Rice Price Crisis: Causes, Impacts, and Solutions

Sushil Pandey
International Rice Research Institute, Philippines
E-mail: Sushil.Pandey@cgiar.org

Mark W. Rosegrant
International Food Policy Research Institute, USA
E-mail: m.rosegrant@cgiar.org

Timothy Sulser
International Food Policy Research Institute, USA
E-mail: t.sulser@cgiar.org

Humnath Bhandari
International Rice Research Institute, Philippines
E-mail: h.bhandari@cgiar.org

INTRODUCTION

A rapid increase in food grain prices in the first half of 2008 has diverted global attention to the food crisis. Rice, the staple food of millions of Asia's poor, is not only an economic good but also a political commodity. The price of rice escalated in May due to a number of short- and long-term factors, with the export price exceeding USD 1000 per ton.

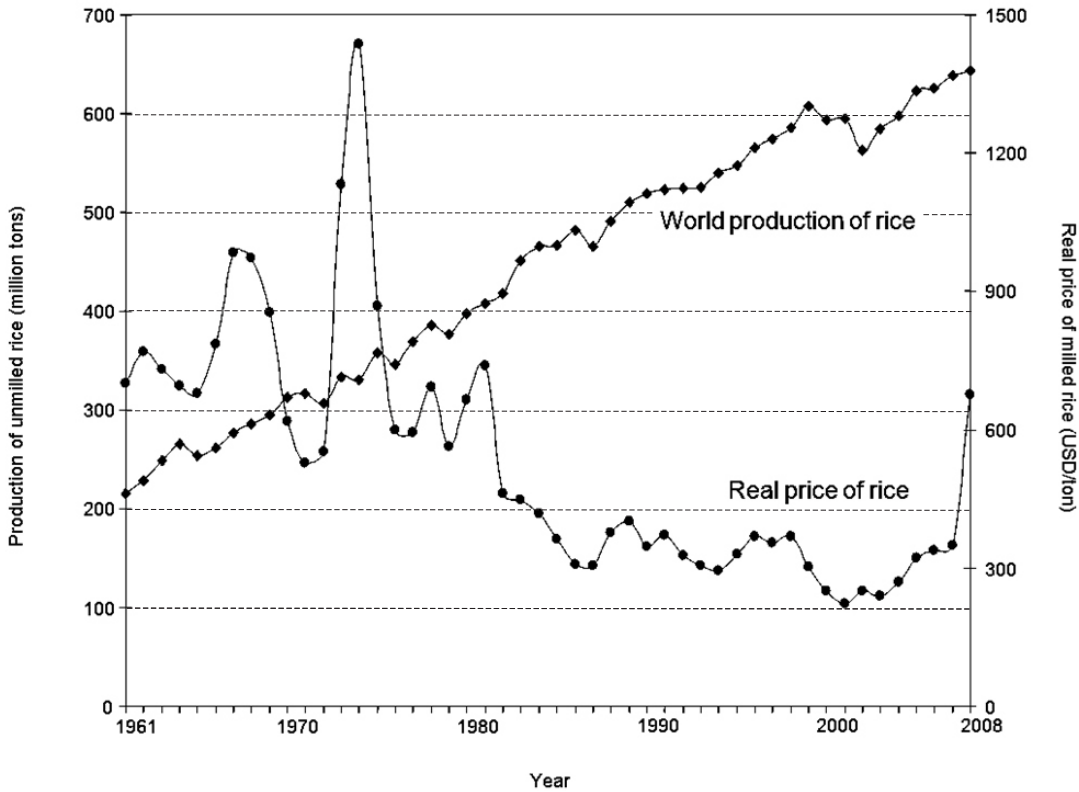
Keeping the price of rice low, thus making the commodity affordable to the poor, is critically important in reducing poverty. Poor households spend a substantial portion of their incomes on rice; an increase in rice price is equivalent to a reduction in their real incomes.

This paper analyzes the factors that have contributed to the rapid rise in rice price and assesses the impact of price upsurge on poverty. A scenario analysis on rice prices was conducted through projection of long-term demand and supply of rice. The final section of the paper includes short- and long-term solutions to the price crisis.

EVOLUTION OF RICE PRICE

It is now well recognized that rapid production growth in the wake of the Green Revolution led to a long-term decline in rice prices. In 1970-1990, rice production in Asia grew at the rate of 2.71 percent per annum (pa), with growth in yield being the major source of this production growth. Except for the price spike in 1972-1974 caused by production shortfall in several countries and the oil crisis, rice prices sustained a decrease over time until 2001 (Figure 1). During this period, the world rice market went through a major structural change that helped maintain a low and stable rice price during the 1990s (Dawe 2002). This was conducive to the expansion of the rice trade as importing countries could obtain the required quantities of rice cheaply from the world market. The low and stable rice price also contributed to poverty reduction—directly by raising the income of rice farmers, and indirectly by raising the real income of poor consumers.

Figure 1. Trends in world rice production and real export price of milled rice, 1961-2008



Rice price: The 2008 price data is average of January-July 2008. Real price of rice relates to Thai rice 5% broken deflated by G-5 Manufactures Unit Value (MUV) Index. Nominal export price of rice (quoted at FOB Bangkok) is converted to real price based on 2008 average price of rice.

