB.

⁴ IED. 2012. *Special Evaluation Study of ADB's Response to Natural Disasters and Disaster Risks*. Manila: ADB.

Executive Summary

After decades of declining real prices of basic food commodities, international prices for rice, wheat, and corn began rising in the early 2000s and accelerated sharply after 2006, culminating in a spike in mid-2008. The 2008 spike was led mainly by rice and, following a brief decline in corn and wheat prices, peaked again in mid-2012. The price rise and spikes reflect the confluence of a number of factors: urbanization and rising prosperity, both of which bring more diversified food demands; a tighter linkage between food, energy, and financial markets; adverse weather; declining growth in agricultural productivity; and, during the peak of the crisis, ill-advised policy reactions by major food exporting and importing countries.

Despite rapid economic growth, Asia remains the home to 67% of the world's hungry people (some 552 million) and more than 900 million people who subsist on less than \$1.25 per day. Given that these people spend a large share of their income on food, they have been significantly affected by higher and more volatile food prices. This was exacerbated by the simultaneous global economic downturn, where many of the poor experienced significant reductions in their income. The sharp increases in global food prices came as a surprise to many policy makers and illustrate an additional risk, especially for the poor in Asia. This paper takes stock of the crisis and the broader issues related to food security and the ensuing implications for Asia and partner aid agencies such as the Asian Development Bank (ADB).

While it was significant for certain poor urban and landless populations and a few relatively small countries, the net impact of the food price spike on Asia has been smaller than initially feared. Transmission of world prices to domestic markets was considerably lower in Asia than in other regions of the world. Due to the region's rapid growth, in other sectors of the economy, many governments and consumers were better able to absorb the costs of higher food prices than would have been the case one or two decades ago. Asia's largest countries were buffered by their ample food stocks and by trade and subsidy policies that protected consumers. Asia's hardest hit countries received international financial support to address both the food crisis and the broader impacts of the world economic recession.

Compared to historical trends, food commodity prices are projected to fall back to a more stable but relatively higher level. The expected stabilization is due, in part, to the supply response of producers to higher prices in the major exporting countries. The rise in the level of food prices will reflect underlying supply and demand forces that are unlikely to recede. On the supply side, the critical concerns are slowing gains in agricultural productivity, an over-exploited natural resource base, increasing water scarcity, and climate change, the latter of which is already having measurable adverse impacts. On the demand side, Asia will continue to become more urban and prosperous. This will put upward pressure on food prices if supply cannot keep pace with demand. If the problems of agricultural productivity are not addressed, it is quite possible that food security will be a recurrent world and regional concern in the coming decades, potentially jeopardizing Asia's economic growth, particularly to the detriment of the poor as higher prices make it more difficult to get out of poverty.

Volatility, most pronounced in the rice market, was caused mainly by ineffective policy responses in Asia's major exporting and importing countries. High oil prices and the tighter links between energy and crop markets and prices also contributed significantly. Fortunately, policies have improved for the most part, while oil prices have stabilized and are projected to remain relatively stable in the medium-term. The so-called "financialization" of commodity markets is believed to have added to the volatility, but there is considerable ongoing debate in the literature about the size of the impact. Rice will continue to be more volatile than other food commodities. The key question is how will Asia

respond going forward. So far, the overall supply response and replenishment of grain stocks in Asia gives confidence that volatility will be less of an issue in Asia. In addition, the region's continued growth and the introduction of safety nets for the most vulnerable should reduce the effects of future fluctuations in prices. Nevertheless, regional trade policies, energy prices, biofuel policies, commodity speculation, and weather shocks are all potential sources of returning volatility. Hence, the crisis should be viewed as a wake-up call. Asia's poor remain vulnerable.

Agriculture and food security were subjects of high-level discussions at Group of Twenty (G20) meetings in September 2009 and November 2010, as well as at the World Food Summit in November 2009. After declining for more than two decades, official development assistance to agriculture and food security rose by almost 50% between 2005 and 2010. More recently, however, this financing appears to be falling back toward pre-crisis levels. As of late 2012, the global fund of the Consultative Group on International Agricultural Research was well short of meeting its annual funding target. With the principal exceptions of India and the People's Republic of China, no change is apparent so far in the levels of national investment in Asian agricultural research and extension systems. Hence, despite the high-level attention, the evidence on whether the international and national responses to the crisis will be adequate and sustained is, so far, unknown.

The problems of food security and agriculture should be viewed within the context of the broader structural transformation as Asia becomes increasingly urban and nonagricultural. Examples include South Korea and Taipei, China, which have developed from an agricultural base. Although the contribution of agriculture to national income inevitably declines during this process, the rural share of employment remains high. A major concern is what happens to rural people who, for one reason or another, cannot readily make the transition to employment in the urban economy. History has shown that a vibrant rural economy, based on both a dynamic agriculture sector and growing rural nonfarm incomes, will facilitate inclusive economic development.

Looking forward, the review of the recent food price crisis and an understanding of the transformation process from an agrarian to urban society highlights long-run challenges for sustaining Asian food security and promoting inclusive rural growth.

First, there is an urgent need to revitalize growth in agricultural productivity and simultaneously to address the increasingly tangible impacts of climate change on agriculture. Climate change is often thought of as a longer-run threat, but there is accumulating empirical evidence that rising average temperatures, extreme heat events, rising atmospheric ozone levels, and other climate-related phenomena are already adversely affecting agricultural productivity. To some degree, it will be possible to adapt to climate change through the application of existing technologies for conservation agriculture. More efficient use of irrigation water will also be critical, particularly in South and Central Asia. During the coming decades, the scientific challenges of adapting agriculture to climate change will be formidable. Evaluation shows that investment in agricultural research has an enormous economic payoff, but it is a long-run process requiring sustained commitment from international and national research centers as well as the private sector.

Second is the need to ensure that Asia's 350 million small farmers, those on less than 2 hectares, have the opportunity to compete and thrive in modern food value chains. Led by the private sector, agriculture is commercializing rapidly in Asia's rapidly growing economies. The challenge is to involve small, resource-poor farmers in this highly competitive process. Although small farms occupy only about 40% of the total farm area, they produce a much larger share of the region's staple crops. Their productivity growth over the past 35 years has been critical to Asia's food security and its success in poverty reduction. However, while small farm families can make ends meet, there are limits to how much income they can generate by growing only rice or wheat. In Asia, with its large rural population and a preponderance of small farms, a successful structural transformation would see agriculture evolve from small-scale, subsistence-oriented production to small-scale, commercially oriented farming

driven by the market forces of a dynamic, urbanizing economy. Without such a transition, there is a risk that a large share of Asia's poor will remain mired in a rural poverty trap. If small farmers are to prosper, they must diversify and commercialize.

At the same time, if modern marketing systems are to bear the transaction costs of dealing with small farmers, then these farmers must be able to compete on the basis of quality, reliability, and efficiency. This warrants special attention to ensure that Asia's resource-poor farmers are not bypassed. Numerous approaches are being tried—extension and farmer training, marketing cooperatives, credit, contract farming, engaging nongovernment organizations, and innovative public-private partnerships. The public sector can facilitate but cannot lead the process, since modern agricultural value chains are almost completely driven by the private sector. However, efforts by the public sector will be required to build the necessary skills of small farmers and the supporting institutions and organizations and to reduce the transaction costs for smallholder engagement in value chains.

The third challenge is the persistent problem of malnutrition in preschool children, which has long-run impacts on society's human capital, and needs to be addressed in a sustainable, financially efficient manner. Despite rising incomes and rapid poverty reduction, reducing malnutrition remains an elusive Millennium Development Goal, particularly in much of South Asia. The causes of malnutrition are complex, involving inadequate food access at the household level, intra-household food distribution that may reflect gender and age bias, cooking and feeding practices, household hygiene, water supply and sanitation, and parental knowledge. There is evidence that the multidimensional nature of malnutrition may not readily lend itself to large-scale development projects that attempt to address many aspects of malnutrition at once. However, there are ways in which some of the underlying causes of malnutrition can be addressed in relatively simple, cost-effective interventions, including community-managed water supply and sanitation, micronutrient supplementation, and biofortification of staple crops. Low-cost interventions based on simple technologies are often relatively inexpensive to add in rural investment projects such as irrigation and roads without overly complicating the project design.

Finally, the food price crisis reveals the need to give greater attention to the political dimensions of food security when providing economic policy advice to Asian governments. The challenge for policy makers is to find a reasonably efficient and politically acceptable balance between supply and price management, subsidies, safety nets, and other programs to protect the poor without simultaneously suppressing the price incentives to farmers that encourage their supply response. This challenge applies to both food importing and food exporting countries.

G20 and World Bank advice encourages developing countries to allow full transmission of world prices to domestic markets, and to use consumption-oriented safety nets to protect the poor while the agricultural supply response is awaited. This blanket prescription has merit at a global level, but within individual Asian countries, policy advice needs to reflect the local political and institutional context. Safety nets can play a useful role, particularly in a crisis, but they also present a number of difficulties in practice. Meanwhile, resource and technology constraints may limit farmer capacity to respond quickly to higher prices. In rural areas, programs that raise farm productivity and create employment are often preferable to safety nets that subsidize consumption. Indeed, in the longer-run structural transformation, a productive rural economy is the best safety net for the rural poor.

Given the changing context for agricultural commodities and based on the challenges outlined in the paper a review of evaluations show that development partners and particularly ADB can respond effectively in many ways to upscale their efforts to promote food security:

- As a private sector activity, agriculture requires well-functioning institutions and infrastructure. ADB's forte—infrastructure—is important both for food security and broader rural growth. Research and evaluation demonstrate the high returns to investment in rural

- infrastructure—roads, irrigation, and markets—particularly when this investment is complemented by related support to the specific needs of small farmers and rural communities.
- Performance of some public investment in agricultural and natural resource projects has improved over time. As analyzed in depth in IED's *2012 Annual Evaluation Report*, ADB's agriculture and natural resources projects now match the average ADB-wide evaluation success rate. Hence, the concern about ADB's relatively weak performance in agriculture may no longer be warranted.
 - Commercial agriculture and agribusiness has great potential for expansion and directly addresses the challenge of facilitating small farmer engagement in modern value chains driven by the private sector. ADB's work with commercial agriculture provides a useful foundation that can be scaled up with support from both its public sector and private sector operations.
 - While supporting agriculture through projects, the dots need to be connected with the needed complementary investment. For instance, where projects support tubewells for irrigation, electricity and diesel supply and roads and markets and other needed inputs and conditions need to be functioning well, for such investments to yield their expected effect.
 - There is an urgent need for continued agricultural research and technology diffusion. ADB's support to international agricultural research has been successful and could be revitalized and expanded.
 - Multilateral donor partners are well positioned to provide regional support. Although not yet formally evaluated, ADB can continue playing a unique role in facilitating regional dialogue and cooperation on food security and agricultural development and policy.
 - Development partners should consider policy and program lending options in addition to projects. ADB program lending has been less successful in the past, but there may be a way forward. Lessons show the need for simpler policy matrices and more flexible timeframes for policy actions. The food crisis and longer-run challenges present an opportunity for nuanced policy advice and financial support for institutional reforms and investment through phased ("adaptive") program lending to address both short-term impacts of volatility and the longer-run revitalization of national agricultural support systems.

I. Introduction

"...the challenge is far deeper, longer-term, and more intractable than most people, and certainly most governments, understand. It stems from the magnifying and interacting constraints on food production generated as civilization presses harder against the finite bounds of the planet's natural resources, combined with human appetites that seem to know no bounds."

— from *The Coming Famine* by Julian Cribb (2010)

"The set of recommendations put forward here, if implemented, would probably constitute the single most important contribution to an enduring solution to global food insecurity. While the benefits would accrue in the longer term, actions are needed immediately."

— from *Price Volatility in Food and Agricultural Markets: Policy Responses, prepared for G20* (2011)

1. Despite historically unprecedented economic growth, Asia remains the home of three-fifths of the world's undernourished people, comprising more than 900 million who subsist on less than \$1.25 per day. The region also remains vulnerable to a range of natural disasters and economic crises, as amply shown by the events of recent years. The sharp increase in global food prices since 2007 came as a surprise to many and illustrates an additional vulnerability, especially for the poor. If the food security¹ of Asia's poor cannot be assured, then inclusive growth may prove to be an elusive goal.

2. The so-called "food price crisis" has entailed both a higher level and greater volatility of food prices, reflecting the confluence of urbanization and rising prosperity, which bring more diversified food demands. In addition, it was exacerbated by the tighter linkage of food, energy, and financial markets; adverse weather; stresses on the natural resource base, especially water; the slowing of agricultural productivity growth; and, during the peak of the crisis, ill-advised policy reactions by major food-exporting and -importing countries.

3. As of July 2013, it appears that world food prices are stabilizing, but at a considerably higher level than prevailed before the crisis. A secular rise in the food price level would reflect underlying supply and demand forces that are not likely to recede. On the supply side, the critical concerns are an overexploited natural resource base, stagnating agricultural productivity, and the increasingly tangible impacts of climate change. On the demand side, Asia will continue to become more urban and prosperous, which will put upward pressure on food prices if supply cannot keep pace with demand. Regional and global food trade policies, energy prices, biofuel policies in the United States (US) and Europe, and speculation in financialized commodity markets are all potential sources of renewed volatility in food prices.

4. The problems of food security and agriculture need to be viewed within the context of the broader structural transformation of Asia, i.e., the transition from a largely agrarian and rural economy to an increasingly urban, nonagricultural economy. During this transition, the agricultural share of national income declines much faster than the agricultural share of employment. Policy makers need to be concerned about the risks of rising inequality and about providing opportunities to the many rural people who cannot readily make the transition to employment in the urban economy. If rural growth in Asia is to be both sustainable and inclusive, key challenges are raising farm productivity and rural

¹ The present internationally accepted definition is that food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

incomes, ensuring that small farmers have the opportunity to compete in modern value chains, adapting to climate change, and addressing persistent malnutrition. History has shown that a vibrant rural economy, based on both a dynamic agriculture sector and growing rural nonfarm incomes, will facilitate an inclusive structural transformation.

5. This paper builds upon the assessment of the Asian Development Bank's (ADB) agriculture sector performance in the 2012 Annual Evaluation Review. First, it reviews the recent developments in world food markets, and the responses of Asian governments and the international community to high food prices, and analyzes the impacts and prognosis for the region. It then examines the big challenges for Asia in ensuring sustainable food security and inclusive rural growth. Finally, it considers how ADB can most effectively respond to the challenges based on the region's needs and the evaluation track record of ADB operations in agriculture, food security, and rural development.

6. This report is based on a desk review of existing resources. Where possible the paper draws on evaluative evidence from the Independent Evaluation Department's (IED) own work and from the evaluation departments of other institutions such as the World Bank. As the number of relevant evaluations is limited, the paper includes a substantial literature review to supplement the evaluative evidence and substantiate the paper's findings.

II. The Problem

7. After decades of declining real prices of basic foods, international prices of rice, wheat, and corn began rising in the early 2000s, with the increase accelerating sharply after 2006. Prices spiked twice. The first peak was in mid-2008, led mainly by rice. This was followed by a decline, and then corn and wheat prices peaked again in mid-2012, also followed by a modest decline. Globally, rice, wheat, and corn directly contribute 50% or more of the food energy in the diets of the poor. Sharply higher and more volatile food prices threaten hundreds of millions of vulnerable people who spend a large share of their income on food, most of that on starchy staples, and have limited capacity to cope. High and volatile food prices slow the dramatic progress in poverty reduction and add impetus to the concerns about rising inequity in Asia despite the region's remarkable economic growth and development during the last three decades.²

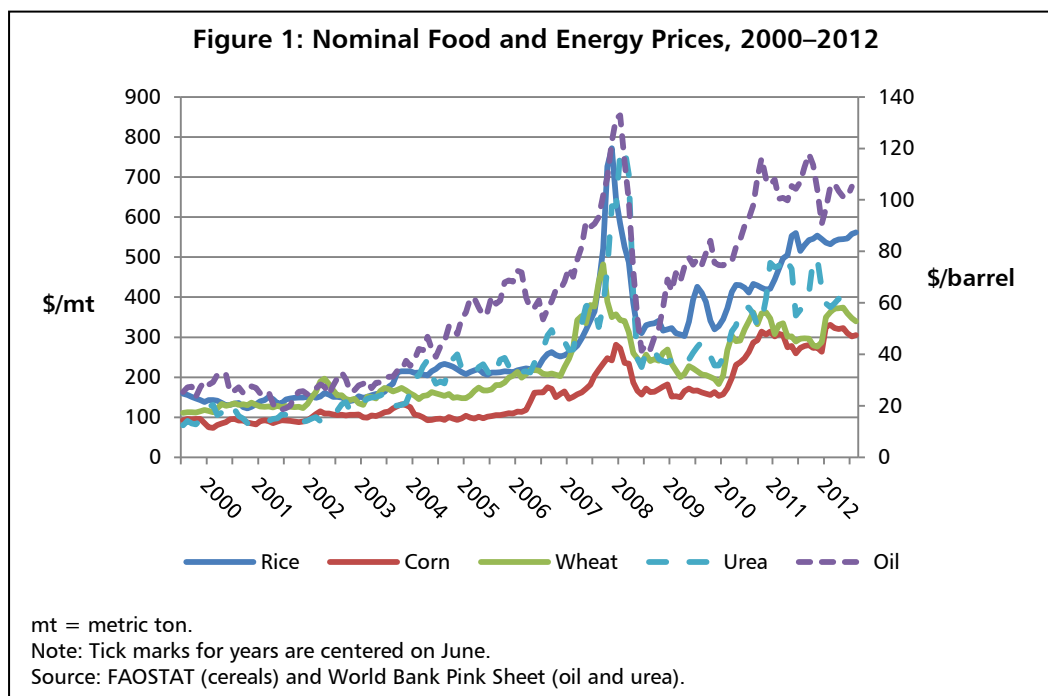
8. The food price spikes occurred along with a major global economic downturn, so the poor were hit simultaneously from the sides of their incomes (due to loss of employment) and the affordability of their staple foods. The spikes also came at a time of increasing recognition of agriculture's vulnerability to climate change. The frequency of extreme weather has been rising globally and in Asia and the Pacific, pointing to the urgency of adaptation to natural disasters.³ Climate variability—drought, intense rainfall, and floods—has been one of many factors contributing to the spike in food prices. It is becoming increasingly evident that measures to adapt to climate change—first and foremost through adaptation of farming systems and rural communities—will be fundamental to long-run efforts to ensure food security at both the national and household levels.

9. International prices of rice, corn, and energy began to move upward from 2000 onward, but the price of wheat and fertilizer (urea) remained stable until mid-2006 (Figure 1). A sharp move upward for all these commodities started in early 2007 and over a 1-year period to mid-2008, the price of rice tripled, while corn and wheat prices doubled, with the spike in rice prices being particularly sharp.

² In 2012, ADB's flagship economic publication, the *Asian Development Outlook*, was devoted to the theme of rising inequality of opportunity in Asia originating from unequal access to capital and skills, and regionally imbalanced growth within countries (ADB. 2012. *Asian Development Outlook and Supplement*. Manila).

³ V. Thomas et al. 2012. *Intense Climate Disasters and Development in Asia and the Pacific*. Working draft. Manila.

Crude petroleum and urea prices also spiked in early 2008. Prices fell back somewhat in mid-2008, but continued on a strong upward trend with an additional spike in mid-2011.



10. The food price increases were inspired not by major food scarcity, but rather by a witch's brew of developments in the world food, energy, and financial markets, reflecting two underlying phenomena: (i) a secular trend to a higher price *level* from the early 2000s as demand grew more rapidly than supply, and stocks were depleted; and (ii) high *volatility* in food prices in the major spikes of 2008 and 2011–2012. Food prices became headline news throughout the world. Street protests, linked at times to broader underlying political dissent, occurred in many countries, most notably in Africa, but also in Bangladesh, India, Pakistan, and Sri Lanka. After almost two decades of benign neglect of agriculture, the international community put food security in a high-level spotlight. The causes of the food price changes have been extensively analyzed elsewhere so are only briefly summarized below.⁴ There is continuing debate about the relative importance of several contributing factors, but it is agreed that the following supply-side and demand-side pressures were at work:

⁴ Examples of major recent international assessments include (i) Food and Agriculture Organization (FAO), et al. 2011. Price Volatility in Food and Agricultural Markets: Policy Responses. Joint report prepared for the G20 by FAO with the International Fund for Agricultural Development (IFAD), International Monetary Fund, Organisation for Economic Co-operation and Development (OECD), the United Nations Conference on Trade and Development (UNCTAD), World Food Programme, World Bank, World Trade Organization (WTO), International Food Policy Research Institute (IFPRI), and the United Nations High-Level Task Force; (ii) United Nations High Level Panel of Experts (HLPE) on Food Security and Nutrition. 2011. Price Volatility and Food Security. United Nations Committee on World Food Security. Rome; and (iii) FAO. 2011. Safeguarding Food Security in Volatile Global Markets. Rome. A detailed assessment of the rice market is contained in FAO. 2010. The Rice Crisis: Markets, Policies and Food Security. Rome.

1. Supply side

- The agricultural land base is stressed by soil erosion, growing water scarcity, and urban encroachment. By 2030, 40% of developing Asia is projected to face a severe water shortage.
- The more variable climate is affecting agricultural productivity. As impacts of climate change mount, there will be increasing aridity and drought risks, with South and Central Asia being the most vulnerable in Asia as a whole.
- Land and crop outputs are being diverted for biofuel use in the US and Europe.
- Crop diseases such as wheat rust have reemerged in major producing countries.
- Productivity growth in food crop agriculture has plateaued during the past decade. Many analysts attribute this to declining investment in the agriculture sector by governments and the international community. There is also growing evidence that climate change is at work.
- High petroleum prices have meant higher input prices (urea, irrigation pumping, and transport) and thus higher costs of food production.
- Carryover stocks of grains have declined for several years in the developed countries, and in the People's Republic of China (PRC) and India.

