Policy Reform, Market Stability, and Food Security

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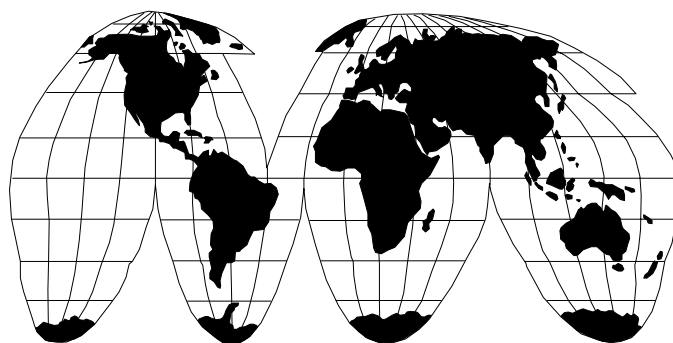
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Asian Economic Crisis
and the Long-Term Global Food Situation

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Introduction

After a decade or more of rapid economic growth, many of the countries of East and Southeast Asia are now facing serious economic and financial problems. Between mid-1997 and the spring of 1998, the currencies of four Southeast Asian nations (Indonesia, Malaysia, the Philippines, and Thailand) and of South Korea have fallen by 40-80 percent against the U.S. dollar, precipitating a financial and economic crisis whose full impacts on global food markets are still unknown. Between July of 1997 and March of 1998, the Indonesian currency depreciated by 67 percent in real terms, and is still spiraling downwards; the Malaysian currency depreciated by 35 percent by January 1998, to apparently stabilize at a rate about 25 percent below the pre-crisis level around March 1998; the Philippine currency dropped by 24 percent by January 1998, before strengthening to around 17 percent below pre-crisis levels in March 1998; the Thai currency fell by 33 percent by January 1998, to recover to about 15 percent below pre-crisis levels by March 1998; and the South Korean exchange rate fell by 36 percent by January 1998, and apparently stabilized at about 26 percent around March of 1998 (Liu et al. 1998a,b). The exchange rate in Japan fell significantly during June 1998, and pressure on China to devalue has increased.

As a consequence of the crisis, the growth rate expectations for gross domestic product (GDP) for East and Southeast Asian countries have been sharply revised downwards: in the most recent estimates, Indonesia's 5 percent GDP growth rate in 1997 is expected to decline to -8.8 percent in 1998; South Korea's rate of 6 percent is expected to decrease to -0.8 percent, and Thailand's growth rate is projected to drop from about 2.5 to -6.0 percent (Radelet and Sachs 1998). The changes in exchange rates and income growth may significantly alter the international pattern of trade competitiveness. Whereas the internal demand in the affected Asian countries is expected to decline substantially, their recovery will be based, in part, on successful increases in exports to some of the larger developed markets, like the United States and Western Europe. Developed countries are also expected to be negatively affected by developments in Asia, with the severity of the impact depending on their respective trade and financial links with Asia and on their relative economic and financial pre-crisis positions.

Due to its higher protection rates, the agriculture sector is not expected to be as strongly affected, in terms of value and volume, as other sectors. Nevertheless, substantial shifts in the trade regimes, net exporting and importing positions, patterns of crop and livestock production, and even the dietary patterns in some Asian crisis countries can be expected. So far, evidence on agricultural production and trade impacts of the crisis is scant and focused on short-term outlooks. The United States Department of Agriculture, for example, expects agricultural exports of the United States to

decline by 3-6 percent over the next two years due to the effects of the Asian crisis. The largest share of the expected US$2 billion export decline in fiscal year 1998 will be in high-value commodities, such as horticultural products, red meats and poultry, and processed products, which are more price- and income-sensitive than bulk commodities. However, in fiscal year 1999, the negative effect on bulk commodity exports is expected to become more pronounced (USDA 1998). San, Rosegrant and Perez (1998) explore potential consequences of the financial crisis on Indonesian crop and livestock production, based on an integrated grain and livestock sector partial equilibrium model. Their results indicate that the economic crisis could severely slow the process of diversification of Indonesian diets and growth in food consumption if income effects are prolonged into the next century.

Liu et al. (1998b) analyze the effects of the Asian crisis based on a computable general equilibrium (CGE) model consisting of 17 regional models, each with 14 sectors (3 of them agriculture), and five primary factors of production. The authors find that the major changes take place in the manufacturing and service sectors that are less regulated than the agriculture sector. The results show that the greater part of the external adjustment comes from declines in imports rather than increases in exports and that the increase in net exports tends to be concentrated in labor-intensive manufactures. The traded-goods sectors in developed economies, on the other hand, are hit by falling demand in Asia for exports and rising competition from Asia for their domestic-import competing sectors.