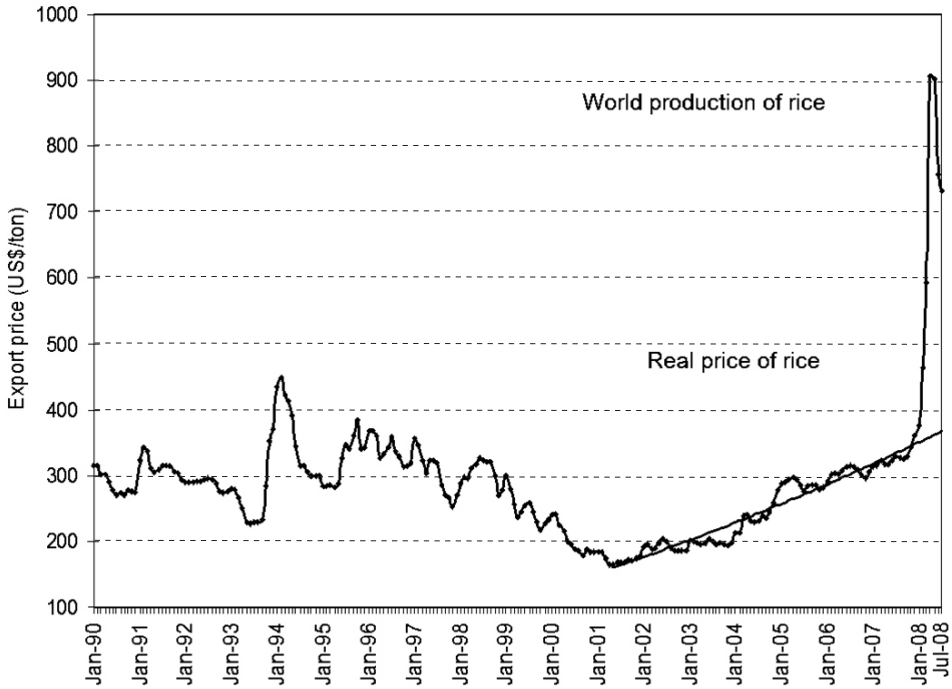
Source: World rice statistics, IRRI; PSD online, USDA; Commodity price data (pink sheet), World Bank

In 2001, this period of low and stable price ended when rice price started an upward trend (Figure 2). The world rice price had been increasing at a rate of about 1 percent per year from 2001 until the beginning of 2008. It suddenly soared to over USD 1000 per ton in May 2008. Several exporting countries restricted export to protect their domestic consumers, while importing countries hurried to purchase additional supplies from the world market. The market became tight as supplies dwindled rapidly. The problem reached crisis level, with world leaders and international agencies expressing serious concern regarding food availability as food riots reportedly broke out in several poor countries. The rice price has decreased since May 2008 but is still twice as much as in 2007.

FACTORS CONTRIBUTING TO RICE PRICE INCREASE

The swift rise in the price of food grains in general is due to the confluence of a number of short- and long-term factors. Studies attempting to identify these contributing factors have proliferated (ADB 2008; FAO 2008; IRRI 2008; von Braun 2008; WB 2008). In the case of rice, the following are the major contributing factors (IRRI 2008):

Figure 2. Trends in monthly nominal export price of milled rice, Thai 5% broken



Rice price: Export price of milled rice (Thai 5% broken) is based on FOB Bangkok.

Source: Commodity price data (pink sheet), World Bank

Deceleration in Rice Yield Growth Rate

In most countries, the growth rate of rice yield has decreased substantially in the past 10 to 15 years. In South Asia, yield growth rate decreased from 2.14 percent per year during 1970-1990 to 1.4 percent per year during 1990-2005. Overall, rice yields in Asia have risen by less than 1 percent per year in recent years. This growth rate is lower than that of population (Figure 3). As Asia accounts for over 90 percent of global rice production, the global growth rate of rice yield has fallen substantially below the rate of 2 percent pa, which was achieved during the Green Revolution in 1970-1990. With the possibility of increasing the rice area almost exhausted in most Asian countries, growth in rice production fell below the growth in demand as population continued to expand.

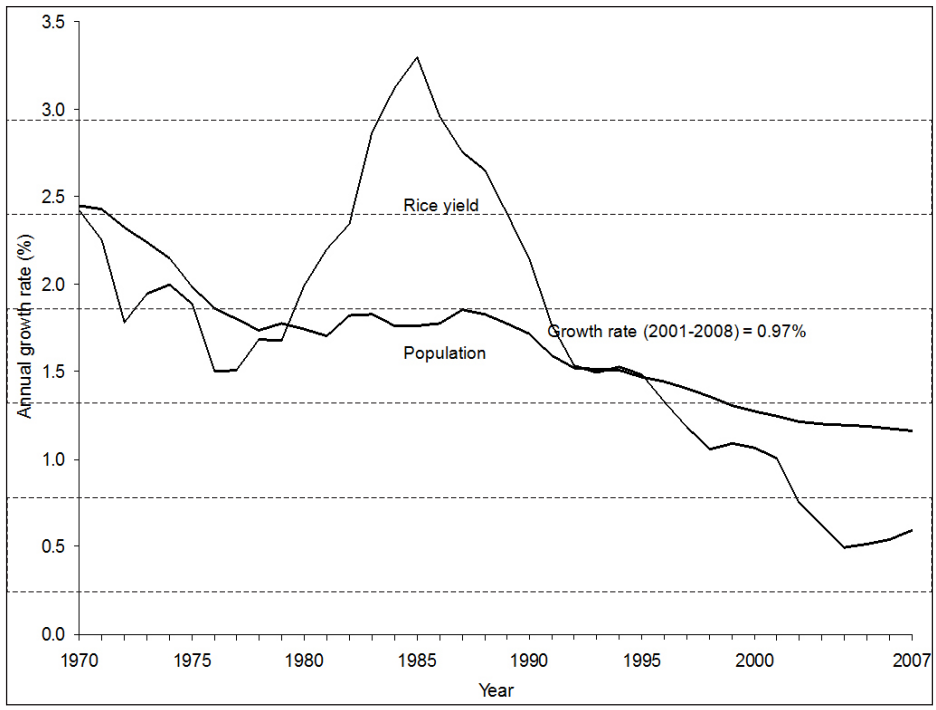
Reduction in the Stock Level

Stock levels decreased substantially during 2001-2004. This indicated that, globally, consumption exceeded production (Figure 4). Rice stocks are currently at their lowest level since the mid-1980s. A large proportion of this drop in stocks is accounted for by stock depletion in China and India. Although it was a policy choice to deplete stocks in these two countries, low stock levels constrained the ability to buffer the price rise resulting from other factors.