2. Demand side

- Rapidly growing incomes and urbanization have fueled changes in dietary patterns. Asian consumers are eating more wheat products, and more corn and soybean in livestock feed. At the same time, changing Asian diets have also entailed declining per capita consumption of rice.
- High petroleum prices and developed country policies have raised the demand for corn, sugarcane, and oilseeds for biofuel and other industrial uses. Biofuel demand directly affects corn (US), sugarcane (Brazil), and rapeseed oil (Europe), and has spillover effects on the demand for wheat and soybean. The biofuel industry now uses about 40% of the US corn crop⁵ (or about 15% of the world total) and two-thirds of the European Union's production of vegetable oils in 2011 (United Nations High Level Panel of Experts [HLPE], footnote 8[ii]).

3. The US dollar exchange rate was an intervening factor

- Since most international prices are quoted in US dollars, the recent depreciation of the dollar against other currencies exacerbated price changes in world markets but also dampened the domestic price increases in countries whose currencies appreciated with respect to the dollar.

4. Higher volatility of food prices

- Weather-related supply shocks for wheat and corn, market concern about declining global food stocks, and the vagaries of policy in major producing countries have all contributed to volatility. While food prices have long been linked to energy prices through the costs of fuel and fertilizer, the links to biofuels and financial markets constitute new phenomena.
- Speculative investment in agricultural commodity markets (wheat, corn, and soybean, but not rice⁶) appears to have contributed to volatility. Complex new financial

⁵ It should be noted that corn-based biofuel does not substitute for food or feed on a one-to-one basis, since dried distiller's grains, the coproduct of corn-based ethanol production, supplement the food (feed) supply.

⁶ Rice is fundamentally different from the other major crops because of the regional concentration of its production in Southeast and South Asia, and the absence of trade in organized international markets, including futures markets.

instruments have come into play. However, there is wide disagreement among analysts about the net impact of this so-called “financialization” of commodity markets on food price volatility, including benefits that speculation may have brought by adding liquidity and reducing risks in the market. What is known is that investment in commodity index funds grew rapidly during the food price run-up, from \$46 billion in 2005 to \$250 billion in early 2008, with outstanding crop options on any given day reaching as much as 58 million metric tons (HLPE, footnote 8[ii]). This is less than 3% of total world production of rice, wheat, corn, and soybean, but amounts to 20% of the volume traded internationally. Most likely, speculation contributes to short-term fluctuations but does not greatly influence prices over the longer term.

- Ill-advised policy responses—export restrictions and aggressive imports by some food deficit countries—destabilized world markets.
- Volatility is enhanced by the nature of supply and demand for agricultural products. In the short run (a single season or crop year) the supply of food is generally inelastic, i.e., unresponsive to price. Food is a basic human need for which there is no substitute, so demand is also inelastic. Indeed, strong empirical evidence shows that food demand becomes increasingly insensitive to price as consumer incomes rise.⁷ Inelastic supply and demand, coupled with lower food stocks, make prices more volatile in the event of market shocks such as bad weather. However, substitutions in demand, e.g., rice and wheat as food, or corn and wheat as feed, ameliorate some of the volatility.

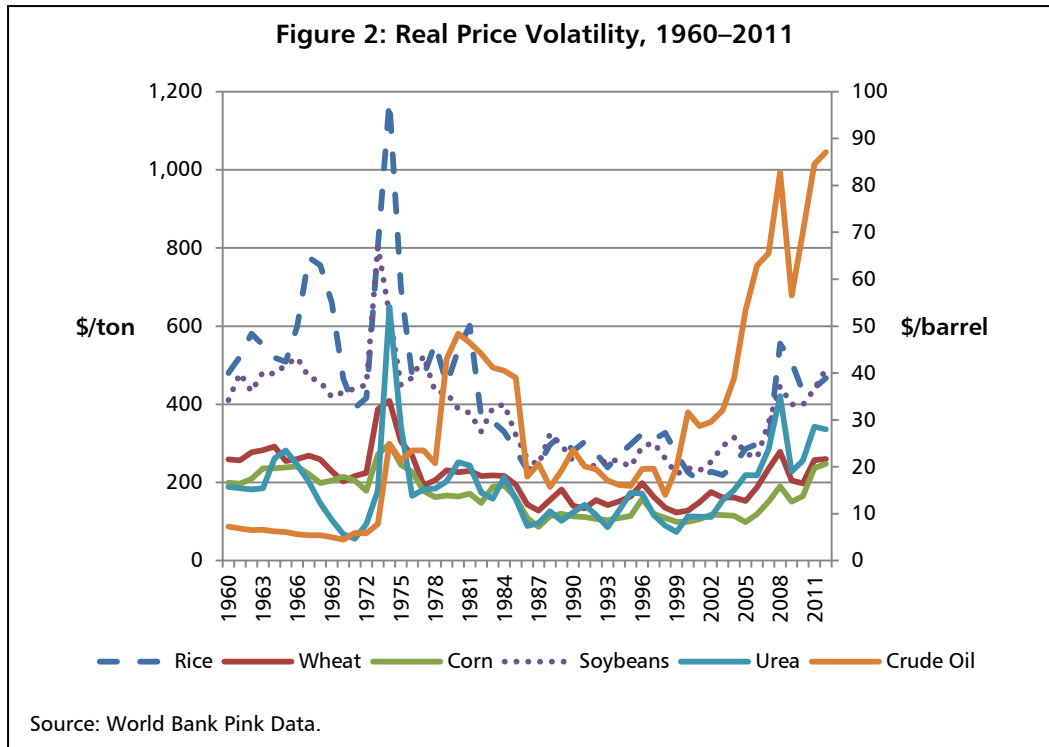
11. The food price spikes and volatility are alarming, but not unprecedented by historical standards.⁸ Over the last century, price spikes have occurred roughly every 30 years.⁹ In past cases, the market turmoil subsided after a few years, and prices fell back more or less to pre-crisis levels. In 1972–1974, rice and wheat prices peaked at far higher levels than occurred during 2008–2012 (Figure 2). For the major crops as a group, recent volatility was higher than in the 1990s, but no higher than in the 1970s.¹⁰ What has changed, however, is that energy prices appear to be more tightly linked to, indeed, “driving” food prices than was the case in the 1970s. HLPE (footnote 8[ii]) synthesized a range of studies and concluded overall that there has been no significant tendency toward increased price volatility from 1960 to the present. Due to the thin, informal, and localized nature of the rice market, rice prices tend to be more volatile than prices of other cereals.

⁷ A. Regmi et al. 2001. Cross-Country Analysis of Food Consumption Patterns. In *Changing Structure of Global Food Consumption and Trade*. Chapter 3. Agriculture and Trade Report. WRS-01-1. Washington, DC: US Department of Agriculture.

⁸ Conclusions about changes in volatility over time depend on the method used to measure it, and the commodities and time period covered. Many studies, including those cited above, measure volatility based on the historical variance in observed market prices. In contrast, some FAO reports use the method of “implied volatility,” which measures the expectation in the market of how much the future price of a commodity will move. Volatility is “implied” because, by assessing the future, it is not observed, but only inferred from the prices of derivative contracts such as options (FAO et al. 2011, footnote 8[i]). By this measure, the volatility of wheat and corn prices rose steadily from the early 1990s, peaked at the height of the crisis in 2008, then subsided as world prices declined in 2009–2010.

⁹ C.P. Timmer, 2010. Reflections on Food Crises Past. *Food Policy*.

¹⁰ The World Bank presents data showing that from 2001 to 2005, food price volatility approached, but did not exceed, that of the 1970s (World Bank. 2013. *Global Economic Prospects: Commodity Market Outlook*. Washington, DC). Since 2010, food price volatility has declined to a level similar to that of the 1990s.



12. In the case of rice, policies and market psychology were more important than supply shocks in contributing to the initial price spike. International rice prices were already rising when India banned exports of non-Basmati rice in 2007. The real move upward occurred in early 2008 after Viet Nam banned new exports. Two months later, the Philippines played a major role on the demand side by moving aggressively into the market with tenders at \$700 and then \$1,200 per ton. Following this, the Thai Government, which never actually restricted exports, hinted publicly at an export ban and proposed renewed consideration of the Organization of Rice Exporting Countries.¹¹ After this, the market was essentially in a panic. Prices peaked in May 2008, and then started to fall back rapidly, prompted in part by a report that the US Government would no longer object to the re-export of American rice by Japan.¹² India and Viet Nam took measures to increase regional, government-to-government sales, which also calmed the market. All of this occurred during a period when there were no major weather-related supply disruptions. Global rice harvest areas and yields had risen steadily during 2006–2009. Although rice stocks in the major exporting countries declined sharply during 2001–2003, the stock-to-use ratio actually rose from 2004 onward.¹³ After spiking at \$800/ton in April 2008, rice prices declined rapidly to their previous long-run level of \$300/ton by late 2009, then rose steadily to about \$550/ton, and have trended downward to about \$430 since early 2013. The World Bank attributes this to strong demand from Southeast Asia (Philippines and Indonesia), West Africa, and PRC,¹⁴ and to subsequent supply responses in Viet Nam and Thailand. With prices stabilizing and stocks at a more comfortable level, panic policies subsided.

¹¹ OREC was envisioned to include Thailand, Viet Nam, Cambodia, and Myanmar.

¹² A comprehensive assessment of the rice market through 2009, including country studies, is contained in FAO 2010, footnote 8). A good succinct discussion of the wheat and rice markets is provided in R. Sharma. Food Export Restrictions: Review of the 2007–2010 Experience and Considerations for Disciplining Restrictive Measures. *Commodity and Trade Policy Research Working Paper No. 32*. Rome: FAO.

¹³ D. Dawe. 2009. The Unimportance of 'Low' World Grain Stocks for Recent World Price Increases. *ESA Working Paper No. 09-01*. Rome: FAO.

¹⁴ World Bank. 2012. *Food Price Watch*. Washington, DC.

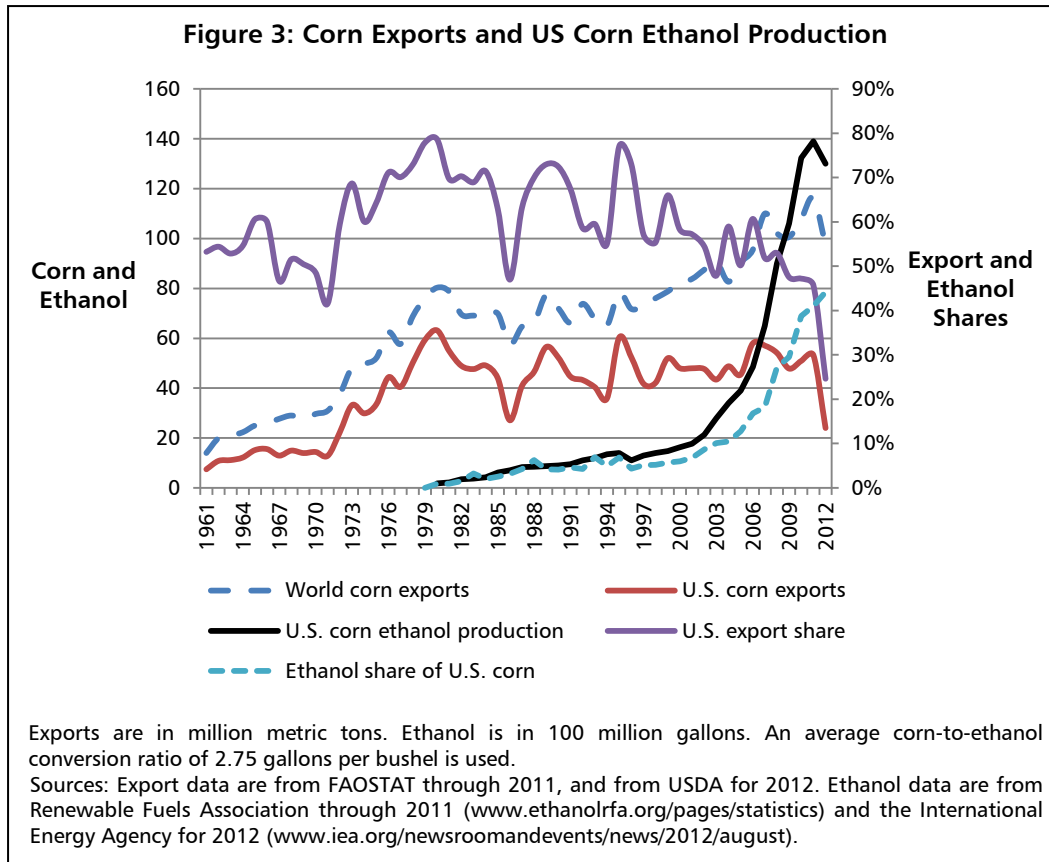
13. Weather and stocks played a larger role in the case of wheat. Drought in Australia combined with yield variability in Central Asia led international prices to move up sharply from May to September of 2007. Sharma shows how the upward price movement closely tracked the timing of export restrictions by India, Argentina, Ukraine, Russia, and Kazakhstan.¹⁵ Prices peaked at nearly \$500 per ton in March 2008, and then fell back to nearly the precrisis level by late 2008 following the relaxation of export restrictions by Kazakhstan, Russia, and Ukraine. From 2002 to 2008, the stock-to-use ratio for wheat fell to less than 20% from the average level of about 33% that had been maintained since the early 1990s, in part due to drawdown of PRC's large stocks from 2000 to 2005.

14. For corn, the US has traditionally been the major world player in both production and exports. The US share of world corn exports declined from 58% to 46% between 2000 and 2011 as other major exporters emerged, particularly Brazil, Argentina, and Ukraine, and as ethanol demand started to rise steadily in the US (Figure 3). From 2005 onward, the diversion of corn for biofuel use skyrocketed because of a mandate imposed by the US Congress (Box 1). While the net impact of biofuel demand on corn prices has been much debated,¹⁶ Naylor and Falcon point out that by isolating such a large share of corn demand from market price signals, the biofuel mandate amplifies volatility in world grain markets when supplies are tight.¹⁷ This was clearly illustrated in 2012, when US corn production fell due to the major drought, sparking a precipitous decline in US exports and record high world corn prices. Corn and biofuel prices now track crude oil prices closely. As corn prices rise, wheat is increasingly used in livestock feed, which in turn puts pressure on the rice market, since wheat and rice are substitutes in food consumption.

¹⁵ R. Sharma. 2011. Food Export Restrictions: Review of the 2007-2010 Experience and Considerations for Disciplining Restrictive Measures. FAO Commodity and Trade Policy Research Working Paper No. 32. Rome.

¹⁶ For example, a controversial 2008 estimate by the World Bank was that 70%–75% of the initial increase in food commodities prices was due to diversion of corn and oilseeds to biofuels in the US and Europe, and the related impacts on low grain stocks, land use, speculative activity, and export bans (D. Mitchell. 2008. A Note on Rising Food Prices. *Policy Research Working Paper 4682*. Washington, DC: World Bank). A more recent and probably more reasonable estimate is that world corn prices would have been 17% lower in 2011 if the US did not subsidize biofuel production (E. Rosenthal. 2013. As Biofuel Demand Grows So Do Guatemala's Hunger Pangs. *New York Times*. 5 January). Since the price of corn essentially doubled from early 2010 to mid-2011, other market forces were clearly at work if this latter estimate is accurate.

¹⁷ R. Naylor and W. Falcon. 2011. The Global Costs of American Ethanol. *The American Interest*.



15. World carry-over stocks of grains have trended downward for more than a decade. There is controversy about the role stocks have played in the rise of prices. Bobenrieth et al. conclude that there is a strong causal relationship between stock-to-use ratios and prices.¹⁸ Dawe (footnote 13) argues that the stock issue is more one of market *perception* than physical scarcity,¹⁹ since stock levels outside of PRC have not departed from their 20-year range. PRC and India downsized their large stocks on economic grounds rather than in response to scarcity. While the contribution of lower stocks to a higher price *level* might be debated, it is certainly logical that lower stocks would contribute to *volatility* by adding to market uncertainty when there are supply or policy shocks.

¹⁸ E. Bobenrieth et al. 2012. Stocks-to-Use Ratios as Indicators of Vulnerability to Spikes in Global Cereal Markets. Paper presented at the 2nd Session of the Agricultural Market Information System (AMIS) Global Food Market Information Group. Rome. October.

¹⁹ Market uncertainty is heightened because the available data on public and private food stocks are incomplete. Dawe (footnote 14) notes that private traders and governments both have good reasons for withholding information on the stocks they hold, the former fearing government intrusion and the latter fearing loss of bargaining power in trade negotiations.

Box 1: Biofuel Issues and Prospects in the US

The United States (US) biofuel mandate has been controversial in industry, environmental, and academic groups since the Renewable Fuel Standard (RFS) was established by the US Congress in the Energy Policy Act of 2005. The RFS became contentious even within the farm community in 2012 as a result of the drought-induced drop in corn production, which led to sharply higher corn prices, squeezing the US livestock and dairy industries, where corn is an essential input. Under the RFS, fuel blenders must use minimum (mandated) amounts of biofuels irrespective of market prices. Up until the end of 2011, blenders received a tax credit of \$0.51 per gallon of ethanol used. Due to competition among blenders who were obliged to meet the mandate, this credit was essentially passed on to producers of ethanol. By guaranteeing a market for biofuels, the RFS substantially subsidized enormous capital investment in the construction of ethanol plants. The use of cornstarch in ethanol production began growing slowly but steadily in the 1980s. From 2005 onward, the growth was explosive. The share of US corn used for ethanol jumped from 10% in 2004 to 44% in 2012.

The goals of the RFS are to enhance US energy security and contribute to mitigating climate change. Supporters believe that agriculture-based biofuels emit substantially lower amounts of direct greenhouse gases (GHGs) than fossil fuels when produced, harvested, and processed with the right technologies. The RFS encourages investment in the “infant” biofuel industry by guaranteeing a market for a specified period. Supporters also argue that the additional demand for US agricultural output has significant rural economic benefits. This is an influential argument, given the political structure of the US Government.

In contrast, critics claim that the energy and GHG efficiency of biofuels is a chimera. Industry claims do not fully account for the energy and GHG intensity of corn production and biofuel processing. Moreover, by “picking the winner” (corn-based ethanol), policy makers distort investment decisions and draw resources away from potentially preferable alternative energy sources. The biofuel subsidies tie up scarce budgetary resources that have other, more compelling demands.^a A better approach for public policy would be technology-neutral, e.g., by defining intended policy outcomes such as a target for the expected diversification of energy sources, then letting the private sector decide what types of energy sources, technologies and investments will meet the target at least cost.^b Other measures could include a carbon tax, a cap-and-trade system of carbon credits, or raising prices of imported oil to encourage domestic energy investment. Critics have also expressed concern about the mandate’s unintended consequences in agriculture and food markets, and the adverse environmental impacts on land use and soil and water quality. In assessing the evolution of the corn-based ethanol industry, Naylor and Falcon concluded that the US has become a significant source of world price instability, although it had traditionally stabilized global grain markets due to its huge surpluses.^c

In 2007, the US Senate set a cap on corn-based ethanol under the RFS, limiting it to 15 billion gallons from 2015 onward.^d The cap was set partly in response to the food versus fuel debate, but more fundamentally to advance the development of alternatives to ethanol made from corn starch, including biodiesel and the so-called “advanced biofuels” (made from cellulosic materials and crop wastes), and sugarcane-based ethanol, which would be largely imported from Brazil. Since the US produced almost 14 billion gallons of corn-based ethanol in 2011, and assuming the cap remains in place, the share of US corn diverted to ethanol will fall back to below 40% (from 44% last year), then gradually decline over time, which would help to stabilize the world corn market. However, this will depend upon continuation of current policies, the speed of advanced biofuel development and expected technical improvements in corn-to-ethanol conversion efficiency, and the growth rate of US corn output, among other factors.

Box 1: Biofuel Issues and Prospects in the US—continued

The biofuel industry is subject to many uncertainties. Nearly 10% of the US cornstarch-based ethanol plants stopped operating during 2012 because of the drought-induced spike in corn prices and declining US consumption of gasoline.^e With nominal oil prices projected at just over \$100/barrel through 2025,^f corn-based ethanol should make economic sense even without RFS subsidies as long as US corn production recovers from the drought and corn prices fall to a more reasonable level. Much also depends on the rate of growth in US gasoline consumption, which fell by 5% from 2007 to 2012 due to greater vehicle fuel efficiency, higher gas prices, and the steep US recession. Technical factors are also critical, most prominently the extent to which US vehicles and the fuel retail system can leap over the so-called “blend wall” by converting to the E85 standard (allowing a 15% ethanol mix as compared with the present 10% limit in most vehicles). Promised gains in the corn-to-ethanol conversion ratio are yet to be realized, and there is uncertainty about whether alternative biofuel processes can reach the needed scale efficiencies. Given these technical constraints and declining gas consumption, the mandate presently requires the use of more ethanol than the transport sector can absorb.

^a R. Schnepf and B. Yacobucci (2012) provide a balanced overview of the RFS, covering the pros, cons, and policy issues in Renewable Fuel Standard (RFS): Overview and Issues. Congressional Research Service. Washington DC.

^b B. Babcock. 2007. High Crop Prices, Ethanol Mandates, and the Public Good: Do They Coexist? *Iowa Ag Review*. Iowa State University: Center for Agricultural and Rural Development. Spring.

^c R. Naylor and W. Falcon. 2011. The Global Costs of American Ethanol. *The American Interest*.

^d The European Union also announced in late 2012 that it would cap food-based biofuels at one-half (5%) of its 2020 target of 10% renewable energy use in transport. This actually allows a modest increase over the 4.7% level achieved of 2012. The concerns prompting this decision included GHG-emitting conversion of land to produce biofuel crops, the impact of biofuels on world food markets, and the wish to encourage advanced biofuels with demonstrably lower GHG implications.