This paper focuses on the potential long-term global agricultural impacts of the Asian financial crisis, exploring possible impacts on developments in global food markets and trade, and on regional agricultural supply and demand.[1] The long-term effects of the crisis on income growth and real exchange rate depreciations are highly uncertain at this point, making it difficult to assess their potential impacts on global food markets and food security. Therefore, in this paper, possible impacts are examined through a comparison of three alternative scenarios using IFPRI's IMPACT global food model. The baseline scenario reflects the conditions prevailing prior to the onset of the crisis. In the second scenario, the "severe Asian crisis scenario," it is postulated that the short-term effects seen so far in Asia will significantly worsen, causing long-term real currency devaluations and sharp drops in long-term income growth rates in the region. In the third "moderate Asian crisis scenario" it is assumed that the final devaluation will be smaller, and that the long-term income growth rates will recover to closer to pre-crisis levels.

After a brief description of IMPACT, the assumptions governing the three scenarios are specified; then, the results for growth in cereal and meat demand, production, world prices, and international trade to the year 2020 are presented. The impacts on food security are examined through projections of the number of malnourished children under the three scenarios.

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[1] It is assumed that the crisis will have persistent real effects. For an elaboration of this "fundamentalist" perspective, see Liu et al. 1998b.

IFPRI's IMPACT Global Food Model

The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) covers 37 countries and regions (which account for virtually all of world food production and consumption), and 18 commodities, including all cereals, soybeans, roots and tubers, meats, milk, eggs, oils, oilcakes and meals. The model is specified as a set of country-level supply and demand equations. Each country model is linked to the rest of the world through trade. World food prices are determined annually at levels that clear international commodity 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 rate of productivity growth. 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 considered include private sector agricultural research and development, agricultural extension and education, markets, infrastructure and irrigation. The basic methodology of IMPACT is described in detail in Rosegrant, Agcaoili-Sombilla, and Perez (1995).

The results presented here are generated from a revised and updated version of IMPACT. The updated model incorporates additional features in its structure and input data that improve its projections capability on both the supply and demand sides. Modifications of the model structure are reflected primarily in the supply and demand equations. In the supply equation, the marginal contribution of further expansion of irrigated area is incorporated in the area function through potential increases in cropping intensities, and in the yield function through the addition of a yield differential between irrigated and non-irrigated crops, that represents the improvement that will be realized with the conversion of farm areas into irrigated ecosystems. The demand side of IMPACT incorporates the dynamic adjustment of income elasticities with respect to growth in income. Adjustments have also been made to some of the elasticities, based on recent studies and surveys. In addition to the modifications in the model structure, the baseline data on which the projections are made is updated from 1990 to 1993. This enables the model to reflect more accurately the most likely trends of commodity markets, incorporating the effects of policies implemented from the late 1980s to the present. The revised IMPACT also includes the November 1996 revised population projections from the United Nations (UN 1996), and updated information on investment in agricultural research (see also Rosegrant et al. 1997).

Specification of Scenarios

In the scenario simulating a severe Asian crisis, domestic agricultural commodity prices due to the exchange rate depreciation are assumed to increase in 1998 by 10 percent for South Asia, by 30 percent for some Southeast Asian countries (Indonesia, Malaysia, the Philippines, and Thailand), by 20 percent for the other Southeast Asian countries, by 10 percent for China, by 30 percent for South Korea, and by 20 percent for other East Asian countries. Agricultural commodity price effects of the currency depreciation under the moderate Asian crisis scenario are assumed to be one-half of

these levels. These additional wedges between international and domestic prices are assumed to be maintained throughout the projections period to 2020.

The income assumptions for Asian countries under the alternative scenarios are shown in Table 1. Under the severe crisis scenario, the average effective income growth rate in 1998-2020 is assumed to be one-half of the baseline income growth rates prior to the crisis. Under the moderate crisis scenario, income growth rates are set as follows: in China to 5.5 percent compared with the baseline value of 6.0 percent per year; in Indonesia to 4.5 percent compared with 6.5 percent per year; in Malaysia to 5.0 percent compared with 6.5 percent per year; in South Korea to 3.5 percent compared with 5.0 percent per year; in Thailand to 5.0 percent compared with 7.0 percent per year; and in India to 5.0 percent compared with 5.5 percent per year in the baseline.

Table 1: Projected annual growth rate in income, 1998-2020, baseline, severe and moderate Asian crisis scenarios

Country/Region	Baseline	Severe crisis	Moderate crisis
	(percent per year)		
Japan	2.8	1.4	2.0
India	5.5	2.8	5.0
Pakistan	5.0	2.5	4.5
Bangladesh	4.5	2.3	4.5
Other South Asia	5.0	2.5	4.5
Indonesia	6.5	3.3	4.5
Thailand	7.0	3.5	5.0
Malaysia	6.5	3.3	5.0
Philippines	5.0	2.5	5.0
Viet Nam	5.0	2.5	5.0
Myanmar	4.0	2.0	4.0
Other Southeast Asia	4.0	2.0	4.0
China	6.0	3.0	5.5
South Korea	5.0	2.5	3.5
Other East Asian countries	2.4	1.2	2.4