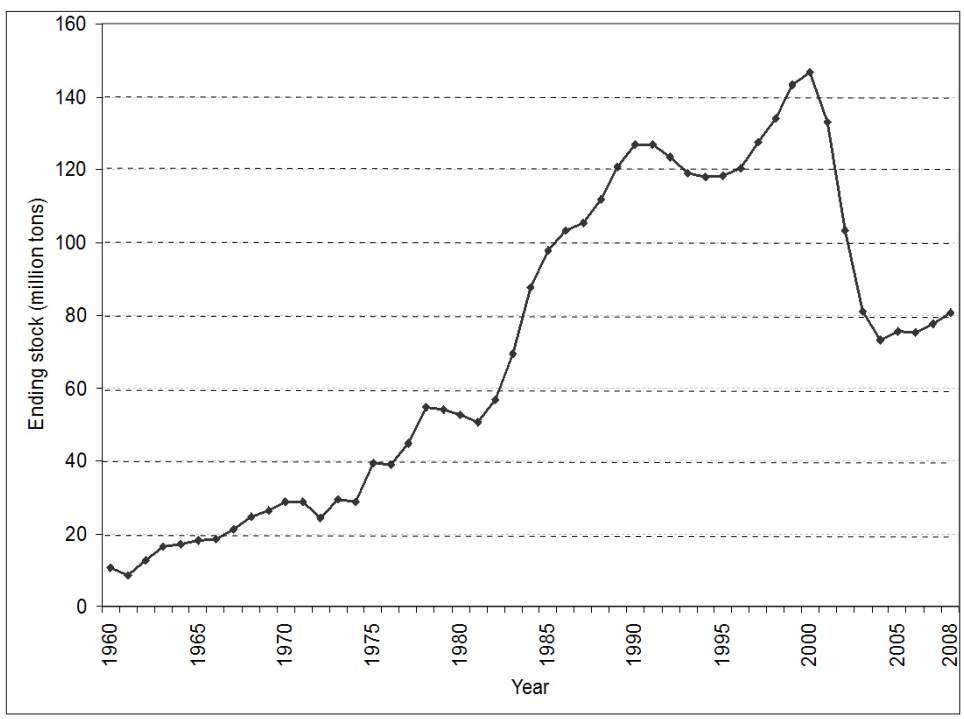
Demand Growth

The demand for rice increases as population grows. Population growth in Asia, though decreasing over time, is still about 1.2 percent per year. The increase in population drives

Figure 3. Annual average growth rates of rice yield and population in Asia, 1970-2007



Source: PSD online, USDA; FAOSTAT, FAO



Source: PSD online, USDA

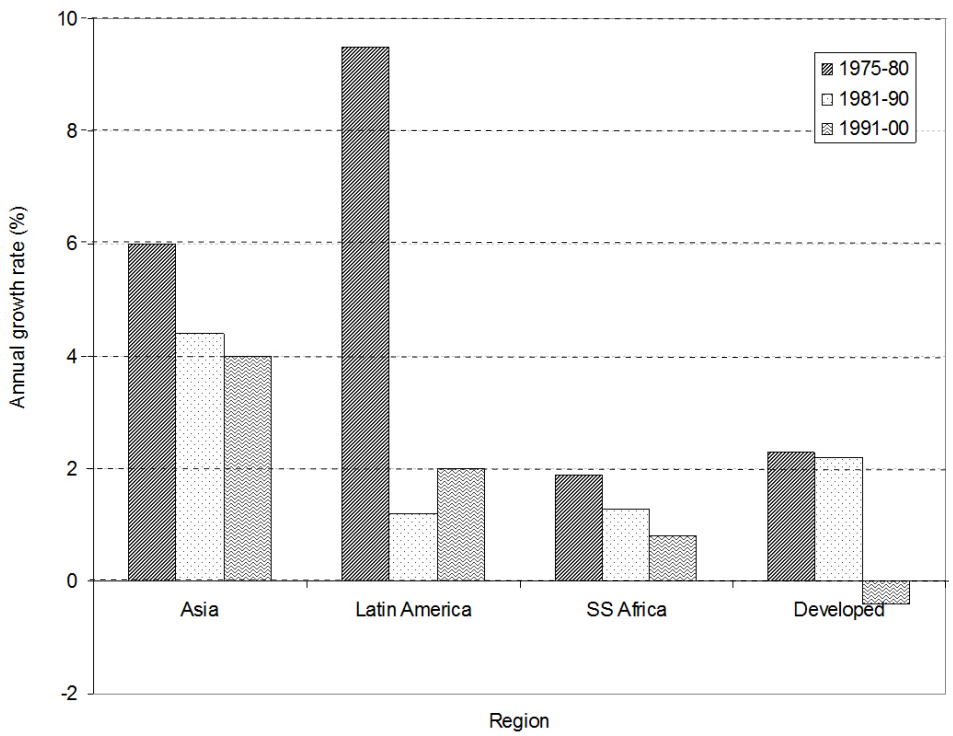
the increase in total demand for rice, the crop being a staple food in Asia and progressively becoming a popular food in Africa. In Africa, most of the demand for rice is being met through imports from Asia. African imports now account for almost one-third of total world trade. There are also additional demands arising from the income-induced boost in consumption, especially in South Asia where income elasticity of demand for rice is small but positive.