^e J. Eligon and M. Wald. 2013. Days of Promise Fade for Ethanol. *New York Times*. 16 March.

^f World Bank. 2013. *Global Economic Prospects: Commodity Market Outlook*. Washington, DC.

III. Impacts and Responses

A. Household and Country Impacts

16. The spike in food prices was indeed worrisome, but numerous intervening factors have tended to dampen the impacts of the world price rise on consumers. In the short run, the impacts varied considerably across countries depending upon the extent to which world prices were transmitted to domestic markets, the degree of dependence on food imports, the domestic availability and release of food stocks, both public and private, and the socioeconomic characteristics of poor households. In the longer run, the impact depends significantly upon the extent to which higher domestic prices induce a supply response by farmers.

17. Transmission of world prices to domestic markets is determined by the degree of trade openness, domestic price controls, and the quality of infrastructure as it affects transport and distribution costs. During 2006–2011, many domestic currencies were appreciating with respect to the US dollar, thus dampening the impact of dollar-denominated cereal prices in local markets.²⁰ Estimates of the level and relative rates of transmission depend on the time frame covered and the data sources

²⁰ In the cases of Pakistan and Viet Nam, the domestic currencies were depreciating rapidly during this period—faster than the dollar—thus increasing the degree of transmission.

used. As a result, different analysts have reported quite different findings. Sharma²¹ has undertaken probably the most comprehensive analysis, using the Food and Agriculture Organization's (FAO) database that covers 155 price series in 52 developing countries. His results show that price transmission was lower in Asia than in Africa and Latin America.²² Transmission of rice and wheat prices was low (<25%) in PRC, India, and Indonesia, where large domestic food stocks buffered local markets. Most affected were the open exporting countries (Pakistan, Thailand, and Viet Nam) and small, import-dependent countries such as Kyrgyz Republic, Mongolia, and Tajikistan. Globally, and with a smaller set of countries, the World Bank and FAO estimate that for 2006 and 2011 overall, only about one-third of world price increases were transmitted to domestic retail markets (footnote 7).²³

18. At the household level, impacts depend first and foremost on income level and source (agriculture or other), the budget share for food, and within that budget share, the importance of rice, wheat, and corn, and the substitutions in consumption as households shift to cheaper foods (with potential implications for their nutritional status). In the absence of effective safety nets and consumer subsidies, other household coping mechanisms come into play. Some are relatively benign (e.g., longer work hours or borrowing from relatives), but others have adverse longer-run implications for household welfare.²⁴

19. To the extent that higher prices are felt at the farm level, they should, over time, induce a producer supply response, and through that response, there would be impacts on farm labor demand and wage rates. Disentangling these dynamic impacts is challenging. Using household level datasets from 28 countries and extrapolating to the global level, Ivanic and Martin²⁵ estimate that the 2010–2011 price increases caused a net 44 million people to slip below the \$1.25 poverty line. This comprised 68 million people who became poor due to food price increases and 24 million, presumably all farmers, who rose out of poverty due to higher income. By comparison, FAO estimated in 2009 that more than 130 million people had become food-insecure because of the initial price spike in 2008, with the number subsequently dropping when prices fell back. The conventional argument is that higher prices raised farm incomes of net sellers of food, but had a net negative impact on small farmers, who on balance buy more food than they sell.²⁶ Although not yet empirically substantiated, farm labor demand and wage rates should respond if there is a dynamic supply response. Hence, the estimated increase in poverty is largest in the short run and declines over time as supply and wage rate adjustments build up.²⁷

²¹ R. Sharma. 2011. Review of Changes in Domestic Cereal Prices during the Global Price Spikes. AMIS.

²² Overall, Sharma estimated that transmission in Asia was 40% lower than in Africa and 43% below that of Latin America.

²³ From 2006 to 2011, the median domestic corn price increase in 22 monitored countries was about 30%, as compared with the doubling of world, US dollar-denominated corn prices. The respective changes for wheat were 6% versus 37%, and 18% versus 48% for rice.

²⁴ Heltberg et al. synthesized data from 17 developing and transition countries on the responses of poor households to the impacts of the global financial crisis and food and fuel price volatility between 2008 and early 2011. The most frequent responses were reduced quantity and quality food, reduced nonfood expenditures, longer working hours, sale of assets, borrowing, often at high interest rates, and removing children from school. A disturbing number of respondents also reported resorting to migration and criminal activity in order to cope with crisis impacts. R. Heltberg et al. 2012. Anatomy of Coping: Evidence from People Living through the Crises of 2008–11. *Policy Research Working Paper 5957*. Washington, DC: World Bank. Social Development Department. January.

²⁵ M. Ivanic and W. Martin. 2011. Estimating the Short-Run Poverty Impacts of the 2010–11 Surge in Food Prices. *Policy Research Working Paper 5633*. Washington, DC: World Bank. April.

²⁶ This argument has strong empirical support (see, for example, N. McCulloch. 2008. Rice Prices and Poverty in Indonesia. *Bulletin of Indonesian Economic Studies*. Vol. 44, No. 1). However, it is not always clear what is meant by being a "net seller" or "net buyer" of food. Farmers may grow high-value commercial crops and rely on local markets for staple food purchases. These farmers do not directly benefit from higher cereal prices, but may, on balance, enjoy a higher net income from commercial farming than would be possible from staple crops alone.

²⁷ World Bank. 2012. Food Prices, Nutrition, and the Millennium Development Goals. Global Monitoring Report. In *Food Price Watch*. Washington, DC.

20. Overall, the evidence suggests that Asia coped fairly well after the rice market stabilized in late 2008.²⁸ The worst affected countries over 2007–2011—Kyrgyz Republic, Tajikistan, and, during the initial spike, Bangladesh and Cambodia—are relatively open economies, poor, and/or chronically in food deficit. Some were experiencing macroeconomic turmoil unrelated to the food price crisis. Bangladesh was particularly hard hit by the Indian export ban, but prices fell back in late 2008 after India relaxed the ban for its neighbors on “humanitarian grounds.” Fortunately, excepting Bangladesh and Pakistan, rates of price transmission were highest mainly in countries with small populations. All had access to concessional external financial and food aid to help them manage.

B. Government Responses to Stabilize Prices and Protect the Poor

21. What actions did governments take to respond to the food price spikes? How effective were these actions in reducing price levels and protecting the poor? In the absence of detailed data on prices and changes in consumption, the second question is harder to answer than the first. The available evidence supports the view that Asia coped fairly well overall after the initial price spikes. Asia’s largest countries—PRC, India, and Indonesia—had comfortable food reserves and long-standing, although not necessarily efficient, public mechanisms in place to stabilize food prices and protect the poor.²⁹ A number of countries received external crisis financing from the World Bank and ADB to counter the impacts of high food prices and, more broadly, the global economic recession.

22. Demeke et al.,³⁰ the World Bank,³¹ and ADB³² provide detailed reviews of government responses to the crisis. The Demeke study covered 81 countries in Asia, Africa, and Latin America. The ADB study covered all of ADB’s developing member countries, while the World Bank study focused on South Asia.³³ In Asia, as noted above, most exporting countries initially responded with measures to restrict trade, including minimum export prices; quotas; variable export taxes; and, at the extreme, outright export bans. Because cereal crop production is more regionally concentrated in Asia than in Africa and Latin America, a higher proportion of Asian exporters resorted to these measures than occurred elsewhere.³⁴ Export restrictions differed between countries in their effectiveness in keeping domestic prices lower and in some cases had only a politically symbolic effect.

²⁸ In a unique study, and in seeming stark contradiction to the findings of Heltberg et al (footnote 25). Headey questions the extent to which people became food insecure as a result of higher food prices. He analyzes changes in subjective, self-reported food insecurity using data from large Gallup World Poll surveys conducted in 69 low- and middle-income developing countries over 2005 (pre-crisis) to 2010 (mid-crisis). Respondents were asked to provide a yes or no answer to the question, “Have there been times in the past 12 months when you did not have enough money to buy the food that you or your family needed?” Although there were plausible regional and country variations, overall the data showed no major change in the percentage of “yes” answers over time, suggesting that people have generally not perceived themselves as being less able to acquire food, even though food prices had risen. Reasons for this may include the effects of rapidly rising incomes, policies that buffered domestic markets from the transmission of higher world prices, and coping mechanisms that allowed poor households to adjust their food consumption bundles, work hours, incomes, and non-food expenditures in order to maintain adequate food access. D. Headey. 2013. *The Impact of the Global Food Crisis on Self-Assessed Food Security. Policy Research Working Paper 6329*. Washington, DC: World Bank. January.

²⁹ The Indian system of federal and state agricultural and food subsidies is justifiably famous for both its admirable intentions and its inefficiency. By the government’s own estimate, 58% of the food intended for poor households through the public food distribution system is lost in transit or diverted to people using fraudulent identity cards or otherwise having access despite being ineligible. In two states, the leakages are an astonishing 90% (Indian Planning Commission. 2005, cited in A. Ganesh-Kumar and K. Ganguly. 2011. *Role of Policies and Institutions in Delivering Food Security in India*. IFPRI. Report prepared for ADB. New Delhi. August.). Despite the enormous cost to the federal government, the system has been operating for decades, so is now seen as an entitlement, making reform politically difficult.

³⁰ M. Demeke, G. Pangrazio, and M. Maetz. 2009. *Country Responses to the Food Security Crisis: Nature and Preliminary Implications of the Policies Pursued. FAO Initiative on Soaring Food Prices*. Rome: FAO.

³¹ World Bank. 2010. *Food Price Increases in South Asia: National Responses and Regional Dimensions*. Washington, DC.

³² ADB. 2011. *Global Food Price Inflation and Developing Asia*. Manila.

³³ The World Bank has conducted studies of crisis responses in other parts of Asia, but these either did not focus on the food crisis or were undertaken too early in the crisis for government responses to have been clearly articulated.

³⁴ R. Sharma. 2011. *Food Export Restrictions: Review of the 2007-2010 Experience and Considerations for Disciplining Restrictive Measures*. FAO Commodity and Trade Policy Research Working Paper No. 32. Rome.

23. Globally, the importing countries reduced tariffs and taxes on food imports, but in the absence of import subsidies, this had only a modest impact on domestic prices. In countries where price transmission was high, domestic prices fell back only when world prices declined or when food aid and government-to-government shipments arrived. Despite the high prices, a few middle-income importing countries—the Philippines being most prominent in the case of rice—made large international purchases to ensure adequate domestic supplies, thus contributing to the world price spike. The Philippines also introduced severe penalties for rice hoarding. In South Asia, Bangladesh, Pakistan, and Sri Lanka announced domestic price controls and took measures to restrict the private trade.³⁵ More than half of the countries in Demeke’s global sample implemented targeted and untargeted programs for the poor, including cash transfers, direct food assistance, or income-enhancing measures. In Asia, these included Bangladesh, Cambodia, Malaysia, Nepal, Pakistan, Philippines, Thailand, and Viet Nam. A significant number of countries granted support to producers in order to offset rapidly rising input costs, since fertilizer prices were also surging, as were feed costs for livestock producers.

24. Serious readiness gaps were revealed by the crisis, reflecting poor market monitoring, particularly short-term forecasts of supply and stock levels, as well as in preparedness to implement safety net programs. Some of the drastic policy responses and market frenzy might have been averted with more timely information and better capacity to analyze the warning signs.

C. International Responses

25. After the onset of the sharply rising food prices, FAO announced an initiative on “Soaring Food Prices” in late 2007. In April 2008, the United Nations High Level Task Force (HLTF) on Global Food Security was established. In July 2009 at the G8 Summit in L’Aquila, Italy, leaders of the Organisation for Economic Co-operation and Development’s (OECD) Development Assistance Committee (DAC) pledged a total of \$22.2 billion in development funding for “sustainable agriculture development” in order to reverse the decline in international financing of agriculture. Food security was the subject of high-level discussions at Group of Twenty (G20) meetings in September 2009 and November 2010, as well as at the World Food Summit in November 2009. The 2010 G20 meeting requested a joint international effort to formulate policy recommendations on price volatility in global food and agricultural markets. In response, a consortium of international organizations released a report in June 2011 that made 10 recommendations on how the affected countries and the international community should respond to the food price crisis (Appendix). Within international organizations and academia, the food price crisis prompted considerable research and analysis from 2008 onward, resulting in scores of reports and assessments. Given the nature of its preparation, the consortium’s report to G20 should be considered the international community’s definitive statement on the way forward.

26. Since timely market information had proven to be a gap, the agricultural market information system (AMIS) was launched in 2011. AMIS publishes a bimonthly Market Monitor covering wheat, corn, rice, and soybean, and has online links to databases maintained by FAO and the US Department of Agriculture (USDA). The World Bank published a quarterly Food Price Watch from February 2010 to March 2013. In addition, there are regional market and price monitoring activities under way with support from various aid agencies. While there are differences among the various reports and forecasts depending upon the data sources, time frames, and regional focus, the quantity and quality of readily available assessments of market conditions have improved considerably since the food crisis began.

27. To assess the adequacy of the international response to the food crisis, a number of questions need to be asked about the recommendations of the G20 report and subsequent aid agency responses:

³⁵ Anti-hoarding laws, a colonial legacy, are still on the books in South Asia. Although these are rarely enforced in practice, public threats to do so during times of high food prices have a chilling effect on private traders engaged in the storage and distribution of grain. In Pakistan, the Provincial Government of Punjab implemented administrative measures limiting the flow of wheat to other provinces.

- (i) Did the recommendations break new ground in addressing the recent developments and key issues? Are the recommendations likely to be acceptable to policy makers and other stakeholders in both developing and developed countries?
- (ii) Have the recommendations been implemented?
- (iii) What actions have the developing countries taken to improve long-run food security?
- (iv) Are the aid agencies delivering on the financing commitments made to G20?
- (v) Was the international financing response appropriate in terms of timeliness, relevance, and impact?
- (vi) What are the prospects for sustained aid agency commitment to food security?

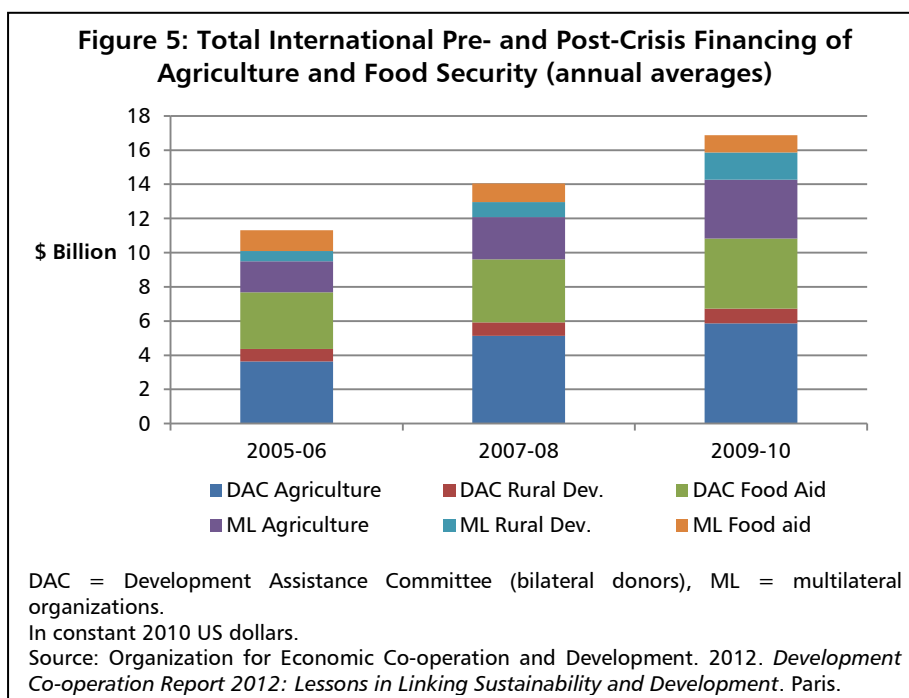
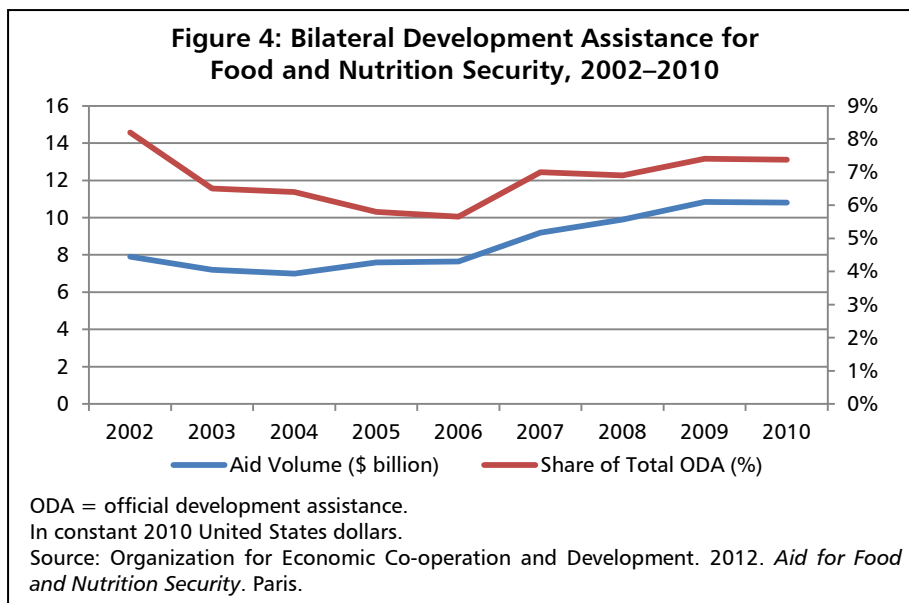
28. Answering all these questions definitively is not possible at this point. Developments in food markets are still unfolding, and it is too early to evaluate the impacts and sustainability of financial aid. At this time, it is also difficult to assess how the developing countries themselves have acted to address the longer-run implications of high food prices.

29. The recommendations to G20 are comprehensive, as to be expected given the range of expertise involved in the exercise. To counter the drop in international funding for agriculture from the late 1980s onward, greater sustained investment in agriculture was proposed, as was increased financing of agricultural research at global (Consultative Group on International Agricultural Research [CGIAR]) and national levels. Delivery of emergency food assistance to vulnerable countries would be accelerated by steps to expedite the operations of the World Food Programme and other humanitarian assistance, and by creating small, strategically positioned regional food reserves. Appropriately, the report focuses on efficient delivery of emergency food supplies, and urges caution in regard to large national buffer stocks for the purpose of general price stabilization. The report recommends crisis financing of safety nets for the poor, a role in which the World Bank has substantial experience.

30. Some recommendations may encounter greater controversy and pushback from some corners. The report proposes action to deal with several villains of the crisis, including commodity speculation, biofuel subsidies, and export bans. The report argues that open trade is the most efficient means of achieving food security by stimulating higher food production and ensuring predictable trade flows between exporting and importing countries.

31. Aggregate bilateral and multilateral funding for all development sectors grew rapidly after the 2000 Millennium Summit established the Millennium Development Goals. In response to the food crisis, funding specific to agriculture and food security has grown both in absolute volume and, more modestly, as a share of total official development assistance (ODA) (Figures 4 and 5). OECD³⁶ reports that bilateral aid for agriculture, rural development, and food aid grew by about 41% from 2005–2006 (precrisis) to 2009–2010. Multilateral funding rose by 66% during this period.

³⁶ OECD monitors development funding by its 25 member countries that comprise the DAC. In estimating aid to agriculture, OECD uses a narrow definition focused on aid targeted at farming and rural areas. A limitation is that OECD tracks concessional funding to agriculture, but does not systematically report trends in the use of higher-cost multilateral funds, e.g., the World Bank's International Bank for Reconstruction and Development and ADB's ordinary capital resources (OCR). All ADB agriculture-sector lending to PRC, India, and Philippines, and most to Indonesia, is now from OCR, so is not regularly captured in published OECD statistics.



32. The increase in funding for agriculture and food security is encouraging, but OECD analysts question whether the aid has gone to the right countries, i.e., those with the highest prevalence of hunger and malnutrition. OECD calculated Gini coefficients for the cross-country distribution of bilateral agriculture and food aid and found that the allocation across countries better responds to the incidence of hunger than to the prevalence of child malnutrition, but for both indicators the evidence shows that targeting on these dimensions is far from perfect.³⁷ For the bilateral and multilateral community as a whole, it is not clear how much funding has gone to subsidies and safety nets, and

³⁷ Organization for Economic Co-operation and Development. 2012. *Aid for Food and Nutrition Security*. Paris.

how much to productivity-enhancing investment in agriculture. Finally, among the alternative productivity-enhancing investments, it is not known how well the aid has been targeted to areas that have the highest economic pay-off. Research shows these areas are agricultural research and rural infrastructure (roads and, to a lesser extent, irrigation). See Box 2.

33. It is fair to say that the World Bank dominated the multilateral response to the food crisis in terms of analytical work, policy advice, and financing. The Global Food Crisis Response Program (GFCRP) was launched in May 2008 and provided technical assistance (TA), investment, and policy-based financing totaling \$1.2 billion as of late 2011. The Global Agricultural and Food Security Program (GAFSP) was launched in 2010 with the view of coordinating G20's support to agriculture and food security. Seven aid agencies had pledged \$972 million to GAFSP as of October 2011. The International Finance Corporation (IFC) launched the Global Food Initiative in mid-2008 to provide liquidity to agricultural value chains, including trade finance, working capital, and wholesaling finance, and aims to stimulate supply responses through the food distribution system. The program has provided \$600 million in investment lending and \$300 million in TA. Through its Agricultural Price Risk Management Program, IFC is also trying to improve access to hedging instruments that shield farmers, agroprocessors, and consumers from food price rises. In research, policy analysis, and advice, the World Bank has produced a large number of reports on the food crisis at the global, regional, and national levels. It also provides international stakeholders and national governments with policy advice on short-term and longer-term policy and strategies.