Reduced Public Investment in Agricultural Research, Development, and Infrastructure

Reduced public investment in agricultural research and development (R&D) is an important factor in the deceleration of yield growth. A declining trend in rice price prior to 2001 was taken by various governments to mean that rice supply was plentiful, thus generating complacency. Overall, agricultural R&D remains underinvested and has decreased in Asia in real terms over time (Figure 5). Public spending in agricultural research in Asia grew by an average of 3.9 percent per year in the 1990s, compared with 4.3 percent annually during the previous decade. Public sector investment in agricultural infrastructure such as irrigation similarly decreased over time.

The overall public research intensity, measured by the percentage of agricultural gross domestic product (GDP) invested in public agricultural research, remained low at 0.53 percent in 2000 for developing countries as a whole. There has been some increase in research intensity in major rice-growing countries such as China and India, but the overall intensity still remains well below the 1 percent norm (Beintema and Stads 2008).

Figure 5. Public spending on agricultural R&D, by region, world, 1975-2000



Source: Byerlee et al. 2008, World Development Report 2008

Oil Prices

The rapid rise in oil price has increased the energy costs of rice production, especially the fertilizer cost which has more than doubled over the past four years. Rising oil prices and concerns about climate change have also spurred rapid investments—particularly in developed countries—in biofuels, such as ethanol production from maize and biodiesel from oilseeds. Biofuel production is unlikely to have a strong impact on rice production in developing countries at this stage as rice grown in monsoon Asia does not compete with biofuel production directly. However, the rise in oil prices has put considerable pressure on input costs of agriculture in general, including those for rice.

Exchange Rate Movements

Part of the gradual rise in the export price of rice from 2001 onwards can be attributed to the appreciation of the Thai Baht (THB) against the United States Dollar (USD). With rice export price being denominated in USD, a depreciation of THB against USD reduces the USD price of rice. This happened after the Asian economic crisis in 1997 when THB collapsed against USD. The export price of rice continued to decrease until 2001, and rice price increased as THB appreciated. This trend continued until 2007; at this point, THB had appreciated by over 30 percent relative to the 2001 level.

Export Restrictions and Panic in the Marketplace

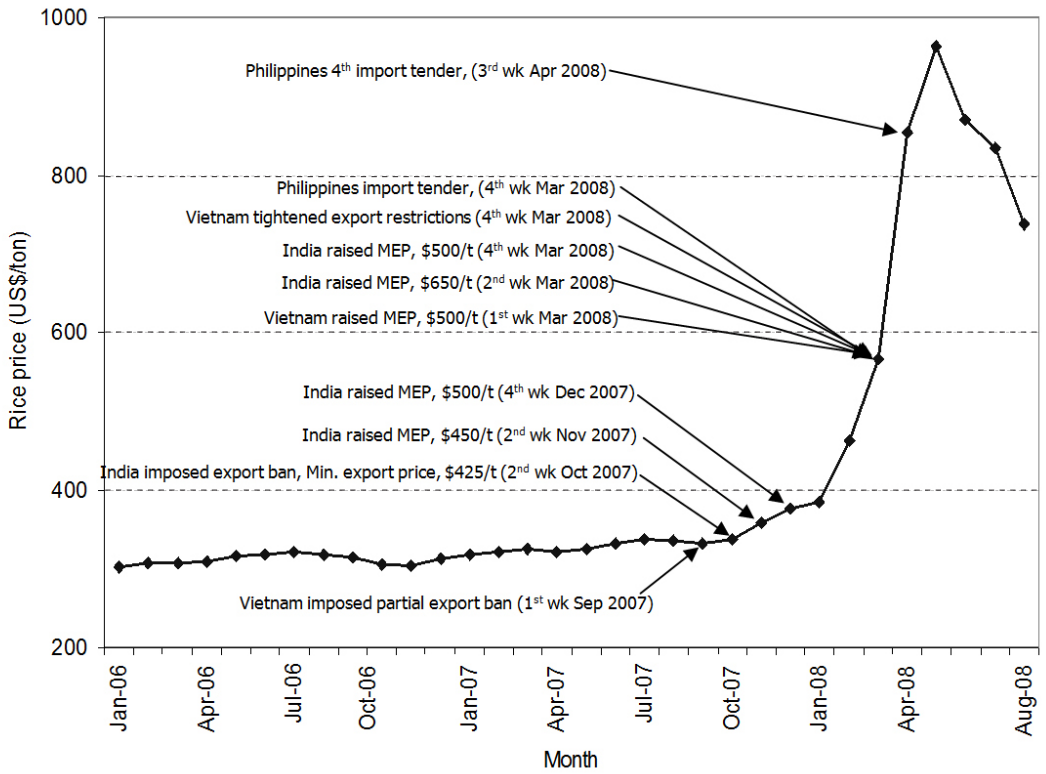
The above factors contributed mainly to the long-term trend in price increase. However, the spike in rice price seen in April/May 2008 was largely the result of the panic arising from export restrictions imposed by major exporters: India and Vietnam (Figure 6). These countries imposed export restrictions to contain domestic inflation. Export restrictions and the prospect of a growing shortage in the world market encouraged traditionally importing countries, such as the Philippines, to rush to the market to obtain the required supplies. Speculative demand and hoarding increased in anticipation of further price rise, thus leading to the upward spiraling of price.

RICE PRICE AND IMPACT ON POVERTY

Rice is a staple crop in Asia, which is home to nearly 700 million people with incomes of less than a dollar per day. Rural poverty is concentrated among small and marginal farmers and landless laborers (IFAD 2001). Though rice growers, small and marginal farmers are net buyers as their production is generally inadequate to meet the rice needs of their families. Landless laborers and urban poor obtain food through market purchases only. Rice share in the total expenditure of the poor has been estimated to be 30-50 percent. With rice accounting for such a large share of total expenditure, any rise in its price is equivalent to a drop in the real income of the poor. For example, a 50-percent increase in rice price is equivalent to a drop in real income by 15-25 percent—a substantial loss in real income for the poor. However, government policies and adjustments in exchange rate limit the passing through of international price changes to domestic price (Dawe 2008). It is the domestic price that affects the poor's consumption level.