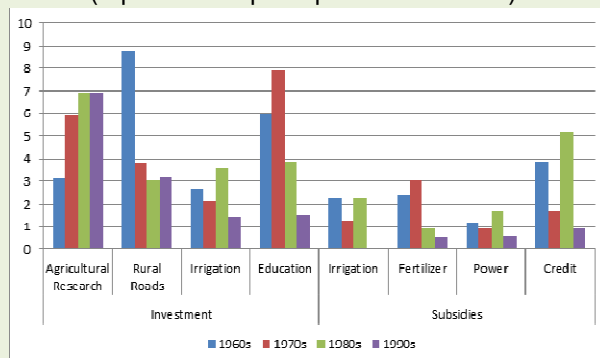
34. The World Bank increased agriculture sector financing from \$8.8 billion in the immediate precrisis years (2006–2008) to \$13.0 billion in the postcrisis period (2009–2011). However, these commitments peaked in 2009 (\$5.3 billion) and have since fallen back to a level approaching that of the precrisis years (\$3.6 billion in 2011 as compared with an average of \$2.9 billion annually during 2006–2008). By far the sharpest proportional increase in World Bank funding has been for safety net and social protection programs, which jumped from \$1.2 billion in the precrisis years to \$9.0 billion in the postcrisis period. These safety nets responded to both the food crisis and the global economic downturn.

35. Millions of poor Asians received assistance through direct food aid, conditional cash transfers, and other means in programs supported by the World Bank's GFCRP. GFCRP has financed operations in 35 countries, almost all low-income economies and concentrated in Africa. In Asia, GFCRP is financing operations in Afghanistan, Bangladesh, Cambodia, Kyrgyz Republic, Lao People's Democratic Republic, Nepal, Philippines, and Tajikistan. GFCRP operations have been about equally divided between programs focused on safety nets and social protection, and programs that mainly promote short-term gains in agricultural productivity.

Box 2: Economic and Poverty Impacts of Alternative Rural Investments

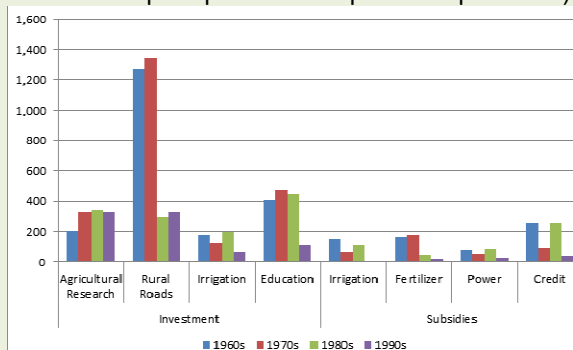
Which rural investments offer the highest payoffs? Research on India suggests that the priorities should be agricultural research and rural infrastructure, especially roads. Using state-level data for the years 1961–2000, Fan and his colleagues^a estimated the economic returns and poverty impacts of alternative public expenditures in rural India from the 1960s to the 1990s (Figures 5a and 5b). The estimated economic and poverty-reduction payoff to investment in rural roads was very high until the 1980s. It declined thereafter but still provided an attractive benefit-cost ratio in the 1990s. The returns to investment in agricultural research have grown over time and were the highest of all subsectors after the 1970s. The sharp difference between the economic and poverty-reducing impacts of research probably reflect the time lag between research outputs, productivity gains, and changes in farm employment and wage rates, with the latter potentially being the major impacts for the poorest households. Rural education shows a similar pattern. The economic return to irrigation investment has declined over time, but still provided a benefit-cost ratio of 1.4:1 in the 1990s. However, in all time periods, irrigation ranks low in terms of poverty reduction. This may reflect limited direct access to irrigated land by the poor and a time lag between investment and subsequent impacts on rural employment and wages. Finally, India's untargeted subsidies to irrigation, fertilizer, and power had much less economic impact than physical investment after the Green Revolution peaked in the 1970s, and had low impacts on poverty in all time periods,^b reflecting the disproportionate benefits of these subsidies to larger landowners.

Figure B2.1. Benefit-Cost Ratios in Agricultural GDP
(rupee benefit per rupee of investment)



GDP = gross domestic product.

Figure B2.2. Rural Poverty Reduction (decrease in number of poor per million rupees of expenditure)



In a comprehensive literature review, Mogues et al. concluded that the high payoff to agricultural research is consistent across countries, followed by rural infrastructure, farm extension, and education.^c In general, investment related to staple crops shows a higher return than investment in commercial export crops due to stronger employment impacts and stronger forward and backward growth linkages with other sectors of the economy. Interestingly, estimated returns to *total* agricultural investment have been mixed across countries, suggesting that it is the *composition* of investment, rather than its aggregate amount, that determines the outcomes in terms of growth and poverty reduction.

^a S. Fan, A. Gulati, and S. Thorat. 2007. Investment, Subsidies, and Pro-Poor Growth in Rural India. *Discussion Paper 00716*. Washington, DC: International Food Policy Research Institute (IFPRI).

^b Birner et al. provide a very detailed study of fertilizer and electricity subsidies in India. They conclude that while the subsidies stimulated adoption of improved crop technology and groundwater irrigation during the Green Revolution, they have long outlived their original purpose. They benefit large farmers much more than smallholders, are a huge fiscal burden, and crowd out more effective growth promoting investments. They also have increasingly adverse environmental impacts. See R. Birner, S. Gupta, and N. Sharma. 2011. *The Political Economy of Agricultural Policy Reform in India: Fertilizers and Electricity for Irrigation*. Washington, DC: IFPRI. Unfortunately, reducing the subsidies has proven to be a major political challenge. This challenge is even greater in regard to India's food subsidies (A. Ganesh-Kumar and K. Ganguly. 2011. Role of Policies and Institutions in Delivering Food Security in India. IFPRI. Report prepared for ADB. New Delhi. August.).

^c T. Mogues et al. 2012. The Impacts of Public Investment in and for Agriculture: Synthesis of the Existing Evidence. IFPRI Discussion Paper 01217.

36. ADB's direct response to the food crisis was modest. Its recent crisis operations focused mainly on the regional economic downturn, not on food price impacts. In early 2008, ADB set aside \$700 million of concessional funds for possible fast-disbursing, emergency-type assistance to countries hit by food price spikes. Several developing member countries (DMCs) expressed interest, but only Bangladesh and Cambodia ended up taking loans, which were used mainly for safety net measures and input delivery to poor farmers. A number of other countries received ADB support in response to the global economic crisis, and they often served to address food security issues. Overall, ADB financing of safety nets has been much smaller than that of the World Bank.

37. From 1999 to 2007, ADB's direct funding of agriculture and natural resources (ANR) declined from 11% to just 4% of total lending. From 2007 to 2011, this share rose to almost 7%, while the dollar volume more than doubled to just below \$1 billion due to increased lending for water and natural resources management.³⁸ However, direct support to agricultural production and markets accounts for less than 10% of total ANR lending. In its Operational Plan for Sustainable Food Security,³⁹ ADB use a broad definition of lending for "food security," which includes operations in many sectors (e.g., education, transport, and energy) that are viewed as having impacts relevant to food security. By this definition, 18% of ADB's total lending was considered supportive of food security during 2009–2012. However, ANR comprised just 32% of the total that was food security-related, while transport and energy together accounted for 55%. ADB's Work Plan and Budget Framework for 2013–2015 makes several references to food security, but allocates just 1% of total lending to agriculture. However, ADB envisions that 17% of its infrastructure operations, by volume, will be located in rural areas, and this share is projected to increase to 22% by 2015.⁴⁰

38. The responses of other regional banks, particularly the Inter-American Development Bank (IADB) and the African Development Bank (AfDB), have been small. The IADB website says little about the global food crisis. It appears that IADB's main specific response to the crisis was the 2010 approval of a \$3.5 million Food Security Fund, which provides TA to improve agricultural production, productivity, and food trade. Quite likely, this small response reflects the fact that Latin America, with the exception of the small countries, has been a net beneficiary of higher food prices.⁴¹ Agriculture has never been a major part of the IADB portfolio, amounting to less than 9% of total lending since operations commenced in 1961. AfDB's agriculture sector strategy envisions support to agriculture amounting to \$5.3 billion for 2010–2014, but achieving this may be problematic. In 2011, AfDB lending to agriculture and rural development amounted to \$231 million, or just 3.5% of total lending.⁴² This may reflect an allocation of responsibilities among African development agencies based on their comparative strengths. Africa is highly dependent on agriculture, and many countries have been particularly hard hit by rising food prices.

39. In proportional terms, the largest increase in multilateral support to agriculture has come from the International Fund for Agricultural Development (IFAD) and the European Union, which, respectively, doubled and tripled their support between 2004/05 and 2008/09. For the bilateral donors, OECD estimates that \$6.8 billion of the \$22.2 billion pledged at L'Aquila was over and above previous DAC commitments for agriculture.⁴³ The largest increase was from the US, which doubled its funding after 2005. The US and Japan are the largest supporters of food and nutrition security in the DAC, accounting for almost half of total DAC funding. Under its Feed the Future initiative, the focus of US aid is on directly improving agricultural productivity in poor, food-insecure regions.⁴⁴

³⁸ ADB. 2010. Annual Report. Manila; ADB. 2012. Asian Development Outlook Supplement. Manila. December.

³⁹ ADB. 2010. *Operational Plan for Sustainable Food Security*. Manila.

⁴⁰ About 57% of Asia's population is rural (ADB. 2012. Key Indicators for Asia and the Pacific. Manila).

⁴¹ Argentina and Brazil are upper middle-income countries and major food exporters. Guatemala, on the other hand, is poorer and dependent upon corn imports.

⁴² AfDB. 2012. Annual Report 2011. Tunis.

⁴³ OECD. 2012. *Aid for Food and Nutrition Security*. Paris.

⁴⁴ USAID is focusing on the diffusion of farm technologies that are viewed as particularly relevant to improved food security, mainly in East Africa and South Asia. Among others, these include salt- and flood-tolerant rice, which could cover 120 million

40. Overall, bilateral donors, the World Bank, and ADB upscaled operations related to food security after the onset of the food price crisis. However, no strong response is apparent for IADB and AfDB. Despite the mixed regional responses, the overall increase in support is encouraging. Key questions are whether it is well focused and can be sustained if, as many experts predict, world food prices stabilize from 2013 onward (see para. 44). Fiscal constraints in DAC countries will also be important. In April 2013, OECD reported that, due to the continuing financial crisis and euro zone turmoil, total ODA fell by 4% in real terms in 2012, following a 2% fall in 2011.⁴⁵

41. Agricultural research and productivity enhancement are the critical foundations of long-run food security. The recommendations to G20 call for upscaling agricultural research both in CGIAR and in the national research and extension systems. So far, it is not clear whether the financial commitment will be adequate. The CGIAR Fund has grown but remains well short of its \$1 billion annual funding target. Aid agencies are at times slow delivering on their commitments.⁴⁶ CGIAR's Strategic Results Framework estimates that funding for agricultural research and technology development in the developing countries must increase from \$5.1 billion (2009) to a minimum of \$16.4 billion by 2025, of which \$1.6 billion is needed for CGIAR.⁴⁷ Hence, a big question mark is whether regional governments and the donors will mount an adequate and sustained response.⁴⁸

IV. Prognosis for Asia

42. At a macroeconomic level, the evidence suggests that the food crisis, per se, has had much smaller impacts on growth in Asia than the regional impacts of the global economic downturn. This is to be expected, since the main sources of economic growth in Asia lie outside of agriculture. Assuming there are no further shocks, most countries are capable of managing year-to-year variations in cereal supply through public and private stocks and trade. However, food prices contribute to inflation, particularly in the poorer countries, where food is a significant part of the consumer price index. Inflation can contribute to political unrest and through this have a more serious impact on overall economic growth.

43. Overall, Asia weathered the food crisis fairly well despite some bad initial policy reactions. However, Asia remains vulnerable in the face of increasingly unpredictable weather, stagnating agricultural productivity, the likelihood of a sustained higher *level* of food prices, and the possibility of continuing price volatility.

hectares; rust-resistant wheat in Central Asia and Africa; drought-tolerant corn, mainly for Africa and benefitting 30 million–40 million people; high-yielding pigeon and chick pea, which may cover 6 million hectares in Africa and South Asia; agronomic practices to restore and sustain soil fertility; livestock vaccinations, especially for East Coast Fever in Africa; and biofortified crops.

⁴⁵ OECD. 2013. Aid to poor countries slips further as governments tighten budgets. *OECD Newsroom*. Paris. 3 April.

⁴⁶ CGIAR. 2012 and 2013. CGIAR Fund Updates. October 2012 and January 2013. Contributions to the CGIAR Fund in 2012 totaled \$513 million.

⁴⁷ Global Author Team. 2010. Transforming Agricultural Research for Development. The Global Forum for Agricultural Research (GFAR). Report for the Global Conference on Agricultural Research (GCARD). March.

⁴⁸ Unfortunately, there is little up-to-date information available on public investment in agriculture in Asia. IFPRI's ASTI database (Agricultural Science and Technology Indicators, <http://www.asti.cgiar.org/data>) contains data on public expenditure on agricultural research and development (R&D) up to 2007 for the PRC and to 2009 for South Asian countries. The data show a rapid increase in real public R&D expenditure in the PRC from 2000 to 2007, and in India from 2004 to 2009. However, expenditures were flat elsewhere in South Asia. Data for other Asian countries are available only up to 2003. While it is believed that private investment in agricultural research has grown over time, no data are available.

44. The price surge is a loud wake-up call. Based on the history of past food crises, prices can be expected to stabilize.⁴⁹ But at what level? And does the past provide a sound basis for predicting the future in regard to price volatility? If climate change will bring, indeed is bringing, greater frequency of extreme weather events, then the droughts and flooding that have contributed to supply disruptions can be expected to continue and possibly worsen. The tighter linkage between energy and food prices will affect the future level and volatility of corn and oilseed prices. Various supply and demand stresses on agriculture and the natural resource base make it likely that international food prices have indeed moved to a higher long-run level.

45. Fortunately, most of Asia is better able to absorb higher food prices today than was the case two decades ago. At the household level, average incomes are higher, so budget shares for food in general, and for cereals in particular, have declined. As a result, wealthier households are much less sensitive to food price changes. Higher incomes and urbanization have led to a more diversified diet, with a significant decline in direct consumption of cereals. The role of rice in the Asian diet is changing rapidly. In Southeast Asia, the income elasticity of demand for rice is actually now negative.⁵⁰ Nonetheless, while the well-off are less sensitive to food prices, the price of rice is still a major barometer of the welfare of the poor. Fortunately, at the macro level, many Asian governments have more fiscal space today to absorb the costs of tariff reductions, safety nets, and other programs to protect the poor. In urban areas, the challenge is to create well-targeted programs with minimal leakage and a manageable fiscal burden. In rural areas, the poor may be helped best by programs that generate employment and income by simultaneously addressing the fundamental issue of raising agricultural productivity.

46. It is impossible to predict the future, but some things appear certain. In the absence of a significant agricultural supply response, it is safe to bet that supply side factors (para. 9) will continue to put upward pressure on food prices. The World Bank calls the higher level of food prices the “new normal.” The World Bank’s new global Commodity Market Outlook (2013) projects that real world prices of corn and wheat will be 6%–14% higher but will gradually decline in nominal terms from 2013 to 2020. The nominal price of rice is projected to remain fairly stable at about \$500 per ton during this period. OECD and FAO examine a broader set of commodities (including fish and livestock) and project prices up to the year 2021 that will remain flat or decline in real terms from recent levels, but nonetheless average 10%–30% above the precrisis levels.⁵¹ The USDA projects a decline in prices received by US farmers for the major crops over the next 2–3 years. ADB (2012) forecasts somewhat subdued Asian growth in 2013 due to continued repercussions of the world recession, but notes that world food prices have eased.⁵²

47. Whether the price volatility of recent years will continue is hard to say. Rice prices moved higher up to late 2012, but have gradually declined by about 10% since early 2013. The second food price spike in 2010–2011 involved corn and wheat, not rice. The stock-to-use ratio of corn is at its lowest level in many decades, while recent prices of corn have been exceptionally high relative to wheat, so another poor growing season in the US could trigger a further increase in corn prices that would reverberate in other cereal markets. Any sharp jump in oil prices could exacerbate both the food price level and volatility.⁵³ Other question marks include the continuation of biofuel policies in the US

⁴⁹ Recent market monitoring reports have been upbeat about trends in international supplies and trade in rice, wheat, corn, and soybean. However, while prices for these commodities have been softening, they remain about 100% higher than precrisis levels. See AMIS. 2013. *Market Monitor No. 10*. September; and World Bank. 2013. *Food Price Watch*. July.

⁵⁰ C.P. Timmer. 2013. The Dynamics of Agricultural Development and Food Security in Southeast Asia: Historical Continuity and Rapid Change. Draft chapter in I. Coxhead, ed. *Handbook on Southeast Asian Economics*.

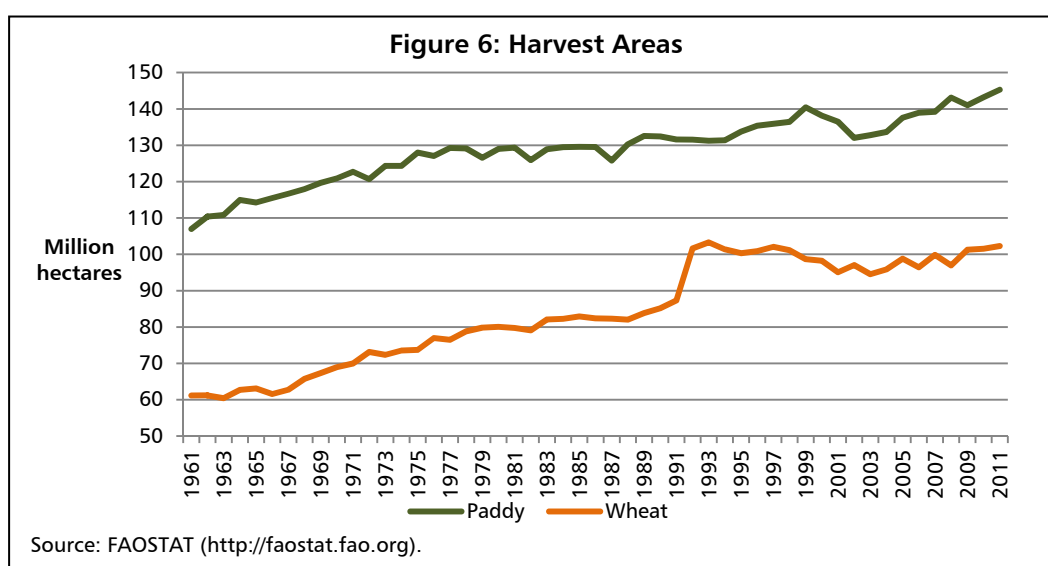
⁵¹ OECD and FAO. 2012. *Agricultural Outlook 2012–2021*. Rome.

⁵² ADB. 2012. *Asian Development Outlook Supplement*. Manila.

⁵³ In an analysis of the period 1997–2012, Baffes and Dennis (J. Baffes and A. Dennis. 2013. Long Term Drivers of Food Prices. Mimeo. Washington, DC: World Bank. February) decomposed the effects of energy prices, food stocks, exchange rate movements, interest rates, and gross domestic product growth on world prices of rice, wheat, corn, and soybean. The price of crude oil accounted for almost two-thirds of their model’s explained variance of post-2004 food price increases, a result they believe is broadly consistent with a number of other studies. Unfortunately, the impact of trade restrictions by exporting

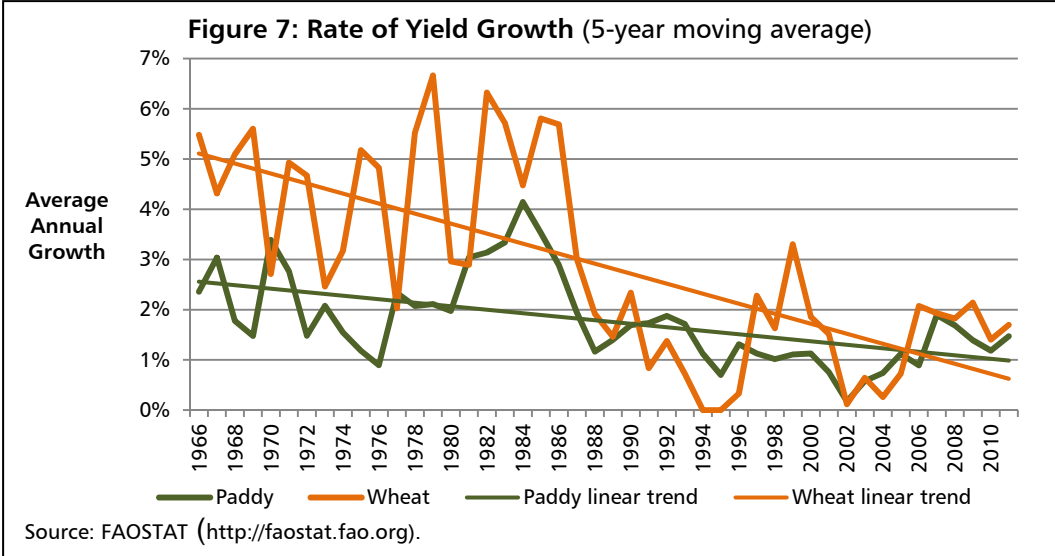
and Europe; the future of commodity market indexes; and, most important of all, the trade policies of the major food-exporting and -importing countries.