Domestic rice prices have not risen as much as international prices due to the weakening of USD and stabilization policies implemented by national governments. Various initial estimates of the impact of food price increase on poverty have been generated (ADB 2008; Ivanic and Martin 2008). These studies by the ADB and Ivanic and Martin find the impact of general food price rise to be substantial. Based on

Figure 6. Monthly export price of milled rice (Thai 100% B) and policy responses to control rise in rice price, January 2006 to August 2008



Source: Commodity price data (pink sheet), World Bank

parameter estimates from these two studies, the poverty impact of a 50 percent rise in rice price has been derived (Table 1). The estimates indicate that such an increase in price would lead to at least 32 million people falling back into poverty; this number could be as high as 100 million.

LONG-TERM DEMAND, SUPPLY, AND PRICE PROJECTION

Though factors like climatic shocks determine rice production and prices in the short run, the future scenario of rice prices must be based on long-term projections of rice demand and supply. For making long-term projections of rice prices, the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) is used. IMPACT was developed in the early 1990s, revised in 2002 to include the global water simulation model, and updated in 2007 (Rosegrant et al. 1995; Rosegrant et al. 2002; Rosegrant et al. 2008).

IMPACT offers a methodology for analyzing baseline and alternative scenarios for global food demand, supply, trade, income, and population. This model covers 29 commodities, including all cereals, soybeans, roots and tubers, meats, milk, eggs, oils, oilcakes and meals, fruits and vegetables, major dryland pulses, sugar, and cotton. IMPACT models the behavior of a competitive world agricultural market for crops and livestock. It is specified as a set of country or regional sub-models within each of which supply, demand, and prices for agricultural commodities are determined. The

Table 1. Impact of 50-percent increase in rice price on poverty in Asia

Country	Increase in the Number of Poor (Millions)	
	Estimate A	Estimate B
Bangladesh	8.1	1.44
Cambodia	1.4	0.13
China	19.8	13.00
India	60.2	11.00
Indonesia	1.4	2.26
Lao PDR	0.3	0.06
Nepal	1.1	0.27
Pakistan	2.3	1.60
Philippines	1.9	0.86
Sri Lanka	0.2	0.20
Thailand	0.1	0.63
Vietnam	2.4	0.83
Total	99.2	32.30

Source: Based on elasticity estimates derived from ADB (2008) for Estimate A and Ivanic and Martin (2008) for Estimate B

country and regional agricultural submodels are linked through trade and a global equilibrium is obtained through iteration, such that the sum of net trade balances is driven to zero for each commodity.

IMPACT uses a system of linear and non-linear equations to approximate the underlying production-and-demand relationships, and is parameterized with country-level elasticities of supply and demand (Rosegrant et al. 2002). World agricultural commodity prices are determined annually at levels that clear international markets. Demand is a function of prices, income, and population growth. Growth in crop production in each country is determined by crop prices and the productivity growth rate. Future productivity growth is estimated by its component sources, including crop management research, conventional plant breeding, wide-crossing and hybridization breeding, and biotechnology and transgenic breeding. Other sources of growth that are considered include private-sector agricultural R&D, agricultural extension and education, markets, infrastructure, and irrigation. Details of the model structure and assumptions can be found in Rosegrant et al. (2008).

A scenario approach is used to assess the future demand-and-supply situation. The scenario approach associated with the projections presented here focuses on alternative paths of particular policy options for technological development and investments in agricultural production with respect to a reference scenario. The reference scenario contains a basic set of assumptions on population growth, income growth, income and price elasticity, agricultural productivity growth, and trade (Rosegrant et al. 2008). The following alternative scenarios are considered for projections to 2025 and 2050 and assessment relative to the reference scenario:

- A *low* scenario presents a fairly pessimistic view of future developments in favor of

agricultural production around the world. It is a further reduction in the already declining rates of investments in agricultural R&D.

- A *high* scenario inverts the trends of the *low* scenario. This is an optimistic outlook on how governments and other decision-makers around the world will prioritize investments in the foundations of productivity, particularly in the developing world.
- A *very high* scenario augments the improved situation found in the *high* scenario with increased investments in yield improvements and intensification of existing agricultural systems. Investment in irrigation infrastructure is increased and actually causes a decline in rainfed agriculture. In addition, this scenario includes increases in other critical poverty- and malnutrition-reducing investments.

The parameter assumption with respect to the reference scenario and the three alternative scenarios are summarized in Table 2.

Impact of Alternative Technology and Investment Scenarios

The three abovementioned scenarios representing alternative paths of investment in agricultural technology and development lead to distinct outcomes that have strongly different

Table 2. Scenario analysis of agricultural technology investments and development, 2000-2050

Parameters	Reference Scenario (Global Average)	Alternative Scenarios of Investment in Agricultural Technology, Research, and Development (R&D) (Change from Reference Scenario)		
	Reference	Low Agricultural R&D	High Agricultural R&D	Very High Agricultural R&D and other Poverty-reduction Investments
Global GDP growth (global, % per year)	3.07% annual	2.86	3.31	3.31
Livestock numbers and yield growth	0.71% annual	-20%	+20%	+30%
Food crop yield growth	1.14% annual	-40%	+40%	+60%
Irrigated area growth	1.07% annual	n.c.	n.c.	+25%
Rainfed area growth	0.12% annual	n.c.	n.c.	-15%
Basin water use efficiency	0.57 in 2050	n.c.	n.c.	Increase by 0.15 by 2050 (max 0.85)
Access to water (66% of regions have full access)	0.45-0.99 for regions without full access	n.c.	n.c.	Increase by 50% relative to baseline by 2050
Female secondary education (40% of regions have full parity)	0.19-0.99 for regions without full parity	n.c.	n.c.	Overall improvement by 50% by 2050

Note: n.c. = no change
Source: IFPRI IMPACT Model Projections, April 2008

implications for both agricultural production and trade, and general development paths for different regions around the world. Looking at the impacts on global rice prices gives a basic idea of such differences (Figure 7).