48. From the supply side, the rate of growth of Asian rice and wheat productivity has trended downward since the 1980s (Figures 6 and 7). Rice harvest areas continue to rise gradually, but Asian wheat areas have stagnated since the early 1990s. For rice, climate change is a looming threat through sea level rise and saltwater intrusion in low-lying areas of South and Southeast Asia. However, there is scope for area and yield growth with existing crop technology in the less intensively cultivated areas of eastern India and, perhaps most promising of all, Myanmar.⁵⁴ Realizing this potential will require considerable physical investment in irrigation and roads, and also suitable price incentives and a policy environment conducive to stable international trade. Asian wheat, on the other hand, may face greater challenges. Growth in wheat areas has plateaued, although there is potential for growth of extensive rainfed wheat production in Central Asia, particularly in Kazakhstan. However, wheat is grown mainly in semi-arid environments that will be particularly prone to heat and rainfall stresses as the climate changes.



countries could not be modeled with their annual data, since the sharp spike and decline in rice prices occurred within a single calendar year. In a much simpler analysis, Heady estimated that export trade restrictions accounted for about one-half of the rise in the world rice price from 2006 to 2008, while demand spurts by Bangladesh, Philippines, and the Gulf countries were also important (D. Headey, Rethinking the global food crisis: The role of trade shocks. *IFPRI Discussion Paper 00958*. Washington D.C.).

⁵⁴ Myanmar was the world's largest rice exporter until World War II and the subsequent economic decline under military rule. The recent opening of the economy is bringing a huge inflow of foreign investment, including in agriculture. Myanmar will soon resume rice exports to Japan after a 45-year hiatus. Japanese private investment is planned in rice milling capacity for exports of 300,000 tons a year (Financial Times. 2103. Myanmar to resume rice exports to Japan. March 26).



49. For all the major food crops, there is potential with existing technology to raise productivity both per unit land and per unit of water used. The “yield gap”—the difference between the yields actually obtained by farmers and the yields achieved with the same crop variety under optimal management, and when water and nutrients are nonlimiting and the crop is free of biotic stress—are often quite large in Asia. Similarly, water from irrigation, rainfall, and other sources is typically used with low efficiency, well below its potential productivity. Farmers are rarely able to achieve more than 80% of potential yields—i.e., a 20% yield gap—due to a range of agronomic factors (e.g., pests, drought) and economic constraints (e.g., risk aversion, unattractive crop and input prices). Nonetheless, with yield gaps of 40% or more often being observed in rice and wheat, there is clear scope for efforts to assist farmers through traditional extension and modern telecommunications media in order to enhance productivity and contribute to better food security.

50. Over the next 10–20 years, climate change may prove to be the greatest threat to food security, so much so that a separate section below is devoted to this topic. The international community has so far been incapable of taking firm action to control greenhouse gas (GHG) emissions. If the world cannot act firmly to mitigate climate change, then it must learn to adapt, and adapt quickly. Agricultural research and technology diffusion will be critical to meeting this challenge. The CGIAR system has recently completed a major reform process but has not yet achieved its funding goals (para. 41). Many developing country research and extension systems are burdened by high overhead costs and are underfunded for actual operations. Public expenditure on agricultural research has grown in a few countries but on the whole appears to have stagnated in Asia.

51. International funding for agriculture has grown, but a concern is whether it will reach a sufficient level and be sustained. The World Bank and (on a much smaller scale, ADB) provided relevant short-run financing of safety nets that protected the poor from the effects of high food prices. Some of this effort was in direct response to the food price crisis, but the bulk was provided under separate programs that responded to the global economic downturn. If, as projected, world food prices stabilize during the medium term, the big question is whether the international community will sustain its focus on food security in order to address the longer-run productivity issues that contributed to the crisis. For Asia’s large exporting and importing countries, the question is whether the return to more open trade will be sustained, which will greatly reduce the prospect of future price volatility.

V. Key Challenges for Asia

52. Looking beyond the 2007–2012 crisis, which appears to be diminishing for the time being, there remain huge long-run challenges for sustaining Asian food security and promoting inclusive rural growth. The biggest are

- (i) revitalizing agricultural productivity growth in order to feed Asia’s ever more urban and prosperous population, a challenge that is magnified by the simultaneous need to adapt to climate change and, ideally, create a more carbon-neutral agriculture;
- (ii) ensuring that small, resource-poor farmers have the opportunity to compete and thrive in modern food value chains; and
- (iii) tackling Asia’s persistent malnutrition in a sustainable, financially efficient manner.

53. In addition, the recent turmoil in food markets and the vulnerability that the crisis exposed prompt the question of whether the standard food policy prescriptions of the past three decades remain relevant in a world where food security and international trade flows may be less assured. For this reason, the final section of this chapter addresses the challenge that Asian policy makers face—in both food importing and exporting countries—in finding a reasonably efficient and politically acceptable set of policies that protect the poor without simultaneously suppressing the price incentives to farmers that encourage their supply response.

A. Climate Change Impacts Are Being Felt Today

54. Most climate change projections look ahead to what can be expected in the year 2050 or beyond. For example, recent projections by the International Food Policy Research Institute suggest that climate change impacts may be manageable up to 2050, assuming there is a large and sustained increase of investment in agriculture.⁵⁵ Such projections consistently point to the need for massive action, but the long timeframe may give the misleading impression that climate change can be dealt with gradually. When the distant future is discounted to the present, higher priority goes to issues that are judged to be more pressing today.

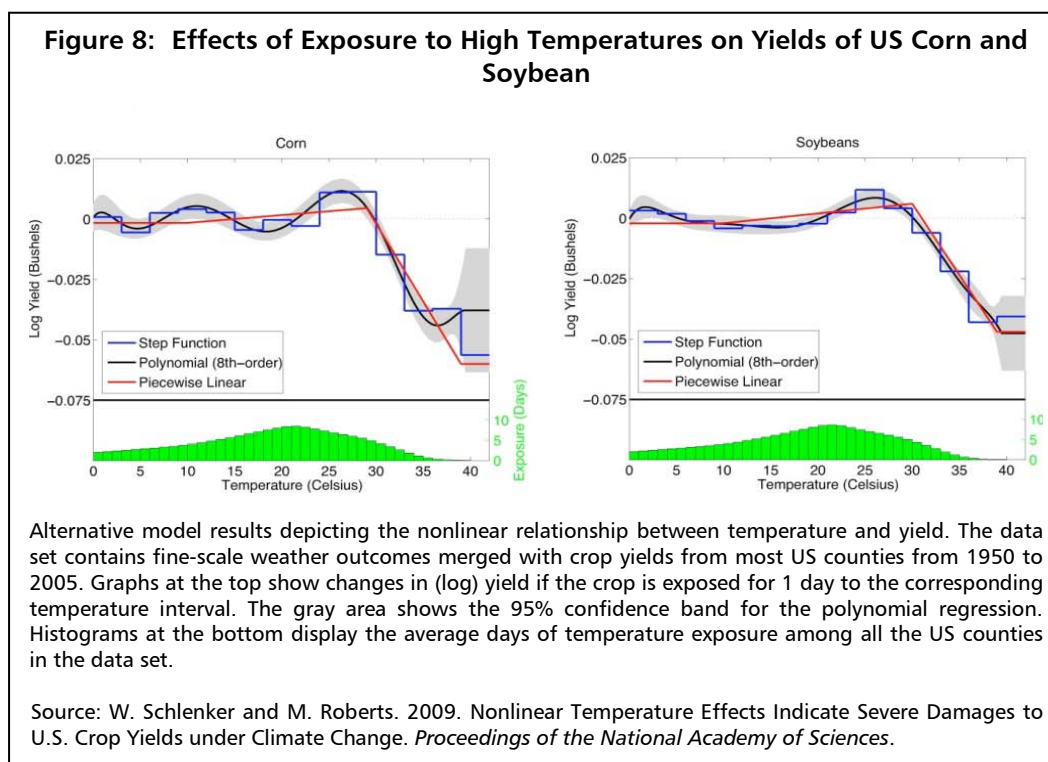
55. Climate change impacts should not be thought of as a distant threat. Studies are documenting the rising intensity of rainfall and increased frequency of extreme weather and climate-related disasters⁵⁶ Accumulating evidence, ranging from research over large geographical areas to studies at the household level, add up to a compelling argument that climate change is already having measureable impacts on agriculture in a wide range of economies, crops, and farming systems, and over and above the more dramatic effects of major floods and droughts. The impacts of climate change are amplified by other anthropogenic impacts on the natural resource base through population growth, urbanization, rising incomes, growing water scarcity, and the degradation of forests and watersheds.

56. The major food crops—wheat, corn, and rice—grow best within a fairly narrow temperature range, which varies by the stage of growth (e.g., flowering versus grain filling). Optimal mean growing season temperatures—allowing for the range of daytime highs and nighttime lows—are about 15 degrees Celsius (°C) for wheat, 20°C for corn, and 25°C for rice. Scientific evidence is revealing the sensitivity of crop yields to temperature spikes that greatly exceed these optima even for short periods (Figure 8). As average temperatures rise and the probability distribution of temperature shifts to the right, short periods of extreme heat will become more frequent and have more severe impacts on

⁵⁵ G. Nelson et al. 2010. *Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options*. Washington, DC: IFPRI.

⁵⁶ For example, V. Thomas et al. (footnote 3) and S. Westra, L. Alexander, and F. Zwiers. 2012. Global Increasing Trends in Annual Maximum Daily Precipitation. *Journal of Climate*.

yields. It is likely that extreme heat will pose a greater risk to crop productivity than the impacts of variations in rainfall associated with climate change.⁵⁷ At the same time, the impacts of extreme heat are intensified when water is scarce.



57. In contrast, there remain many unknowns at this point about the magnitude of the fertilization effect of higher atmospheric carbon dioxide (CO₂) concentration. Most research on CO₂ impacts has been undertaken in highly controlled laboratory settings, and the effects are as yet unconfirmed in farmers' fields or in tropical conditions. Leakey⁵⁸ notes that most current projections of crop yields are likely to be overoptimistic, since they assume that CO₂ will directly enhance photosynthesis in all crops. Recent research suggests that the benefits will vary, with legumes likely to benefit more than cereals, and cereals having the C3 photosynthetic pathway (rice and wheat) likely to gain more than C4 crops such as corn, sorghum, and millet. Even for a single crop, the benefits of higher CO₂ will depend upon complex interactions among CO₂, temperature, water availability, soil nutrient status, and other factors that are not yet well understood. For example, laboratory research on rice shows that elevated CO₂ interacts with temperature and can adversely affect the crop's growth when temperatures are also extremely high.⁵⁹ Although it is believed that elevated CO₂ will, overall, enhance yields, this is unlikely to overcome the yield-dampening impacts of higher temperatures and the other stresses of climate change.

⁵⁷ The empirical evidence and projections of climate models suggest that at a regional level, rainfall changes will be smaller in terms of standardized variance than temperature changes during the coming decades. Regions that are presently arid or semi-arid are expected to become even drier, but smaller changes are projected in humid areas. Averaged over continents, changes in rainfall will likely be <10% over the next 50 years. It should be borne in mind that while climate models have tended to converge in projections of change at regional or continental scale, much less is confirmed about the changes at a local level.

⁵⁸ A. Leakey. 2009. Rising Atmospheric Carbon Dioxide Concentration and the Future of C4 Crops for Food and Fuel. *Proceedings of the Royal Society B: Biological Sciences*. Volume 276; and A. Rogers, E. Ainsworth, and A. Leakey. 2009. Will Elevated Carbon Dioxide Concentration Amplify the Benefits of Nitrogen Fixation in Legumes? *Plant Physiology*. Volume 151.

⁵⁹ Matsui and his colleagues believe that the interaction may be due to reduced cooling within the rice canopy when CO₂ is elevated, which sharply lowers the percentage of spikelets having germinated pollen grains. See T. Matsui, et al. 1996. Effects of High Temperature and CO₂ Concentration on Spikelet Sterility in Indica Rice. *Field Crop Research*. Vol. 51.

58. Models of the growth characteristics of crops and livestock in different agroclimatic environments are being used to estimate the impacts of climate change on agricultural productivity. For example, the Agricultural Production Systems Simulator (APSIM)⁶⁰ simulates the daily growth of crops, pasture, trees, and weeds; animal weight gain and reproduction; soil processes (water balance, nutrients, pH); and a range of management practices, e.g., irrigated vs. rainfed, and different planting dates, crop rotations, and input levels. The biometric analysis of each crop's physiology and growth processes provides estimated parameters that are used to model the impacts of variations in temperature, humidity, rainfall soil water availability, and soil-water-crop interactions. A limitation of these models is that their parameters are usually derived from data collected in a controlled environment, so they are not well calibrated for the conditions of Asia's small farmers or for capturing extreme temperature effects. An alternative approach is based on remote sensing data (satellite imagery) and ground-based crop and climate data at a regional level, with impacts estimated through regression analysis. Many studies of climate change impacts use both approaches and report the resulting range of estimates.

59. Lobell and his colleagues at Stanford University and the International Maize and Wheat Improvement Center (CIMMYT) have used the above methods to estimate the effects of extreme heat on wheat yields in the Indo-Gangetic Plains of northern India, using satellite observations from the years 2000–2009.⁶¹ They found a statistically significant acceleration of wheat senescence—faster maturation entailing a shorter grain-filling period and reduced yield—from exposure to extreme heat (>34°C) over and above the effects of the rising average temperatures during the years of observation. Comparison of these results with simulations using two crop models (including APSIM) shows that existing models underestimate the yield impacts of extreme heat by as much as 50%. The findings indicate that research on new varieties and changes in farm practices such as planting dates must seek to reduce wheat's sensitivity not only to higher *average* temperatures, but also to extremely hot days, which are increasing in frequency. These results are supported by research at the ground level. Gupta et al. found that, despite otherwise good growing conditions, extreme heat for several days during the grain-filling stage reduced wheat yields in India's Punjab by almost 6% in the 2009–2010 season, with the yield reduction reaching as high as 20% in the worst-affected districts.⁶²

60. Although rice is a high-temperature crop, it is not immune to temperature extremes. Peng et al. analyzed weather data at the International Rice Research Institute (IRRI) from 1979 to 2003 to assess the relationship between irrigated rice yield and temperature in field trials conducted from 1992 to 2003.⁶³ Annual mean maximum (daytime) and minimum (nighttime) temperatures increased by 0.35°C and 1.13°C, respectively, during 1979–2003. Rice yields during the dry season declined by 10% for each 1°C increase in the minimum temperature. However, the maximum daytime temperature did not have a significant impact on yield, probably reflecting the compensating effect of adequate irrigation water. The findings provide direct evidence of how rice yields are affected by higher nighttime temperatures associated with global warming. Scientists at IRRI report that rice is most susceptible to heat stress during the crop's reproductive and ripening stages. Extremely high temperatures for even a few hours during flowering can cause sterility, while high temperatures during ripening reduce grain filling and milling quality. If other constraints are binding, such as a lack of irrigation water, temperature impacts are even larger.⁶⁴

⁶⁰ APSIM was developed in a partnership involving Australia's national science agency (the Commonwealth Scientific and Industrial Research Organisation [CSIRO]), and the state and University of Queensland.

⁶¹ D. Lobell, A. Sibley, and J.I. Ortiz-Monasterio. 2012. Extreme Heat Effects on Wheat Senescence in India. *Nature Climate Change*.

⁶² R. Gupta et al. 2010. Wheat productivity in Indo-Gangetic Plains of India during 2010: Terminal Heat Effects and Mitigation Strategies. *Newsletter of the Professional Alliance for Conservation Agriculture*. Vol. 14.

⁶³ S. Peng et al. 2004. Rice Yields Decline with Higher Night Temperature from Global Warming. *Proceedings of the National Academy of Sciences*. Volume 101, No. 27.

⁶⁴ A. Laborte, et al. 2012. Rice feels the Heat. *Rice Today*. IRRI. Volume 11, No. 3.

61. In a similar study of corn, Lobell et al.⁶⁵ used data from more than 20,000 corn trials managed in Africa by CIMMYT and found a significant nonlinear relationship between high temperatures and corn yields, with yield declines accelerating at temperatures above 23°C. Each degree-day above 30°C reduced the corn yield by 1% under optimal rainfed conditions, and by 1.7% under drought conditions. The results suggest that heat damage intensifies when soil moisture is limiting.

62. The impacts of extreme weather on crop yields are being observed in temperate regions as well as the tropics.⁶⁶ In a study of Australian wheat, Asseng et al. reported results similar to those of Lobell et al. in India, with 34°C again being the critical point for yield loss.⁶⁷ As with rice, the alarming finding was that the period of exposure needed for significant damage is extremely short—a single extreme heat event at or immediately following wheat anthesis (flowering) caused yield to decline by about 5%. In field experiments, yields continued to decline almost linearly as the days of exposure to extreme heat increased. In the US in 2012, the severe drought and record high temperatures had a major impact on the corn crop and contributed to a sharp spike in world corn prices that, through stock and trade balances, will spill over into 2013 regardless of whether growing conditions improve this year. In a study of the apparent stagnation of European cereal yields from 1990 to 2010, Brisson et al. analyzed wheat yields in France using crop simulation models.⁶⁸ They found that despite genetic improvement in yield potential over time, yield growth was reduced by heat stress during grain filling and by drought during stem elongation. However, changes in soil fertility practices may also have had impacts from 2000 onward that were not captured in their analysis (lower use of legumes in cereal rotations because of the substitution of oilseed rape for use in biofuel and, possibly, a decrease in nitrogen fertilizer use).

63. At a global level, Lobell et al. used historical country-level data to estimate the effects of temperature and precipitation on yields of corn, wheat, rice, and soybean.⁶⁹ They estimated that wheat and corn yields from 1980 to 2008 were reduced by 5.5% and 3.8%, respectively, as compared with the scenario without climate impacts. They found no significant patterns in the case of rice and soybeans, and also offered caveats on the limitations of their models.⁷⁰ They concluded that temperature effects have been more important than changes in rainfall, and that the overall climate impacts have contributed to rising global food prices through an estimated 10% loss of the yields that would otherwise have been achieved as a result of technology improvement.

64. Increasing levels of tropospheric—or ground level—ozone⁷¹ (O₃) are another significant source of crop yield loss and an existing threat to Asian food security. High concentrations of O₃ are caused mainly by fossil fuel and industrial emissions. Thus, elevated ground-level O₃ results directly from urban-industrial development and will continue rising in line with the rapid economic transition of Asia

⁶⁵ D. Lobell, W. Schlenker, and J. Costa-Roberts. 2011. Nonlinear Heat Effects on African Maize as Evidenced by Historical Yield Trials. *Nature Climate Change*.

⁶⁶ The estimates of heat thresholds beyond which yields of a given crop decline differ somewhat in the literature. For example, Schlenker and Roberts reported a threshold of 29°C for corn in the US, although one of their models suggests that the peak is reached at about 25°C, or much closer to the estimate of Lobell et al. for Africa (W. Schlenker and M. Roberts. 2009. Nonlinear Temperature Effects Indicate Severe Damages to U.S. Crop Yields under Climate Change. *Proceedings of the National Academy of Sciences*). Such differences are to be expected, given differences in the seed varieties and production technology used by farmers, as well as the data sources and estimation methods.

⁶⁷ S. Asseng, I. Foster, and N. Turner. 2011. The Impact of Temperature Variability on Wheat Yields. *Global Change Biology*. Vol. 17.

⁶⁸ A. Brisson et al. 2010. Why are Wheat Yields Stagnating in Europe? A Comprehensive Data Analysis for France. *Field Crops Research*. Volume 119.

⁶⁹ D. Lobell, W. Schlenker, and J. Costa-Roberts. 2011. Climate Trends and Global Crop Production since 1980. *Science*.

⁷⁰ They were unable to model the effects of brief, extreme climate events within a growing season, which would tend to reduce yields. Nor could they model the effects of increased atmospheric CO₂.

⁷¹ The troposphere is the lowest layer of the earth's atmosphere, extending from sea level up to an altitude of about 18–32 kilometers. The stratosphere lies above the troposphere and extends up to about 50 kilometers. Stratospheric O₃ absorbs ultraviolet rays in sunlight, preventing them from reaching the earth's surface. Loss of this O₃—the ozone hole—is a serious environmental and human health problem. In contrast, tropospheric O₃ absorbs infrared rays emanating from the earth, thus acting as a GHG. Unlike CO₂, which disperses evenly in the earth's atmosphere, O₃ is more regionally concentrated, and its level varies considerably by season and depending upon local weather conditions.

unless emission controls are imposed like those currently in effect in the US and Europe. Within the region, O₃ levels are highest in East Asia and are projected to rise steadily in South Asia to levels where significant impacts have been documented on the major food crops and on trees. O₃ contributes to climate change not only directly as a GHG, but also by reducing the terrestrial carbon sink embodied in forests. By reducing plant growth and photosynthesis, O₃ lowers yields and affects the nutritional quality of the major crops. Numerous studies document how global and regional yields of staple crops are being reduced by current O₃ levels. In the US in the 1980s, the annual cost of crop production lost due to O₃ was estimated to be \$2 billion–\$4 billion.⁷² Van Dingenen et al.⁷³ estimated that the global loss of wheat, rice, corn, and soybean amounted to \$14 billion–\$26 billion in the year 2000, which is on a par with, and possibly higher than, crop losses presently caused by other aspects of climate change.

65. Other evidence of tangible climate change impacts is accumulating at the subregional level. In Asia, the low-lying rice-growing deltas are particularly vulnerable to sea level rise and saltwater intrusion. The Union of Concerned Scientists has documented evidence on how these impacts are already being felt, or soon will be, in the Ganges-Brahmaputra delta of Bangladesh and the lower Mekong delta of Viet Nam.⁷⁴ Sadly, people in these regions also face increased risk of disease as water levels rise. Sea surface temperatures and levels are known to be correlated with cholera epidemics. Higher water temperature can trigger the occurrence of epidemic disease. Increasing salinity is also associated with cholera risk.⁷⁵ Hence, the populations of Asia's low-lying delta regions are vulnerable both to lower land productivity and to increased morbidity and lower work capacity due to climate change.