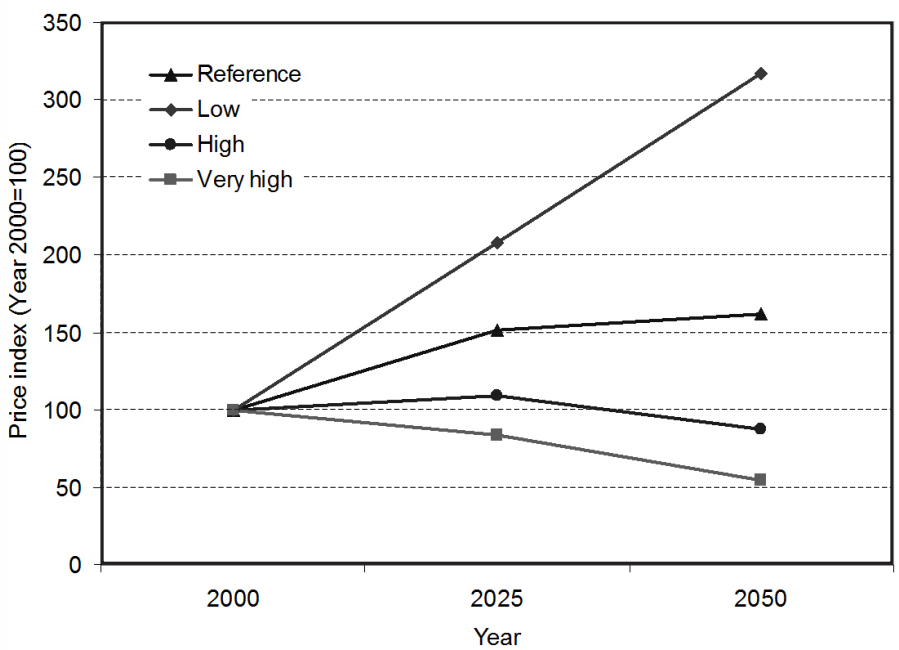
The scenario of decreasing investments in agricultural science and technology (*low*) is extremely unfavorable. Should this scenario become a reality, rice prices in 2050 would be nearly double of the projected reference scenario prices in the same period. This would be a tripling of the starting price in 2000. The trends for aggregate cereals would be even more dismal.

The more optimistic scenarios (*high* and *very high*) show extremely different possibilities. By 2050, rice prices would decline relative to the starting year. The *high* scenario would see rice prices about half of the projected value in the reference scenario, while the *very high* scenario would result in 2050 prices being roughly a third of their reference outcomes.

Per capita food and total demands

Each of the scenarios compared to the reference scenario show differences in per capita food and total demands mostly in accordance with changing prices. Increased prices in the *low* scenario lead to decreased per capita consumption, while decreased prices in the *high and very high* scenarios will lead people to demand more agricultural commodities. The changes in GDP growth will strongly impact per capita incomes that will have additional effects on food and total demands.

Figure 7. Trends in rice price under reference (business as usual) and three alternative policy scenarios, 2000-2050



Note: These long-term projections do not factor in short-term supply shocks and trade restrictions of the kind that prompted price spikes in early 2008
Source: IFPRI IMPACT model projection, April 2008

Area and yield

Changes in the *low*, *high*, and *very high* scenarios compared to reference tell a slightly more complicated story in terms of area and yield. The 40-percent decrease in crop yield growth rates in the *low* scenario and increasing prices stimulates expansion of agricultural areas to make up for the decline in productivity. Total rice harvested area in 2050 for the *low* scenario slightly increases by about 1.6 percent on average across the globe as shown in Table 3. The *high* scenario, on the other hand, reverses the impacts of the *low* scenario and global agricultural areas contract because more favorable yields require less land. Harvested area for rice is 2 percent less than the projected reference scenario in 2050.

The *very high* scenario includes investments in expanding irrigated areas and even stronger developments for agricultural productivity than

Table 3. Total rice harvested area: Reference and alternative scenarios for 2000, 2025, and 2050 (million hectares)

	Reference Scenario			Alternative Scenarios					
	Baseline			Low		High		Very High	
	2000	2025	2050	2025	2050	2025	2050	2025	2050
East Asia	30.9	27.6	19.0	28.4	20.0	26.9	18.0	27.6	20.2
China	29.7	26.6	18.2	27.3	19.1	25.8	17.2	26.5	19.3
Other East Asia	1.2	1.0	0.8	1.1	0.8	1.0	0.8	1.0	0.8
Southeast Asia	42.7	42.2	37.3	42.4	37.8	42.1	36.7	42.5	37.6
Vietnam	7.5	7.3	6.8	7.4	6.9	7.3	6.6	7.3	6.7
Thailand	9.7	9.0	7.2	9.1	7.4	8.9	7.0	9.0	7.3
Indonesia	12.0	11.3	10.0	11.2	9.7	11.5	10.2	11.7	10.6
Philippines	4.0	3.9	3.3	3.9	3.4	3.8	3.1	3.8	3.2
Other Southeast Asia	9.5	10.7	10.0	10.9	10.3	10.6	9.7	10.7	9.8
South Asia	58.1	61.0	58.6	61.4	59.5	60.8	57.5	63.4	60.4
India	43.0	45.3	43.8	45.3	43.9	45.4	43.4	48.0	46.4
Pakistan	2.3	2.4	2.3	2.4	2.3	2.4	2.4	2.5	2.5
Bangladesh	10.5	11.1	10.4	11.5	11.3	10.7	9.6	10.6	9.4
Other South Asia	2.3	2.3	2.0	2.2	1.9	2.3	2.1	2.4	2.2
Sub-Saharan Africa	6.9	7.8	8.3	7.7	7.9	8.1	8.5	8.6	9.4
Latin America and Caribbean	4.8	4.8	4.0	4.9	4.2	4.8	3.9	4.9	4.1
Eastern Europe and Central Asia	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
Middle East and North Africa	1.5	1.5	1.5	1.4	1.4	1.6	1.7	1.7	1.8
Developing World	144.8	145.0	128.9	146.2	130.9	144.2	126.6	148.7	133.7
High Income	3.5	3.2	2.7	3.3	2.9	3.1	2.6	3.2	2.6
Japan	1.0	0.9	0.7	0.9	0.8	0.9	0.7	0.9	0.7
Developed North America	1.3	1.2	1.1	1.3	1.1	1.2	1.0	1.2	1.0
Western Europe	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.5
World	148.3	148.2	131.7	149.5	133.8	147.3	129.1	151.9	136.4