66. Tangible impacts of climate change extend to crops besides the cereals. Two examples include coffee in several major producing regions (where rainfall is increasing) and grapes in the California wine country (where rainfall is declining and temperatures are rising). Livestock and fishery systems are also under threat.

67. At the village level, a report by Oxfam reveals the remarkably consistent perceptions about climate change expressed by rural people of the developing world.⁷⁶ Oxfam has compiled evidence—some systematic and some more anecdotal—from extensive interviews with rural people in 18 countries and regions of Asia, Africa, and Latin America.⁷⁷ The following observations were reported consistently by rural people across these studies, although the relative importance varies from country to country depending on the local environment:

- (i) Seasons are more unpredictable. Transitional seasons are shorter or have disappeared altogether, being replaced by a simpler pattern whose characteristics are predominantly hot (and getting hotter) and dry; or hot (and getting hotter) and wet.
- (ii) Temperatures have increased most in winter.

⁷² The Royal Society. 2008. Ground-level Ozone in the 21st Century: Future Trends, Impacts and Policy Implications. *Science Policy Report 15/08*. London.

⁷³ R. Van Dingenen, et al. 2009. The Global Impact of O₃ on Agricultural Crop Yields under Current and Future Air Quality Legislation. *Atmospheric Environment*. Vol. 43. Using a refined estimation approach, Avnery et al. estimated the year 2000 losses of wheat, corn and soybeans alone to be on the order of \$11 billion–18 billion (S. Avnery et al. 2011. Global Crop Yield Reductions due to Surface Ozone Exposure: 1. Year 2000 Crop Production Losses and Economic Damage. *Atmospheric Environment*. Vol. 45).

⁷⁴ Union of Concerned Scientists. 2011. *Ganges-Brahmaputra Delta, Bangladesh and Mekong River Delta, Vietnam*. Cambridge, Massachusetts. (www.climatehotmap.org/global-warming-locations).

⁷⁵ A. Huq et al. 2005. Critical Factors Influencing the Occurrence of *Vibrio cholerae* in the Environment of Bangladesh. *Applied and Environmental Microbiology*. August, and F. Singleton et al. 1982. Effects of Temperature and Salinity on *Vibrio Cholera* Growth. *Applied and Environmental Microbiology*. November.

⁷⁶ S. Jennings and J. Magrath. 2009. What Happened to the Seasons? *Oxfam Research Report*. Oxfam Great Britain.

⁷⁷ In Asia, countries included Cambodia, India, Indonesia, Nepal, Tajikistan, Thailand, and Viet Nam. In Africa, they were Kenya, Malawi, Mali, Mozambique, South Africa, and Uganda, and famine-prone regions of East Africa. In Latin America, Bolivia, Haiti, Nicaragua, and Peru were covered.

- (iii) Rain is more erratic. There is less predictability to the start of rainy seasons. Rainy seasons and monsoons are shorter. In mountainous areas, there is much less snowfall. Dry periods have increased in length, and drought is more common.
- (iv) Within the seasons, unusual events are occurring more frequently, including heavy rains in the dry season, dry spells in the rainy season, storms at unusual times, dense and lingering fogs, and unpredictable temperature fluctuations.
- (v) Rains are intense and there are longer periods between rains during the rainy season, thus increasing the risk of crop losses, floods, and landslides.
- (vi) Winds and storms have increased in strength and may come at unusual times. Prevalent wind directions have also shifted.

68. These perceptions are quite consistent with observed patterns and global models of climate change. Over the centuries, small farmers have used traditional knowledge to sustain their farming systems and livelihoods by managing year-to-year climate variations within a fairly predictable range of extremes. The perceptions above show that historic weather averages are no longer as reliable a guide for farm activities. The agricultural systems these people have practiced for years are thus becoming less secure.

69. A substantial body of knowledge exists on water and soil conservation practices that could lessen climate change impacts, but these may involve some trade-offs between sustainability and productivity.⁷⁸ Agronomic practices like mulching, direct seeding, and minimum tillage conserve soil moisture and hence offer some resistance to high temperatures. Better meteorological data and faster weather forecasts to farmers will also help. Altering planting times can reduce exposure to extreme heat in a given season, but may upset crop calendars in multiple cropping systems. Switching to earlier maturing varieties can help, but early-maturing varieties tend to be lower yielding. Alternatively, there can be substitution away from wheat or rice to short-season crops such as pulses, but these would tend to bring lower returns to the farmer. From the standpoint of varietal breeding, the encouraging news is that wheat varieties bred for stress-prone, semi-arid environments appear better able to resist extreme temperatures than varieties bred for optimal growing conditions, although the yield potential is lower. Finally, intensified effort is needed to improve water use efficiency in irrigation and to restore degraded watersheds and forests in order to enhance water-holding capacity and resilience to more erratic or intense rainfall.

70. The scientific challenges of adapting agriculture to climate change are formidable and merit strong financing of research and technology dissemination. National research and extension systems have fallen behind due to the long decline in public funding of agriculture. Agricultural research is an incremental process that requires sustained commitment, but the payoff is high (see Box 2 and para. 102). In addition to the traditional crop breeding goals of high yield and good eating quality, new goals include resistance to biotic and abiotic stresses of climate change, including heat, O₃, drought, flooding, salinity, and the pests that are projected to increase in variety and virulence.⁷⁹ The extremely narrow genetic base of the world's food crop varieties is a risk to food security and must be broadened.⁸⁰ Unfortunately, many national breeding programs are underresourced, and extension systems are moribund in many countries. The private sector can potentially play a major role in technology development and diffusion, including proprietary technologies appropriate for the needs and capacities of small farmers. This will require an enabling policy, legal, market, and regulatory environment that provides the needed incentives for well-governed private investment and innovation.

⁷⁸ S. Gourdjji et al. 2012. An Assessment of Wheat Yield Sensitivity and Breeding gains in Hot Environments. *Proceedings of the Royal Society*. December; and Gupta et al. (footnote 62).

⁷⁹ An excellent technical assessment of crop breeding and biotechnology development goals is contained in E. Ainsworth et al. 2008. Targets for Crop Biotechnology in a Future High-CO₂ and High-O₃ World. *Plant Physiology*. Vol. 147.

⁸⁰ C. Mba, E. Guimaraes, and K. Ghosh. 2012. Re-orienting Crop Improvement for the Changing Climatic Conditions of the 21st Century. *Agriculture & Food Security*. Volume 1.

71. It is often said that much of adaptation will simply be “good development,” meaning that the investments make sense irrespective of climate change. More efficient agricultural water use will be critical to this approach. A disciplined effort is needed to improve the efficiency of Asia’s large irrigation systems, particularly in South and Central Asia, where water scarcity is growing. Rural roads and markets are also a high priority and have proven economic and poverty-reduction benefits. Hence, well-designed and internationally coordinated efforts like ADB’s support to climate-resilient coastal infrastructure in Bangladesh⁸¹ are relevant and timely. But beyond this, there are many unknowns.

72. What is certain is that temperatures and sea levels are rising; permanent ice and snow cover are receding rapidly (with potentially disastrous downstream consequences for South Asia); and there is increasing intensity of rainfall and frequency of extreme weather events. Global climate models are converging in their projections of broad regional changes, but forecasts at the local level are much less precise. The promised benefits of CO₂ fertilization are not yet confirmed under real world conditions, nor are the potential productivity gains in regions projected to become more arable because of climate change. What we know today with high certainty should already be sufficiently alarming to prompt urgent action. The unknowns pose tremendous risk for the future stability of the world’s food systems and the livelihoods of almost one billion food-insecure people who depend upon them.

B. The Fate of Small Farmers in Modern Value Chains

73. It is estimated that Asia contains some 350 million small farms operating less than 2 hectares (ha) of cropland. If the average farm household has five members, then about 1.8 billion people, about 45% of all Asians, depend on small farms for all or part of their livelihoods.⁸² The number of small farms has been growing over time. In India, for example, there were 49 million farm units of <2 ha in 1971 and almost 108 million as of 2006.⁸³

74. Asia’s small farms are important for many reasons. First, although small farms occupy only about 40% of the total farm area, they produce a much larger share of the region’s staple crops, a significant part of which enters the market. Their productivity growth over the past 35 years has been critical to Asia’s food security and its success in poverty reduction. Second, small farmers are stewards of the natural resource base and will play a central role in efforts to sustain agriculture and reduce land-based GHG emissions. Third, history shows that with the right technology and incentives, small farms are economically viable (at least on a part-time basis), as evidenced by the rural dynamism of the Green Revolution on the postage stamp-sized family farms of Java, in India and PRC, and more recently in Viet Nam. Fourth, while small farm families can make ends meet, there are limits to how much income they can generate by growing only rice or wheat. Despite Asia’s phenomenal aggregate growth, small, subsistence-oriented farms could easily stay poor. Fifth, in Asia’s democracies, rural families cast a lot of votes, so they have considerable political influence, a fact that is not lost on politicians and policy makers.

75. These issues point to the vital need for an inclusive structural transformation as Asia’s economies grow and modernize. In Asia’s economic development, the structural transformation is entailing a rapidly declining share of agriculture in gross domestic product (GDP), and a much slower

⁸¹ ADB. 2012. *People’s Republic of Bangladesh: Coastal Climate-Resilient Infrastructure Project*. Report and Recommendation of the President to the Board of Directors. Manila.

⁸² Complete and up-to-date statistics on Asian land holdings are scarce. The estimates used here are based on FAO. 2010. *Characterisation of Small Farmers in Asia and the Pacific*. Bangkok: Asia and Pacific Commission on Agricultural Statistics. April, which reports data for 11 ADB DMCs but excludes Bangladesh, Indonesia, Thailand, most of Central Asia, and other small countries for which data were unavailable. For these latter countries, estimates are based on G. Thapa and R. Gaiha. 2011. *Smallholder Farming in Asia and the Pacific: Challenges and Opportunities*. Paper presented at the IFAD Conference on New Directions for Smallholder Agriculture. Rome. January. In the cases of PRC, Sri Lanka, and Viet Nam, adjustments were necessary to account for differences in farm size definitions.

⁸³ P. Hazell. 2011. *Five Big Questions about Five Hundred Million Small Farms*. Keynote presentation at Conference on New Directions for Smallholder Agriculture. Rome: IFAD. 24–25 January.

decline in agriculture's share of employment. At the same time, the GDP shares of industry and services are rising, and rural workers, often the relatively young, are migrating to rapidly growing urban areas. The concern is what happens to rural people who, for one reason or another, cannot readily make the transition to employment in the urban economy. History has shown that a vibrant rural economy, based on both a dynamic agriculture sector (in modernizing value chains) and a growing nonfarm rural economy, can facilitate a relatively equitable transformation.⁸⁴ Indeed, a productive rural economy is the best safety net for the rural poor as a country's share of nonagricultural employment catches up with the share of nonagricultural GDP. For policy makers, achieving this requires sustained focus on agricultural and rural investment, including rural human capital. The literature often points to the examples of Japan; Republic of Korea; and Taipei, China, which got through the structural transformation process fairly smoothly, in part due to increasing trade protection and other support of agriculture.⁸⁵ Examples of "bad" transformations are found in economies where highly commercial, often large-scale agriculture may prosper, but many small farmers remain mired in poverty. In Asia, with its large rural population and a preponderance of small farms, a successful structural transformation would see agriculture evolve from small-scale, subsistence-oriented production to small-scale, commercially oriented farming driven by market forces. Thus, commercial farming in modern value chains is a crucial part of the way forward for small farm families.

76. Since the 1980s, Asia's success in raising cereal production has moved many importing countries from an import parity regime of high cereal prices and a focus on foodgrain self-sufficiency to a situation of a more secure foodgrain supply, with trade balancing out shortfalls or surpluses. Until the recent spikes, real prices of foodgrains declined, thus raising the relative prices of more commercial crops. The more secure cereal supply and better-connected markets as rural infrastructure improved opened the door for diversification of farming, as farm families gained confidence that they could buy rice or wheat flour in local markets at predictable prices. Rapid urbanization and income growth in Asia have fueled growth in demand for the relatively income-elastic foods such as livestock products, fruits, and vegetables, in forms that reflect greater value addition in quality control, processing, and packaging. Despite the recent price spikes, rice is becoming an inferior good for many Asians due to higher incomes, urbanization, and changing food preferences.⁸⁶ This trend will continue as Asia grows. The declining dietary role of starchy staples is observed almost universally as economies develop. In short, there is unlikely to be a bright future in growing rice or wheat on small farms, although the recent rise in prices offers some respite if world price signals are transmitted to the farm level. However, over the medium term, it is safe to bet that if small farmers are to prosper, they must diversify and commercialize.

77. A farm-level shift from foodgrains to commercial crop production depends on the dynamics of market demand and developments in the marketing system. The rapid expansion of supermarkets and modern procurement systems is exerting tremendous pressure on farmers for competitive efficiency.⁸⁷ As compared with the Green Revolution of the 1970s, a central feature of this new agricultural transformation is that it is led almost entirely by the private sector.⁸⁸ A concern is whether Asia's small and so-called "marginal" farmers have the technical knowledge, access to market information, financial wherewithal, and capacity for responsiveness and risk bearing that market-led commercial agriculture requires. If modern marketing systems are to bear the transaction costs of dealing with small farmers,

⁸⁴ Seminal work on this topic is found in B. Johnston and J. Mellor. 1961. *The Role of Agriculture in Economic Development*. *American Economic Review*. Vol. 51. An excellent historical perspective and analysis of present-day Asia is contained in C.P. Timmer. 2007. *The Structural Transformation and the Changing Role of Agriculture in Economic Development: Empirics and Implications*. Wendt Lecture, American Enterprise Institute. Washington, DC.

⁸⁵ K. Anderson. 2009. *Distorted Agricultural Incentives and Economic Development: Asia's Experience*. School of Economics. University of Adelaide. Australia.

⁸⁶ Timmer (footnote 50) presents a concise statement of the dynamics of food demand in Southeast Asia.

⁸⁷ T. Reardon, C.P. Timmer, and B. Minten. 2010. *Supermarket Revolution in Asia and Emerging Development Strategies to Include Small Farmers*. *Proceedings of the National Academy of Sciences*.

⁸⁸ Asian governments are keen to take advantage of the agribusiness trade opportunities that globalization and World Trade Organization negotiations will offer, and it is generally accepted that this must also be private sector-led.

then farmers must be able to compete on the basis of quality, reliability, and efficiency. Asia's resource-poor farmers could be bypassed.

78. Public intervention should focus on efficiency, not farm fundamentalism. However, since rural votes often win elections, the political dimension of farm policy will also be important. There are three pitfalls for policy makers to avoid:

- (i) continued benign neglect, with the risk that small-scale subsistence farming becomes a "poverty trap" (Hazell, footnote 83);
- (ii) inefficient subsidies that may let subsistence farmers survive, but fail to help them thrive by putting them on an efficient, competitive path out of poverty; and
- (iii) taking a top-down, interventionist approach to supporting commercial agriculture by picking winners and trying to compete with or circumvent the more efficient private sector.

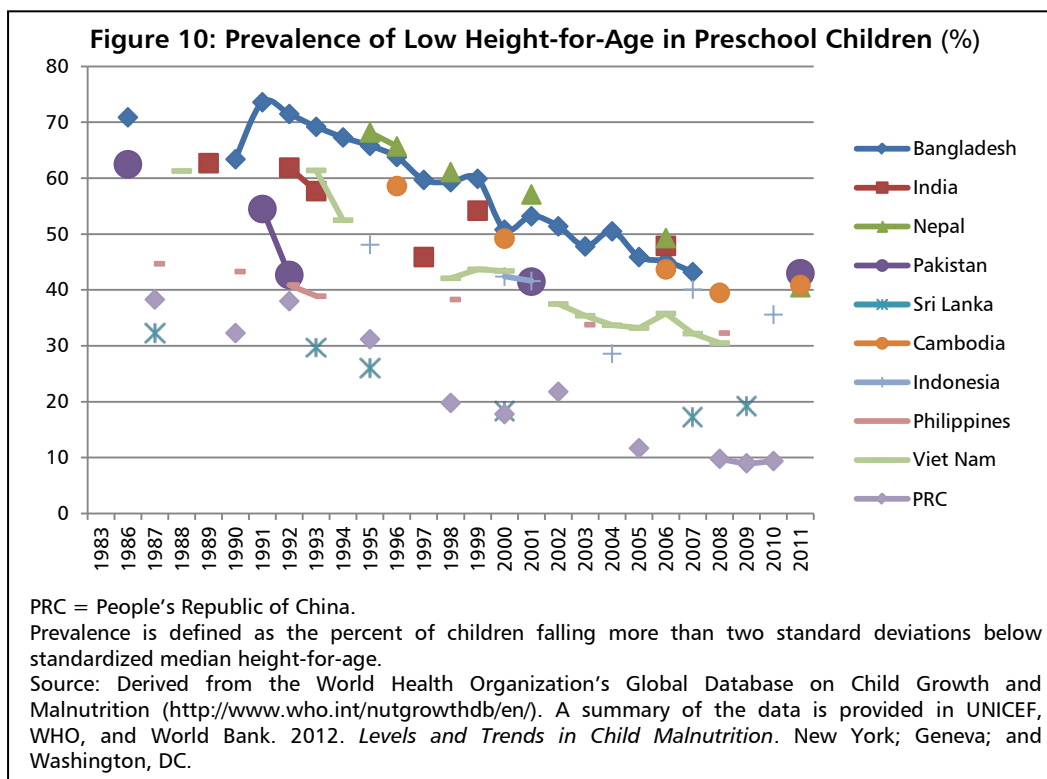
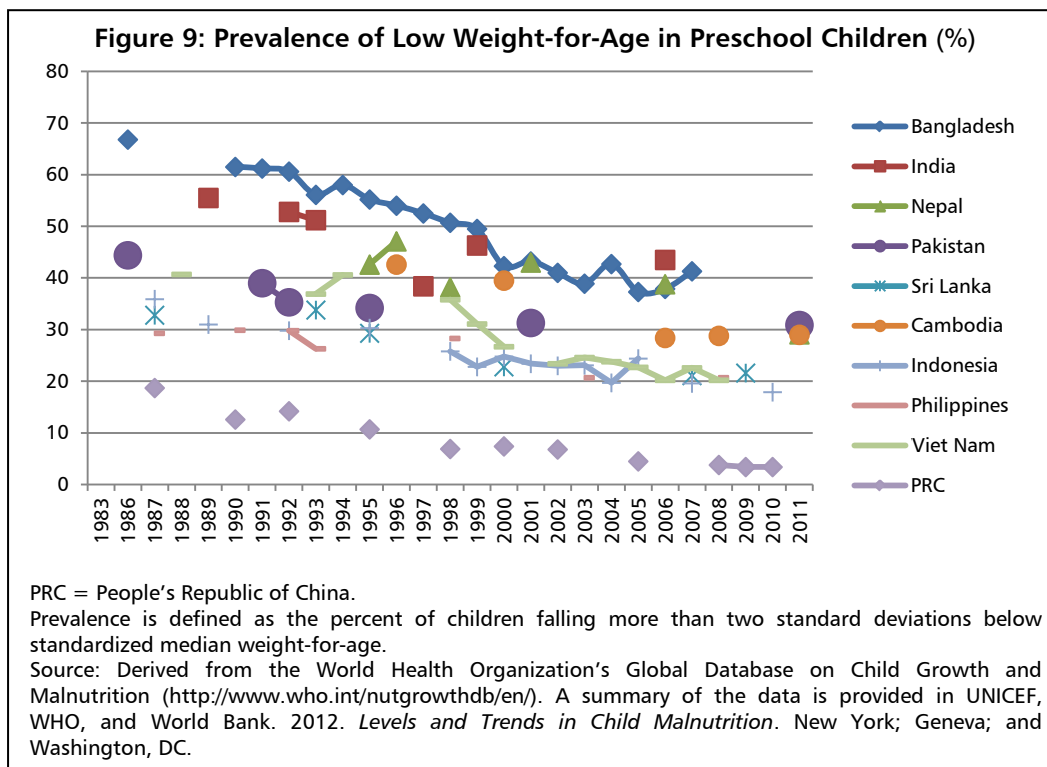
79. Looking at the issue globally, Hazell concluded that small subsistence farmers are unlikely to adapt and survive without subsidies. If so, the critical challenge is to make the subsidies "smart," i.e., they should complement the market, provide opportunities to farmers but also demand their initiative and efficiency, and be time-bound. Numerous approaches have been tried—extension and farmer training, marketing cooperatives, credit, contract farming, engaging nongovernment organizations, and innovative public-private partnerships. The public sector can facilitate but not lead the process. An impediment observed in many Asian countries is that agriculture ministries have traditionally viewed farmers as their sole clients. They often do not understand or feel comfortable working in partnership with the private sector in agricultural value chains.

80. Reardon and his colleagues (footnote 87) have studied Asia's "supermarket revolution" in depth and created a typology of the diverse range of arrangements that emerged in different countries as supermarket chains established procurement and quality control chains down to rural producers. Most of these arrangements were entirely initiated and financed by the private sector. There are encouraging examples of public-private partnerships and purely public initiatives that specifically try to link small farmers to markets, e.g., the large "food parks" in India that will be major procurement and processing centers and smaller "hubs" that serve farmers directly in supplying farm inputs and credit, and in procuring raw produce. They also describe a new paradigm for producer cooperatives that entails a shift from the traditional top-down cooperative approach to a model that focuses membership on specific target markets, and requires joint investment and profit sharing by the cooperative members. It is too early to assess whether these approaches can be sustained and replicated, which will depend on their meeting the challenge of ensuring quality and reliability of supply and minimizing transaction costs in what is one of the world's most competitive industries.