Source: IFPRI IMPACT Model Projections, April 2008

in the *high* scenario. More heavily irrigated crops, such as rice, would be favored over crops that are often produced under rainfed conditions. The combined effects of increased yields, increased irrigation, and increased demands stimulate crop production in a different way than in the *low* and *high* scenarios. Total rice harvested area increases by 3.6 percent compared to the reference scenario in 2050, while irrigated rice harvesting increases by 4.6 percent in that same period (Table 3).

The above analysis thus indicates that, under the 'business-as-usual' reference scenario, the price of rice will increase by almost 50 percent by 2025. The rice price will continue to increase, although at a slower pace, from 2025 to 2050 under this scenario. Rice price will be lower in 2050 relative to the initial value of 2000 only if investments in agricultural technology and R&D are boosted substantially (*high* and *very high* scenarios). Such investments are going to be critical in increasing rice productivity fast enough to keep the prices down.

STRATEGY FOR MITIGATING THE CURRENT CRISIS AND AVOIDING FUTURE CRISES

The above discussions clearly suggest that the current rice crisis is the result of a long-term imbalance between demand and supply. Basically, the production growth has been too slow to keep pace with the demand growth, despite the slowing down of the overall growth in demand over time due to reduced population growth and trends towards diversification of the diet. Other contributing factors mentioned above have amplified the effect of this long-term imbalance and resulted in the price spike and the shortage experienced during the past several months. As the root cause of the problem is on the supply side, the long-term solution will require measures to correct this supply-side problem.

These measures can be grouped into two categories: stimulating investments in technology and infrastructure, and implementing policy reforms. Indeed, the current crisis provides a tremendous opportunity to properly implement suitable strategies as the world's attention is now focused on the plight of the poor and hungry, and the need to redress the relative neglect that the agricultural sector suffered during the past decade.

Investments in Agricultural Research and Development, Infrastructure, and Extension

A substantial boost in agricultural R&D and infrastructure is needed to increase growth in agricultural productivity. Unfortunately, the overall growth in such investments has been very slow in the past. Funding levels for international agricultural research centers have eroded substantially over time in real terms. For example, the budget of the International Rice Research Institute (IRRI) has decreased from USD 64 million in 1993 in terms of 2007 prices to only USD 32 million in 2007. National systems are also unable to invest adequately in agriculture due to an overall decrease in official development assistance (ODA). The steady decline in rice prices prior to 2001 led many governments and international donors to believe that there was a perpetual supply of plentiful rice. Lower prices were taken for granted, leading to complacency in agricultural R&D. The current crisis has taught an important lesson that these investments are of high priority and must be kept high enough to prevent similar crises in the future.

In the context of rice, a related issue is that of the balance in the R&D investment portfolio between favorable (irrigated) and unfavorable (rainfed) environments. High productivity growth in irrigated areas was the main factor behind the Green Revolution. Though rainfed

areas have benefitted from the spillover effects of research in irrigated areas, recent evidence indicate that the marginal returns and poverty impacts of investment in rainfed areas may now be higher (Fan and Hazell 2001). It has been found that, in the case of rice, rainfed areas are slightly underinvested in India (Pandey and Pal 2007). It is important to ensure that the research priorities among rice-growing environments and various components of research are adequately balanced for generating the maximal impact.

Regarding the specifics of rice technologies, there is a considerable scope in raising rice productivity by closing the yield gap, especially in the rainfed environments. In areas affected by abiotic stresses, such as drought and submergence, considerable yield gains can be achieved through stress-tolerant varieties. High variability of yield across farms also indicates the presence of management-related constraints which, if addressed through suitable practices, will increase farm productivity. Advanced scientific tools that are now available can be brought to address some of these major abiotic stresses affecting rice yields.

In addition to closing the yield gaps, improved technologies are also needed to push the yield ceiling upwards. Hybrid rice, with the yield advantage of about 15 percent relative to inbred varieties, provides an opportunity in this regard. Rice varieties that can produce high yields under raised temperature likely to result from global warming are similarly needed. Important scientific progress is being made in these areas of research, and sufficient investment now and in the future is needed to develop viable solutions. IRRI's 9-point Action Plan for addressing the rice crisis provides a full listing of technological opportunities (IRRI 2008).

Effective strategies are similarly needed to quickly disseminate improved technologies to farmers. There are serious constraints in the current institutional set-up and mechanisms for technology delivery and dissemination (Byerlee 1994). Innovative mechanisms involving civil society organizations and the private sector can deliver technologies and information more effectively than the usual formal extension systems that are based on the traditional mode of transfer-of-technologies.

Policy Reforms

The current crisis also provides a superb opportunity for critically examining the established policy framework, much of which has its origin during the Green Revolution. Some of the past policies, such as subsidies on fertilizers and energy, have had high opportunity costs. Resources drained away in providing such supports could be used to support other areas, such as greater investments in agricultural R&D, which help build the foundation for a more productive and efficient agriculture.

A twin-track approach to policy actions is needed. In the short run, the objective is to avoid hunger and poverty through the provision of safety nets and social safety protection to the most vulnerable people. International agencies and governments have been very active in providing such safety nets through mechanisms such as targeted cash transfer to the poor. Such programs are essential in the short run despite their large fiscal costs.

The long-run policy reforms aimed at improving the productivity and efficiency of agricultural production and of the overall marketing systems are needed. Three major components include the efficient organization of farming (farm size, mechanization, and tenure security), improved marketing policies for both inputs and outputs, and trade policy reforms. The process of structural transformation of the economy puts a resource squeeze on agriculture as key resources, such as land and labor,

are increasingly absorbed by the non-farm sector. The role of policy is to facilitate such transformation by creating enabling conditions for an efficient reorganization of agriculture. These include the required institutional set-up for the development of land, labor and rural financial markets, establishment of marketing infrastructure, standards or procedures for quality control, and trade policy reforms. The trade restriction imposed by major exporting countries is partly the reason for the current crisis. Notwithstanding the failure of the Doha Round, policies that promote trade need to be an integral part of the overall strategy for preventing future crises.

CONCLUSION

Rice prices in international markets have dropped from their peaks in May 2008. Commodity prices have also softened somewhat in recent weeks. However, the world price of rice is still high relative to the 2007 level and is likely to remain too high to be affordable to millions of the poor.

The analysis presented above clearly indicates that the fundamental cause of the current rice crisis is the long-term imbalance between the supply and demand for rice. Yield growth over the past decade or so has slackened considerably. Long-term projections indicate that the price of rice will increase substantially unless a major boost in investments in agricultural R&D is made. Productivity growth through the development and dissemination of improved technologies is the only viable long-term solution for bringing the prices down and preventing future increases in rice prices.

A second Green Revolution to reverse the rising trend in rice prices and to keep prices low is needed now as much as the first Green Revolution was needed earlier to avoid famine and mass starvation. The task is equally challenging but not insurmountable, provided a substantial boost is given to agricultural research, which continues to remain highly underinvested. Increased research investments, together with policy reforms that make rice markets more efficient, will be the ultimate solution to the rice crisis.

REFERENCES

Asian Development Bank (ADB). 2008. *Food Prices and Inflation in Developing Asia: Is Poverty Reduction Coming to an End?* Special Report. Manila, Philippines: Economics and Research Department, Asian Development Bank.

Beintema, N.M. and G.J. Stads. 2008. *Diversity in Agricultural Research Resources in the Asia-Pacific Region.* Bangkok, Thailand: Asia-Pacific Association of Agricultural Research Institutions; Washington, DC, USA: International Food Policy Research Institute.

Byerlee, D. 1994. Technology Transfer Systems for Improved Crop Management: Lessons for the Future. In *Agricultural Technology: Policy Issues for the International Community,* edited by J. Anderson, 208-230. Washington, DC. : CABI Publishing.

Dawe, D. 2002. The Changing Structure of the World Rice Market, 1950-2000. *Food Policy* 27 (4): 355-370.

Dawe, D. 2008. Have Recent Increases in International Cereal Prices been Transmitted to Domestic Economies? The Experience in Seven Large Asian Countries. *ESA Working Paper No. 08-03.* Rome, Italy: The Food and Agriculture Organization of the United Nations.

Fan, S., and P. Hazell. 2001. Returns to Public Investments in the Less-favored Areas of India and China. *American Journal of Agricultural Economics* 83 (5): 1217-1222.

Food and Agriculture Organization (FAO). 2008. "Soaring Food Prices: Facts, Perspectives, Impacts, and Actions Required." Paper presented at the high-level conference, World Food Security: The Challenges of Climate Change and Bioenergy, Rome, Italy, June 3-5.

International Fund for Agriculture Development (IFAD). 2001. *Rural Poverty Report 2001: The Challenge of Ending Rural Poverty.* Rome, Italy: IFAD.

International Rice Research Institute (IRRI). 2008. *Responding to the Rice Crisis: How IRRI Can Work with Its Partners.* Los Baños, Philippines: International Rice Research Institute.

Ivanic, M. and W. Martin. 2008. Implications of Higher Global Food Prices for Poverty in Low-income Countries. *Policy Research Working Paper 4594.* Washington, DC, USA: The World Bank.

Pandey, S. and S. Pal. 2007. Are Less-favored Environments Over-invested? The Case of Rice Research in India. *Food Policy* 32 (5-6): 606-623.

Rosegrant, M.W., M. Agcaoili-Sombilla, and N.D. Perez. 1995. Global Food Projections to 2020: Implications for Investment. *Food, Agriculture and the Environment Discussion Paper 5.* Washington, DC, USA: International Food Policy Research Institute.

Rosegrant, M.W., X. Cai, and S.A. Cline. 2002. *World Water and Food to 2025: Dealing with Scarcity.* Washington, DC, USA: International Food Policy Research Institute.

Rosegrant, M.W., S. Msangi, C. Ringler, T.B. Sulser, T. Zhu, and S.A. Cline. 2008. *International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): Model Description.* Washington, DC, USA: International Food Policy Research Institute.

von Braun, J. 2008. *Rising Food Prices: What Should Be Done?* Policy Brief. Washington, DC, USA: International Food Policy Research Institute.

World Bank (WB). 2008. *Rising Food Prices: Policy Options and World Bank Response*. Special Report. Washington, DC, USA: The World Bank.