C. Addressing Malnutrition

81. Malnutrition is an elusive Millennium Development Goal. Globally, too many preschool children in the developing countries are underweight or stunted (low height for age). Even before the food price crisis, malnutrition in children remained stubbornly high despite decades of declining real food prices, rising incomes, and rapid poverty reduction. The global food and financial crises of the last half decade have contributed to higher malnutrition risk in many regions. According to the United Nations Children Fund (UNICEF), 30% of children under 5 in Asia-Pacific are underweight, topping Sub-Saharan Africa, where the figure is 28%. Bangladesh, India, and Pakistan together account for half the world's underweight children. Bangladesh, PRC, and Southeast Asia have made significant progress in reducing child malnutrition, but prevalence rates in India and Pakistan have changed little in more than a decade (Figures 9 and 10).⁸⁹

⁸⁹ Overweight is an increasing health concern in fast-growing and urbanizing countries of Asia. However, WHO data show that, with few exceptions (most notably Indonesia and parts of Central Asia), overweight is not increasing significantly among preschool children, who are the major concern here.



82. Adequate nutrition in early childhood is essential for healthy growth, a strong immune system, and good physical and cognitive development. Stunted children complete fewer years of school and earn less income as adults. Children affected by undernutrition between conception and 24 months of age have a higher risk of failing to reach their lifelong physical and mental potential, and hence they will not make a full economic contribution to their households and communities as adults. The economic costs of undernutrition in terms of lost national productivity are estimated to range from 2% to 3% of GDP in some countries. Hence, malnutrition is both a consequence and a cause of poverty.

83. The seeming paradox of persistent malnutrition in the presence of adequate food supply and lower poverty reflects multiple “slips ‘twixt the cup and the lip” that influence how effectively household food supply translates into the nutritional and health status of preschool children and nutritionally vulnerable women. The “slips” are complex, involving inadequate food access at the household level, intrahousehold food distribution that reflects gender and age bias, the nutritional content of foodstuffs accessible to the household, cooking and feeding practices, household hygiene, water supply and sanitation, exposure to infectious disease, and parental knowledge.

84. Tough problems rarely have simple solutions. In a synthesis of 46 impact evaluations of nutrition projects, including 12 projects financed by the World Bank, highly mixed results were found.⁹⁰ Because of the complexity of malnutrition, the projects usually had multiple components, including cash transfers, child day care, feeding and food transfers, food for work, growth monitoring, nutrition education, micronutrient supplementation, and child and maternal health care. Most of the projects were implemented in countries or regions of low institutional capacity. Because of the complex, multidimensional causes of malnutrition and the subtle impacts of the interventions on child nutrition and growth over time, the task of evaluation is itself extremely complicated.

85. Many interventions had a positive impact on the key anthropometric indicators. However, there was no clear pattern of impacts across interventions—in every intervention group there were examples of programs that did or did not have impact. Across countries, variations in the local environment, in the ages of the children studied, and in the length of exposure to the intervention, and differing evaluation methodologies accounted for much of the variability in results. Evidence on the distribution of nutrition impacts across demographic groups is scant. In the World Bank-financed projects, three quarters of the evaluations found a positive impact on nutritional outcomes of children in at least one age group, but the magnitude of the impact was in some cases not large. Moreover, the evaluations provided little evidence on cost-effectiveness.

86. Hence, the multidimensional nature of malnutrition may not readily lend itself to large-scale, “results-oriented” development projects that try to address many dimensions of malnutrition at once. However, there are ways in which some of the underlying causes of malnutrition can be addressed on a simple and cost-effective scale. Small-scale, community-managed water supply and sanitation systems based on simple technologies are often relatively inexpensive to include in rural investment projects such as irrigation and roads without overly complicating the project design. Experience has shown that there is usually a high demand for improved water supply in water-scarce communities, particularly among rural women, for whom the time savings can be enormous. Community-based approaches using locally available materials can be sustainable. Micronutrient supplements—iodized salt, vitamin A, and iron—are cheap, have proven effective, and can be distributed as part of larger rural infrastructure projects, possibly in partnership with NGOs and specialized international organizations such as the World Health Organization and UNICEF. Finally, there is promise for biofortification, i.e., breeding crop varieties with higher nutrient content. One example is Golden Rice, which is high in beta-carotene, a

⁹⁰ Independent Evaluation Group. 2010. What Can We Learn from Nutrition Impact Evaluations? Lessons from a Review of Interventions to Reduce Child Malnutrition in Developing Countries. Washington, DC: World Bank.

precursor of vitamin A.⁹¹ Work on other crops and nutrients (mainly iron and zinc) is ongoing within CGIAR and its partner organizations. Zimmerman and Qaim estimated the internal rate of return to investment in Golden Rice to lie between 66% and 133%, depending upon the level of benefits.⁹² In a synthesis of the empirical literature, Mogues et al. (Box 2) concluded that the economic benefits of biofortification are high, whether measured by the internal rate of return or by using the health profession's benchmark of averted disability-adjusted life years.

D. Food Policy in a Less Secure World⁹³

87. The food crisis and the vulnerability it reveals prompt the question of whether rethinking is in order on what sensible food policy should be. Thirty years ago, Timmer, Falcon, and Pearson (footnote 93) produced a textbook on food policy analysis that remains a classic in the field. They applied fundamental micro- and macroeconomic principles to the analysis of policy choices in the domestic food economy, centering on four basic objectives: (i) efficient growth of agriculture and food production; (ii) improved income distribution, primarily through efficient employment creation; (iii) satisfactory nutritional status for the poor; and (iv) adequate national food security to insure against bad harvests, natural disasters, and uncertain world food supplies and prices. The authors recognized that the weights given to these objectives would vary across countries and over time. The task for the food policy analyst is to assess the relative effectiveness of alternative interventions in achieving these food policy goals, and to evaluate their associated costs, i.e., their economic efficiency. World prices usually provide the best benchmark for assessing efficiency, since all countries face the choice between domestic production and international trade in acquiring food, or indeed any other commodity. The fundamental dilemma of food policy is the double-edged sword of the "food price." High food prices hurt consumers in the short run, but low prices do not provide the incentive for farmers to increase production in the longer run. This dilemma is particularly acute in developing countries, where poor people live close to the margin and where farmers, who are often poor, make up a large share of the population. The challenge of food policy is to find the best balance between high and low food prices in achieving the conflicting goals of efficient growth and protecting the poor, bearing in mind that the rural poor benefit greatly in the long run from price policies that stimulate a dynamic agriculture sector.

88. Since the 1980s, the "Washington consensus" has stood for orthodox economic policy: Efficient growth is best achieved by liberalizing trade, deregulating markets, reducing untargeted subsidies, shutting down inefficient state-owned enterprises, and encouraging expanded roles for the more efficient, dynamic private sector. In agriculture, this approach made a lot of sense in an era of rapidly growing food supplies, falling real prices, and confidence that the trends would continue. The view of many was that the "food problem" had essentially been solved, although mopping up was needed to address lingering rural poverty and protect the urban poor. After the peak years of the Green Revolution, and with public sector roles greatly streamlined in many countries, benign neglect of agriculture set in.

89. The G20 recommendations⁹⁴ follow the orthodoxy, calling for "*international disciplines* (sic) on all forms of import and export restrictions, as well as domestic support schemes that distort production

⁹¹ Work on Golden Rice reflects a partnership of national and international institutions, and the private sector, including IRRRI and Helen Keller International. Because Golden Rice is genetically modified, it requires approval by national authorities before it can be distributed to farmers and consumers.

⁹² R. Zimmerman, R., and M. Qaim. 2004. Potential Health Benefits of Golden Rice: A Philippine Case Study. *Food Policy*. Vol. 29.

⁹³ This section has benefitted greatly from the work of C.P. Timmer, W. Falcon, and S. Pearson. 1983. *Food Policy Analysis*. World Bank: Johns Hopkins University Press; and C.P. Timmer. 2011. *Managing Price Volatility: Approaches at the Global, National, and Household Levels*. Stanford Symposium Series on Global Food Policy and Food Security in the 21st Century. Stanford University: Center on Food Security and the Environment.

⁹⁴ Jointly prepared by the Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations Conference on Trade and Development, World Food Programme, World Bank, World Trade Organization, International Food Policy Research Institute, and United Nations High Level Task Force on Global Food Security, June 2011.

incentives, discourage supply in response to market demand, and constrain international trade of food and agriculture products.” The call for reduced “trade distorting domestic support” is tempered somewhat by aiming it mainly at the developed countries. The recommendations call for safety nets to protect the poor, but say less about other direct public interventions in domestic markets. In effect, the recommendations call for transmission of world prices signals to domestic markets in order to stimulate a supply response, with safety nets to reduce collateral damage while the supply response is awaited.⁹⁵ This advice may be sound in some cases, but is a blanket approach right for all countries?

90. There are very good reasons to be concerned about world price transmission. Higher prices provide a powerful incentive for agricultural growth. There is no doubt that the supply response is the only long-run solution for food scarcity. Well-off consumers can and should adjust when relative prices change. When large countries take sudden, drastic steps to insulate themselves from world prices, they intensify the volatility in the world market.

91. In the short run, however, allowing full transmission of volatile world prices to domestic markets and subjecting poor people to external market forces will be risky for politicians worried about restive urban populations. What might have happened in Asia if full transmission had occurred during the recent price spikes, especially for rice in 2008? In a less secure world, there will be political pressure to intervene in markets in order to reestablish control of food prices and supplies through international and domestic trade restrictions, buffer stocks, public food distribution, and subsidies to consumers and producers. The political and economic dimensions of the problem are both of importance in the eyes of policy makers. As Timmer aptly put it, “Governments that fail to stabilize food prices have failed in the provision of a quite basic human need that is rooted in behavioral psychology—the need for a stable environment. Governments that are successful in stabilizing food prices are usually rewarded politically.”⁹⁶

92. The principles of food policy analysis have not changed, nor has the economist’s job of quantifying the costs and benefits of policy options. Border prices remain the best benchmark for assessing the opportunity costs of policy choices on domestic production and consumption. However, if high and potentially more volatile food prices are the “new normal,” there is a need to recognize the political economy of food policy. Policies that are second best in terms of economic efficiency may be first best from a political perspective. Policy advisers who do not accept this may find their advice falling on deaf ears. Public interventions may be second best, but they can at least be designed with a view to limiting both the efficiency losses and political costs, and avoiding unwanted repercussions in domestic and international markets.

93. Safety nets, if well designed and targeted, can be an effective subsidy,⁹⁷ but they also present challenges. They are not always the best way to dampen price transmission to the poor, particularly in geographically dispersed rural areas where the poor are hard to reach. Many countries do not have existing safety net programs that they can readily ramp up in times of crisis, and most governments do not want to maintain the schemes when a crisis ebbs. Safety nets demand scarce institutional capacity. Even the best are prone to leakage. As with general price subsidies, once safety net programs are in place, they may become politically difficult to remove. Hence, safety nets are best viewed as one option in the policy maker’s toolbox for addressing the impacts of high food prices. They are likely to be relevant and cost effective in some contexts but not necessarily in all.

⁹⁵ Since the G20 recommendations were finalized, the World Bank has become more forceful, arguing explicitly that transmission of global prices is essential. World Bank. 2012. *Transmission of Global Food Prices to Domestic Prices in Developing Countries: Why It Matters, How It Works, and Why It Should Be Enhanced*. Contribution from the World Bank to the G20 Commodity Markets Sub Working Group.

⁹⁶ C.P. Timmer. 2012. *Food Security and Political Instability in East and Southeast Asia*. Paper prepared for the workshop on *Food Security and its Implications for Global Stability*. Cornell University.

⁹⁷ One example is the Ethiopian Poverty Safety Net Program, which improved food security for 7.8 million people through cash for work and unconditional cash transfers coupled with unconditional food aid for those unable to work. See C. Arnold, T. Conway, and M. Greenslade. 2011. *Cash Transfers Literature Review*. London: DFID.

94. From the standpoint of longer-run efficiency and effectiveness, it may be better to buffer rural incomes by creating employment (e.g., through public works to rehabilitate roads and irrigation) and/or by addressing the underlying issue of agricultural productivity (e.g., by delivering extension and farm inputs in poor areas). In urban areas, as an alternative to creating permanent safety net programs, governments could consider maintaining a modest reserve of lower-quality rice or wheat, not for price stabilization, but for quick distribution at subsidized prices if and when market prices spike. Because the food is of less preferred quality, the program would be self-targeting. For efficiency, such a program would be financed by the government but implementation would be outsourced to the private trade. At relatively low cost, such a reserve would allow governments to announce that they stand ready to make food available to protect the poor.

VI. Lessons: Has ADB Done Things Well and Could It Do More?

95. The world should not take food security for granted. While international funding responded to the food crisis, no judgment is possible yet on whether the response is adequate in amount and targeting, and whether it will be sustained. World attention may well turn to other issues if food prices, as projected, stabilize and if global trade in food returns to normal patterns. Yet all the evidence of environmental and economic stresses on agriculture suggests strongly that if the fundamental sources of stagnating productivity in developing country agriculture are not addressed, soaring and volatile food prices could return. Addressing the problems meaningfully requires long-term commitment. The highest priorities are agricultural research and technology diffusion, including strengthening of capacities within national research and extension systems after decades of decline, and continued investment in rural infrastructure, particularly in roads and more efficient irrigation.

96. Obviously, the initiative must start in the developing countries themselves through their own efforts and requests for support from the international community. Evaluations have shown repeatedly how critical country ownership is to the successful design, implementation, and impact of development programs.

97. In addition, continued commitment and funding to the sector is required by bilateral and multilateral development agencies. Recently, ADB has moved away from integrated projects addressing the complexities of food security. Instead, ADB focuses its investment on infrastructure that enhances connectivity (agricultural roads) and productivity (irrigation). These projects have performed well but do not always benefit the poorest. The agriculture synthesis paper of the Evaluation Cooperation Group of the multilateral development banks⁹⁸ found that an overarching element of project effectiveness concerns the extent to which the complementarities and synergies across sectors—infrastructure, education, health, the environment—are leveraged. The strong interdependence and backward-forward linkages between agriculture and other sectors indicate the need for cross-sector approaches. Exploiting this cross-sector synergy and complementarity helps capture and respond to the needs of farmers and entrepreneurs and promotes growth in the agriculture and agribusiness sector. The importance of complementarity and linking with other sectors is highlighted in a recent IED impact evaluation in Nepal (Box 3).

⁹⁸ Evaluation Cooperation Group. 2011. *Evaluative Lessons for Agriculture and Agribusiness*. 2011.

**Box 3: Independent Evaluation Department Impact Evaluation
of Shallow Tubewell Irrigation in Nepal**

The shallow tubewell (STW) irrigation project in Nepal, in part of the Terai region, where there is ample groundwater, provided STWs through loans without collateral to water user groups (WUG) of 3–5 members. The impact evaluation compared results for 1,000 project farm households with a comparator group of 500 farm households that accessed STW irrigation with subsidized capital costs, and a control group of 1,000 similar households without access to irrigation.^a The study found that providing STW infrastructure alone was not sufficient to generate tangible welfare impacts; irrigation was not the only missing ingredient. The impact evaluation found that project design had not factored in the key requirement for reliable energy to operate the STW pumps. Diesel prices had increased in real terms, while occasional and irregular diesel shortages did damage in making diesel pump based irrigation farming less secure than it should be. Power cuts averaged 16 hours a day when electric pump based STW irrigation is needed most. This caused many farmers to not plant their entire plot. In addition, there were shortages of fertilizer during the critical application times. In combination, crop yield and cropping intensity remained much lower than expected.

Source: Independent Evaluation Department. 2012. *Impact Evaluation Study: Shallow Tubewell Irrigation in Nepal: Impacts of the Community Groundwater Irrigation Sector Project*. Manila: ADB.

^a In the absence of baseline data, the quantitative impact estimation adopted the propensity score matching method, commonly used in ex-post impact evaluation studies.

98. **Agriculture.** From the 1990s until the food crisis started in 2007, most of the multilateral development banks—the World Bank, IADB, and ADB—scaled down their agriculture sector operations.⁹⁹ There were two underlying reasons. In Asia, there was optimism in the banks and in the finance and planning ministries of the developing countries that the problems of food supply and food security had essentially been solved. In this view, agriculture was a “sunset sector.” Second, agriculture is inherently complex and has historically been a difficult sector for the banks, with postevaluation success rates regularly falling well below those in other sectors, especially large-scale infrastructure.

99. More recently, however, evaluation evidence has accumulated to show that the banks have done many things well in supporting agriculture and food security, and, equally important, they have learned how to do things better over time. In a detailed analysis, IED¹⁰⁰ concluded that the design and performance of ADB operations in agriculture and natural resources have improved steadily and, from 2001 onward, have equaled the average of all other ADB sectors.¹⁰¹ The World Bank recently reached a similar conclusion about its agriculture sector operations.¹⁰² A 2012 IED evaluation of ADB’s work in value chain development was also positive about the relevance and effectiveness of operations in commercial agriculture and agribusiness.¹⁰³ Hence, it appears that concern about ADB’s weak performance in agriculture is no longer justified. In the case of ADB, the improvement is attributed to

⁹⁹ IFAD is devoted exclusively to agriculture and rural development, but with a global mandate and limited resources, it cannot match the potential financing impact of the multilateral banks. IFAD’s annual loan and grant operations almost doubled from 2007 to 2011—from \$550 million to about \$1 billion—but still remain modest in comparison with the World Bank and ADB. IFAD. 2012. *Annual Report 2011*. Rome.

¹⁰⁰ IED. 2012. *2012 Annual Evaluation Review*. Manila: ADB.

¹⁰¹ ADB had prepared a synthesis of agriculture sector evaluations just two years earlier (IED. 2010. *Sector Synthesis: Performance of ADB Assistance to Agriculture and Natural Resources—Evidence from Post-Completion Evaluations*. Manila: ADB), but at that time the available evaluations of operations approved from 2000 onward was considered too small in number to allow performance comparisons with earlier time periods.

¹⁰² Independent Evaluation Group. 2011. *Growth and Productivity in Agriculture and Agribusiness: Evaluative Lessons from World Bank Group Experience*. Washington, DC: World Bank.

¹⁰³ IED. *Evaluation Knowledge Study: Support for Agricultural Value Chain Development*. Manila: ADB.

better project designs that entail greater community and private sector participation; provide synergistic components in infrastructure, agriculture, rural support services, and capacity development; and have greater focus on market-driven value chains.¹⁰⁴ IED calls this the “agriculture-plus” approach. Agriculture-plus combines ADB’s forte—infrastructure—which directly supports the environment for private sector investment, with components that directly target and accelerate benefits for farmers and the rural poor.

100. As of 2009, ADB had financed 53 commercial agriculture and agribusiness operations in 17 countries, all of which were designed in partnership with and implemented mainly by public agriculture agencies. The IED study (footnote 100) identified the prerequisites for a successful take-off of commercial agriculture and agribusiness: (i) assured market demand—whether domestic or international—for higher valued foods with a higher degree of post-harvest processing; (ii) a policy, legal, and regulatory environment that facilitates (or at least does not restrict) private sector investment; (iii) access to formal finance; (iv) adequate rural infrastructure; and (v) market information for all participants.¹⁰⁵ If specific target groups exist (marginal farmers and women), then initiatives to organize, train, and otherwise support them may be needed. Projects under the responsibility of public agencies should create opportunities for private sector engagement by encouraging private investment and innovation in competitive, market-responsive value chains. The study found that the greatest impacts of ADB-financed projects had been on the production end of the value chain. Hence, it is crucial that project managers stay focused on upstream market drivers of commercial agriculture, and not just on production opportunities based on local comparative advantage. The study recommended greater attention during project design to systematic value chain analysis in order to create higher-level value chain linkages. The risk, of course, is that by identifying and analyzing specific value chains, a project may be locked into a few preselected “winners.” Hence, there is a need for flexibility in design to allow innovation and the entry of new participants in response to emerging market opportunities.

101. **Agricultural research.** ADB has supported international agricultural research since 1975, mainly through grants for project-based support to CGIAR and other international centers. From 1975 to 2007, ADB invested a total of about \$91 million in agricultural research. By comparison, the World Bank had provided about \$110 million annually as of 2008, comprising unrestricted funding of \$50 million to CGIAR and competitive grants of about \$60 million open to all other research institutions. IFAD supports research at an annual level of about \$15 million to CGIAR and non-CGIAR institutes. From 2000 through 2007, annual ADB funding averaged only about \$3 million annually. Moreover, during the last 10 years, ADB has supported an increasingly narrow group of CGIAR centers.¹⁰⁶ In addition, recent grants have been designed largely by ADB rather than in response to the priorities of the CGIAR system.

102. Two evaluations of ADB’s support to international agricultural research were very positive.¹⁰⁷ The 2008 evaluation concluded that ADB had made substantial contributions to generating improved technologies and knowledge. Despite its relatively modest level, this support was able to leverage major scientific innovations in the international centers and cooperating national systems. The 2000 evaluation was equally positive about the relevance and effectiveness of ADB support. That study estimated that internal rates of return to a sample of ADB-financed grants to the international centers

¹⁰⁴ Other contributing factors include ADB’s reduced engagement in the weakly performing areas of fisheries, forestry, livestock, and traditional policy-based program lending.

¹⁰⁵ A similar set of necessary conditions for the success of agribusiness interventions was identified by the World Bank in a synthesis study of its own public and private sector operations (footnote 98).

¹⁰⁶ ADB. 2012. Review of ADB Operational Plan for Sustainable Food Security 2010–2012. Version 1. Agrifood Consulting International. Manila.

¹⁰⁷ (i) IED. 2000. *Special Evaluation Study: Policy Implementation and Impact of Agriculture and Natural Resources Research*. Manila: ADB; and (ii) IED. 2008. *Special Evaluation Update: Policy Implementation and Impact of Agriculture and Natural Resources Research*. Manila: ADB.

ranged from 45% to 91%. Those findings are consistent with other studies of the returns to agricultural research.¹⁰⁸

103. There are huge scientific challenges in breeding climate-resilient crops—to say nothing of simultaneously raising crop productivity in order to feed the world’s projected 9 billion people in 2050. Meeting these challenges, which is by no means certain, will require a long-term commitment. ADB’s charter may prevent it from providing unrestricted funding to CGIAR. While ADB’s 1995 policy on agricultural research commits to an annual level of \$6 million in restricted funding, actual funding has been well below this since 2000 (footnote 106[ii]). ADB funding of international agricultural research fell by 43% in the decade 2001–2010 as compared with 1991–2000. Moreover, while the investment in international agricultural research has been highly effective, there has been limited complementary support to national research and extension systems. Adapting new farm technologies to local conditions and disseminating these technologies to farmers largely happens in the national systems.

104. **Crisis responses and safety nets.** IED’s natural disasters evaluation¹⁰⁹ found that ADB performed well in its natural disaster recovery projects. However, greater attention and emphasis are needed in restoring livelihoods and institutions, as well as in balancing recovery and prevention activities through policy dialogue and lending, particularly in high-risk countries. The Bangladesh case study found that the Government was especially appreciative that ADB’s budgetary support addressed food security by making the connection among disaster, vulnerability, and poverty.

105. ADB’s direct response to the food crisis was modest. ADB financed a number of quick-disbursing food crisis operations, with two of the larger programs being in Bangladesh and Cambodia. The Cambodia Emergency Food Assistance project supported food distribution to vulnerable groups, food for work, distribution of seed and fertilizer to small farmers, and development of an emergency food reserve system. A second round of financing focused on agricultural development was recently approved with support under GAFSP. According to the completion report for the Bangladesh Emergency Assistance for Food Security Project, ADB financing successfully contributed to the government’s existing safety net programs by providing food for work and free or subsidized distribution of rice to vulnerable households.¹¹⁰

106. In separate responses to the global economic downturn of 2008–2009, ADB provided quick-disbursing crisis support to 19 countries. Some of these loan funds were used to support social protection and safety net programs, and hence they were relevant to addressing impacts of high food prices in Bangladesh, Philippines, Tajikistan, and other hard-hit countries. IED evaluated these programs in 2011 and found them to be relevant and responsive in achieving their principal objectives.¹¹¹ Evaluation lessons emphasized the importance of monitoring, readiness, and timeliness of response on the part of ADB, and the need to ensure adequate capacity and preparedness of social protection and safety net programs in the developing countries.¹¹² A 2012 study of social protection found that an ADB-supported conditional cash transfer program in the Philippines was more efficient and effective than other subsidy-based programs.¹¹³ The study also suggests that, as climate-induced natural disasters—floods and droughts—are likely to result in pockets of food-insecure populations from time to time (e.g., Bangladesh, Cambodia) and food price inflation is likely to remain variable, it may be more efficient for ADB to provide support to safety nets during stable years rather than to respond to food-related crises as they occur.

¹⁰⁸ Renkow and Byerlee provide an excellent synthesis of evaluation studies of the impact of CGIAR research. M. Renkow and D. Byerlee. 2010. *The Impacts of CGIAR Research: A Review of Recent Evidence*. *Food Policy*. CGIAR.

¹⁰⁹ IED. 2012. *Special Evaluation Study of ADB’s Response to Natural Disasters and Disaster Risks*. Manila: ADB.

¹¹⁰ ADB. 2012. *Completion Report*. Bangladesh: Emergency Assistance for Food Security Project. Manila.

¹¹¹ IED. *Real-time Evaluation of Asian Development Bank’s Response to the Global Economic Crisis of 2008–2009*. Manila: ADB.

¹¹² Similar generic lessons emerged in the World Bank’s evaluation of its crisis response operations. See Independent Evaluation Group. 2012. *The World Bank Group’s Response to the Global Economic Crisis*. Washington, DC: World Bank.

¹¹³ IED. 2012. *Special Evaluation Study of ADB’s Social Protection Strategy 2001*. Manila: ADB.

107. Although it was not yet possible to fully evaluate how effective the responses were in protecting poor consumers and stimulating agricultural supply, the World Bank's recent evaluation of its GFCRP¹¹⁴ provides five main lessons: First, a detailed strategic framework for crisis response—which the World Bank Group had in this case—is necessary but not sufficient for the effectiveness of interventions. Second, expansion in the scale of operations requires commensurate enhancement of administrative budgets to ensure success. Third, owing to the small amount of additional funding made available, many countries received only modest support that could not have had significant crisis-mitigating impacts. Fourth, the effectiveness of increased lending depends critically on adequate analytical work and staff resources. Finally, for short-term responses to food price crises—as for other kinds of crises—having social safety net systems in place before a crisis hits is key to protecting vulnerable households and individuals.

108. Outside of the GFCRP, the World Bank also has a large portfolio of safety net operations. About 200 of these were approved during 2005–2011, many addressing needs that were intensified by the food crisis. Some were adjusted as appropriate when the food crisis hit. Hence, the total coverage of World Bank assistance for the food crisis is considerably more extensive than that provided under GFCRP alone.

109. In 2011, the World Bank undertook a major evaluation of its experience in social safety net programs, covering 242 lending operations in 83 countries that financed conditional and unconditional transfers, and public works programs.¹¹⁵ As also highlighted in ADB's evaluation of its crisis lending, the World Bank study found that safety net programs are most effective when they operationalize or upscale pre-existing programs rather than creating these from scratch when a crisis is already in full swing, particularly in lower income countries, where capacity is limited. Major challenges in formulating safety nets include transparent governance and effective targeting, which minimize leakage. The short-term impacts of safety nets are often positive, but there is less evidence on longer term impacts. Fiscal sustainability and politicization are risks to the effectiveness of safety nets. Downscaling subsidies and free services after a crisis has passed may prove politically difficult.

110. **Programmatic support.** Although reactive rather than proactive, well-designed quick-disbursing programs do help vulnerable people and countries in times of crisis. However, while the crisis programs have dealt with the immediate crisis impacts, they do not address the underlying productivity issues, nor are they financially sustainable in the long run. A goal should be to make the safety nets as productive as the situation allows, e.g., by distributing seed and fertilizer to poor farmers, as recommended by FAO,¹¹⁶ or by channeling funds into labor-intensive public works programs such as rehabilitating roads and irrigation systems. It should be relatively straightforward for local authorities to maintain an inventory of vulnerable rural communities and high-priority civil works so that programs can start up quickly when funds are needed and available. The programs need to be well governed and targeted, clearly time-bound, and as free from politicization as possible.

111. The vulnerability revealed by the food crisis potentially widens the need for flexible policy-based or programmatic lending to foster more productive and resilient agricultural systems. In a more uncertain world, where food insecurity potentially brings large political risks, there may be a role for ADB in providing nuanced food policy advice and financing to its DMCs. As decision makers ponder the

¹¹⁴ As of June 2013, more than half of the World Bank's GFCRP operations were still ongoing. Of the closed operations—including larger operations which contained GFCRP-financed components—only two-thirds were rated moderately satisfactory or better by the Independent Evaluation Group (IEG). Moreover, the quality of monitoring and evaluation for more than 60 percent of GFCRP operations was rated by IEG as modest or negligible. However, the outcome ratings for GFCRP operations are similar to project ratings for operations in Africa and in low-income countries in the World Bank portfolio as a whole. See IEG. 2013. *The World Bank Group and the Global Food Crisis: An Evaluation of the World Bank Group Response*, Washington, DC: World Bank. June.

¹¹⁵ Independent Evaluation Group. 2011. *Social Safety Nets: An Evaluation of World Bank Support, 2000–2010*. Washington, DC: World Bank.

¹¹⁶ FAO. 2009. *Responding to the food crisis: synthesis of medium-term measures proposed in inter-agency assessments*. Rome.

policy choices, they need to avoid the costly policy mistakes—export bans, domestic price and trade controls, or retreat into autarky—that occurred after the 2008 spike in food prices. Decisions should be based on sound economic analysis of the options, and in recognition of the political pressures that high food prices can spark. Policy makers need to appreciate the critical role that price signals play in ensuring an efficient medium- to long-term supply response, together with complementary support from agricultural research, extension, and farmer education. They also need to understand the ways in which food demand is changing with urbanization and rising incomes, and how these demand changes will influence a dynamic agriculture sector. They will benefit from sustained support to ensure that the initial choices made in the face of crisis, if not first best, are at least the best among the second best and can transit toward first best over time. If safety nets or other types of subsidies are under consideration, analysis and advice should seek to make these as efficient and time-bound as possible.

112. Successive ADB evaluations of program lending¹¹⁷ have concluded that there has been too much complex conditionality in ADB's past approach. Agriculture sector programs loans during 1990s focused on accelerating growth by liberalizing markets, reducing public interventions in the agriculture sector, and enhancing efficiency in input and output markets by reducing subsidies and allowing private sector entry. The main objective was efficiency, not food security. Overall, these programs had mixed impacts, and the sustainability of the reforms was often questioned. While there is potentially a useful role for programmatic lending in today's environment, it will need to be more flexible and responsive than in the past.

113. Phased, or adaptive, program lending offers one instrument to provide such support. Traditional programs with excessively complex conditionalities and strict time frames for policy actions will be even less suited to an uncertain, volatile environment. An internal review in 2011 recommended that ADB follow the World Bank model by mainstreaming programmatic budget support based on prior policy-related actions,¹¹⁸ rather than setting a rigid blueprint of future policy actions in advance. Under this approach, the policy framework could comprise a statement of goals to be achieved over a given time frame, say 10 years, together with an initial set of specific steps and a plan for results monitoring, based on which the subsequent phase would be formulated.

114. **Regional cooperation.** Given the trade-related international dimensions of the food crisis, ADB is playing a unique and potentially catalytic role by facilitating regular regional dialogue on food and agriculture. Ultimately, this could result in ADB investments that better integrate regional markets and food systems. The most relevant example is ADB's TA to the Association of Southeast Asian Nations on integrated food security. This is a challenging initiative, given the conflicting interests of the region's importing and exporting countries. Since 2002, ADB has also supported the Greater Mekong Subregion Working Group on Agriculture, including several ministerial level meetings focused on cross-border food safety, transboundary control of animal diseases and invasive species, climate change, flood and drought, and other topics. In partnership with FAO, ADB has facilitated cooperation among national research institutes within the South Asian Association for Regional Cooperation on the initial design of possible joint research and development activities. Any agreements to push forward to tangible investment must come from the countries themselves and cannot be led by ADB. Nonetheless, these efforts are relatively low in cost, offer institutional visibility for ADB, and potentially have a very high pay-off in contributing to improved food security and agricultural productivity growth in Asia.

¹¹⁷ IED. 2001. *Special Evaluation Study on Program Lending*. Manila: ADB; IED. 2007. *Special Evaluation Study Update: Policy-Based Lending: Emerging Practices in Supporting Reforms in Developing Member Countries*. Manila: ADB; ADB. 2011. *Review of ADB's Policy-Based Lending*. Manila.

¹¹⁸ ADB. 2011. Policy Paper. Review of ADB's Policy-Based Lending. Strategy and Policy Department. Manila.

115. **Capacity and partnerships.** With the long decline in agricultural lending, ADB and the World Bank have lost staff expertise in technical areas of agriculture, e.g., crop and soil science, livestock, and forestry.¹¹⁹ The ongoing review of ADB's 2009 Operational Plan for Sustainable Food Security also notes ADB's lack of expertise in agribusiness and the limited interaction between staff engaged in ADB's agriculture sector and private sector operations, observing that "most of (ADB's) engagement on food security comes from generalists rather than specialists".¹²⁰ Reacquiring and repositioning the needed skills would take time and would compete for resources that may be viewed as having higher priorities elsewhere. As an interim measure, gaps can be filled by outsourcing through TA and long-term consultants.¹²¹

116. The complexity of the issues arising from the food price crisis argues for much stronger coordination with other international and regional organizations. No single institution has all the skills and resources necessary to address the challenges of food security. However, the 2012 Annual Evaluation Review notes that ADB has demonstrated its capacity to lead cooperative action on food security. ADB should pursue strategic partnerships on food security at the global, regional, and country levels. The partnerships established with FAO and IFAD are a good start, but these need to be operationalized and given stronger commitment by ADB.

117. Finally, stronger partnerships between governments and the private sector are crucial. Most of the investment in food and agriculture already comes from individual private farmers, as well as from private agribusinesses that deliver technology to farmers, and market and process farm outputs into the final products demanded by consumers.¹²² Therefore, to have high relevance and impact, ADB's investment lending should be formulated with a view of maximizing its catalytic impact on private sector development. Within ADB, a potentially huge contribution could be made through greater involvement of the Private Sector Department in agribusiness and commercial agriculture operations.

¹¹⁹ World Bank technical staff—soil scientists; forestry experts; and extension, livestock, agribusiness, and irrigation specialists—declined by more than 20% between 2000 and 2006 (footnote 98), and are believed to have fallen by half since then. ADB presently has few forestry, livestock, or agronomy specialists working in their fields of technical expertise.

¹²⁰ ADB. 2012. *Review of ADB Operational Plan for Sustainable Food Security 2010–2012*. Manila.

¹²¹ Alternatively, the international community could consider upscaling the specialized work of IFAD and FAO, complemented with programmatic financing to the developing countries to support program implementation. However, IFAD and FAO may not be adequately resourced in staff and field presence to handle such responsibility. While there are huge international political and philosophical divides on the issue of climate change mitigation, the international community seems to agree on the steps needed to address food security. Unfortunately, the rigid bureaucratic architecture of international organizations makes a reallocation of resources based on comparative advantage look unlikely.

¹²² FAO. 2012. *State of Food and Agriculture*. Rome.

APPENDIX: RECOMMENDATIONS OF THE REPORT TO G20 ON PRICE VOLATILITY IN FOOD AND AGRICULTURAL MARKETS: POLICY RESPONSES ¹

Recommendation 1: Productivity Enhancement through CGIAR, Public and Private Investment

G20 governments commit to take comprehensive action to strengthen the longer-term productivity, sustainability, and resilience of the food and agriculture system worldwide, encompassing several elements.

- Improve food and agriculture innovation systems, encompassing public and private investments in scientific research and development, technology transfer, education, training, advisory services and ensure that successful practices are scaled up.
- Strengthen the CGIAR system to support technological innovation and global dissemination of technology, in particular to improve productivity performance in less developed countries taking into account the needs of smallholder and especially women farmers.
- Support the development of technologies and provide the appropriate incentives to address challenges specific to climate change and sustainable resource use (land and water).
- Increase public (official development assistance [ODA] and national governments) investment in developing country agriculture, and in activities strongly linked to agricultural productivity growth, such as agricultural institutions, extension services, roads, ports, power, storage, irrigation systems and information and communication technology, where appropriate. Link public investment to the provision of sustainable public-private-civil society partnerships.
- Support comprehensive national food security strategies that are country-owned and led, evidence-based and inclusive of civil society and farmer organizations. In this respect, follow up on previous G20 commitments, such as the Pittsburgh summit commitment, to fund the Global Agriculture and Food Security Program.
- Provide the enabling environment for farmers and other private sector actors to scale up investments, above and beyond ODA and national government spending, to achieve the increased productivity and enhanced resilience on which long term food security will depend. To elicit the needed level of private sector investment, less developed countries in particular will need to support introduction of effective governance systems and institutions, stable macroeconomic conditions, sound structural policies, human capital development and public services.

Recommendation 2: Market Monitoring and Information Systems, Early Warning

Building upon existing mechanisms, establish an agricultural market information system encompassing four elements.

- G20 governments commit to instruct statistical or other relevant agencies to provide timely and accurate data on food production, consumption, and stocks. Where the mechanisms and institutions are not in place nationally to do so, G20 governments should undertake to create them.
- International organizations, with broad involvement of countries (G20 and other relevant players) commit to undertake monitoring, reporting and analyzing of current conditions and policy developments in major markets as well as to enhance global food security by encouraging information sharing, improving data reliability and increasing transparency, and introducing a global early warning system.
- G20 governments support the establishment of a rapid response forum, with broad involvement of countries (G20 and other relevant players) building on the proposed agricultural market information system to promote policy coherence and coordination in times of crisis.

¹ Jointly prepared by the Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations Conference on Trade and Development, World Food Programme, World Bank, World Trade Organization, International Food Policy Research Institute, and United Nations High Level Task Force on Global Food Security, June 2011.

- International organizations support the improvement of national or regional systems to monitor stocks, production, forecasts (with improved modeling and weather forecasting), food and nutrition security and vulnerability, in order to enhance early warning systems in vulnerable developing countries and regions

Recommendation 3: Futures Market Efficiency and Transparency

- G20 governments recognize the need to improve information and transparency in futures and over-the-counter markets and encourage appropriate rules to enhance their economic functions paying attention to the need for harmonization across exchanges in order to avoid regulatory arbitrage.
- Proposed changes should be considered in light of the ongoing review of regulatory oversight of all financial markets and not solely agricultural commodity markets, in particular by G20 finance ministers and central bank governors.
- The G20 supports the efforts made by the United States, the European Commission, and others in addressing transparency and efficiency issues in futures markets.

Recommendation 4: Doha Development Agenda

G20 governments demonstrate leadership in ongoing World Trade Organization (WTO) Doha Development Agenda (DDA) negotiations, moving immediately to strengthen international disciplines on all forms of import and export restrictions, as well as domestic support schemes, that distort production incentives, discourage supply in response to market demand, and constrain international trade of food and agriculture products. Specifically,

- substantially improve market access, while maintaining appropriate safeguards for developing countries, especially the most vulnerable ones;
- substantially reduce trade distorting domestic support, especially by developed countries; and
- eliminate export subsidies.

Taking existing WTO rules into account and the state of play in the DDA negotiations, G20 governments should:

- develop an operational definition of a critical food shortage situation that might justify consideration of an export restricting measure. An export ban would be defined as a time-limited measure of last resort, allowed only when other measures, including triggering domestic safety net measures for the poorest, have been exhausted, and taking into account, in particular, the food security needs of least developed countries and net food importing developing countries.
- widen, strengthen, and enforce consultation and notification processes currently in place at the WTO. The intention to impose an export restriction would have to be notified in advance of the action being applied and a “fast track” consultation process could be put in place to discuss whether the measure can be avoided and how. Consultation should be ongoing and regular with a view to ensuring that the measure, once in place, is removed at the earliest possible moment.

Recommendation 5: Expediting Humanitarian Food Aid, especially World Food Programme

- G20 governments strengthen the commitments made at the L'Aquila and Rome Summits, calling on all nations to allow purchases of humanitarian food, especially by World Food Programme, to be exempted from food export restrictions and/or extraordinary taxes, so that humanitarian food can be purchased, exported, and/or transited regardless of any prohibitions, restrictions, or extraordinary taxes imposed; and resolve to bring this commitment and call to the United Nations General Assembly and to the WTO.

Recommendation 6: Biofuels

G20 governments remove provisions of current national policies that subsidize (or mandate) biofuels production or consumption. At the same time, governments should

- open international markets so that renewable fuels and feed stocks can be produced where it is economically, environmentally, and socially feasible to do so, and traded more freely;
- accelerate scientific research on alternative paths to reduced carbon emissions and to improved sustainability and energy security; and
- encourage more efficient energy use, including in agriculture itself, without drawing on finite resources, including those needed for food production.

Failing a removal of support, G20 governments should develop contingency plans to adjust (at least temporarily) policies that stimulate biofuel production or consumption (in particular mandatory obligations) when global markets are under pressure and food supplies are endangered.

Recommendation 7: Food Emergency Reserve Systems

- Recognizing the primary responsibility of countries themselves, G20 governments provide support where there is need to increase capacity to implement food emergency reserve systems.
- G20 governments support the World Food Programme in the development of a cost-effective system of small, strategically positioned emergency food reserves by the end of 2011.
- A code of conduct (to) be developed by international organizations to ensure the free flow of humanitarian food supplies, to enhance responsibility and transparency, strengthen the global food security architecture, and avoid negative effects on the market.
- G20 governments put in place sustained support for the efforts of humanitarian agencies to assist countries facing crises by ensuring that they have predictable and reliable access to the financing needed, (for example for advance purchasing facilities).

Recommendation 8: Crisis Financing to the Poorest Countries and Safety Nets for the Poorest People

- G20 governments support continued provision of efficient, well-functioning international mechanisms to assist low income developing countries during food price crises including provision of adequate contingent financing from the international financial institutions.
- G20 governments support the development of appropriate, targeted and cost effective national safety nets that can be stepped up when needed, ensuring that they are adequately resourced, contribute to the improvement of nutrition, and link, when appropriate, to the proposed regional emergency food reserves and distribution systems.

Recommendation 9: Risk Management Systems at Household, Community, and National Levels

- G20 governments support the scale up of efforts to provide vulnerable households (including producers), communities and governments with effective, market-based risk management options.
- G20 governments support the scale up of a broader set of fiscal risk management services which include facilitation of commodity hedging, advisory services to strengthen in-country financial risk management capacity, disaster risk financing, and modernization of meteorological services.

Recommendation 10: Continue International Collaboration and Coordination

The G-20 should support the proposals made throughout this report to strengthen policy coordination in relation to food price volatility, building on and strengthening existing institutions and networks, improving coordination and timeliness in order to improve readiness, and promoting policy coherence and coordination in times of crisis. The international organizations that have prepared this report are asked to continue collaboration with the G20 to further elaborate the recommendations and, as appropriate, to implement them. The Committee on World Food Security should be charged with the broad task of monitoring the implementation of the recommendations of this report.