Source: IFPRI IMPACT Simulations

These changes in underlying assumptions have a number of effects within the projections model, many of which act in opposite directions. The income scenarios are implemented by shocking non-agricultural GDP. The decline in non-agricultural GDP for Asian countries directly reduces demand for those agricultural commodities that have a positive income elasticity and increases demand for those commodities with negative income elasticities. This reduction also leads to a decrease in area (numbers) and yield growth for crops and livestock through a multiplier effect that represents the change in the rate of investment in agriculture due to the change in non-agricultural GDP. The slowdown in agricultural production growth in turn reduces the growth rate in agricultural

GDP. The increase in domestic prices of agricultural commodities due to the exchange rate depreciation directly increases production and reduces demand for these commodities, and increases agricultural GDP (which introduces some upward pressure on demand). The increase in production and decline in demand for Asian countries in turn tends to reduce real world commodity prices, introducing a downward effect on Asian domestic prices and agricultural GDP. The outcomes of these various effects on supply, demand, and prices are determined through global annual market-clearing equilibria for each of the commodities. These results are presented in the following sections of the paper.

Projections of Cereal and Meat Demand

Projected Demand for Cereals

In the baseline scenario, total cereal demand will increase by 42 percent, from 1,773 million metric tons (mt) in 1993 to 2,511 million mt in 2020 (Figure 1). Among the cereals, maize will show the largest increase in demand, at 265 million mt, followed by wheat, 221 million mt, and rice, 135 million mt. The developing countries are expected to account for 84 percent of the increase in cereal demand and the Asian developing countries alone are projected to account for half of the total increase: China for 21 percent, India, 13 percent, and other Asian developing countries, 15 percent (Figure 2). Global cereal demand for human consumption is projected to grow by 354 million mt or 39 percent over 1993 (Table 2). Cereal food demand will more than double in Sub-Saharan Africa and will increase by more than 50 percent in South Asia and the West Asia and North Africa region. However, growth in demand will be slower than in the recent past, mainly due to a relative shift in consumption away from staple cereals in the diet structures in the rapidly growing developing economies (reflected in declining income elasticities of demand for cereals) and slowing population growth rates over the projections period.

Global per capita cereal food consumption will be virtually constant over the projections period, with slightly declining consumption of cereals at higher income levels balancing slightly increasing demands of lower-income countries. Increases in per capita cereal food demand are highest for South Asian countries at around 8 percent between 1993 and 2020, because of strong income growth and relatively high income elasticities of demand in this low-income region (Table 2). Global growth in per capita food demand for wheat will slow down at 0.08 percent per year during 1993-2020, compared with 0.32 percent per year during 1982-1990 but growth is still faster than for other cereals. Continued growth in per capita food demand for wheat in South and Southeast Asia, at 0.74 and 1.32 percent per year, respectively, will be driven by growth in income and the relative shift in diets from rice to wheat. The dietary transition spurs continued declines in rice demand: developing countries as a group will reduce per capita food demand for rice from 72 kilograms in 1993 to 67 kilograms in 2020. Developing country per capita food demand for maize and other coarse grains (barley, millet, oats, rye, and sorghum) will also continue to be declining or stagnant

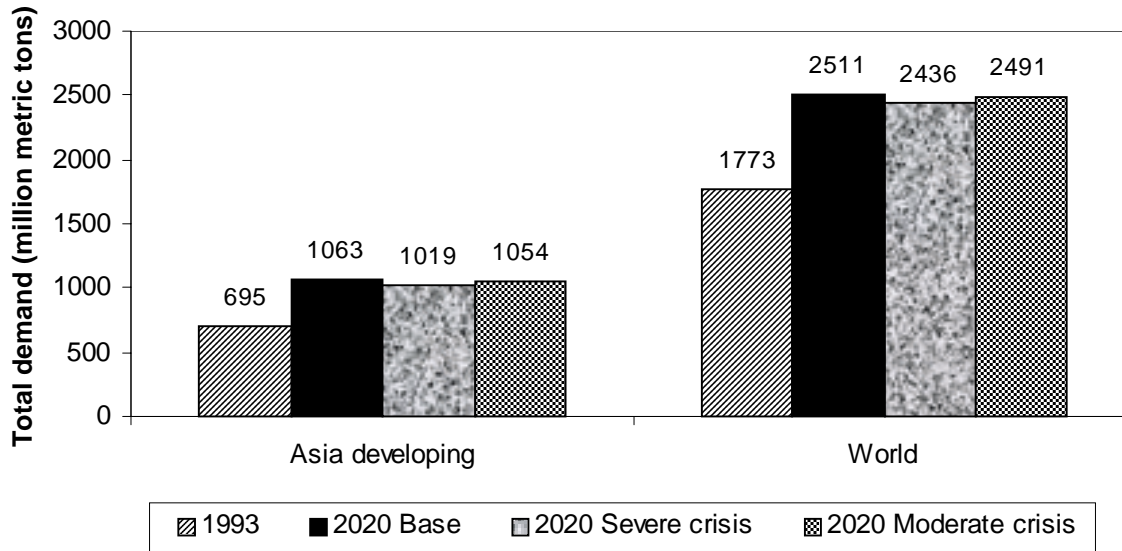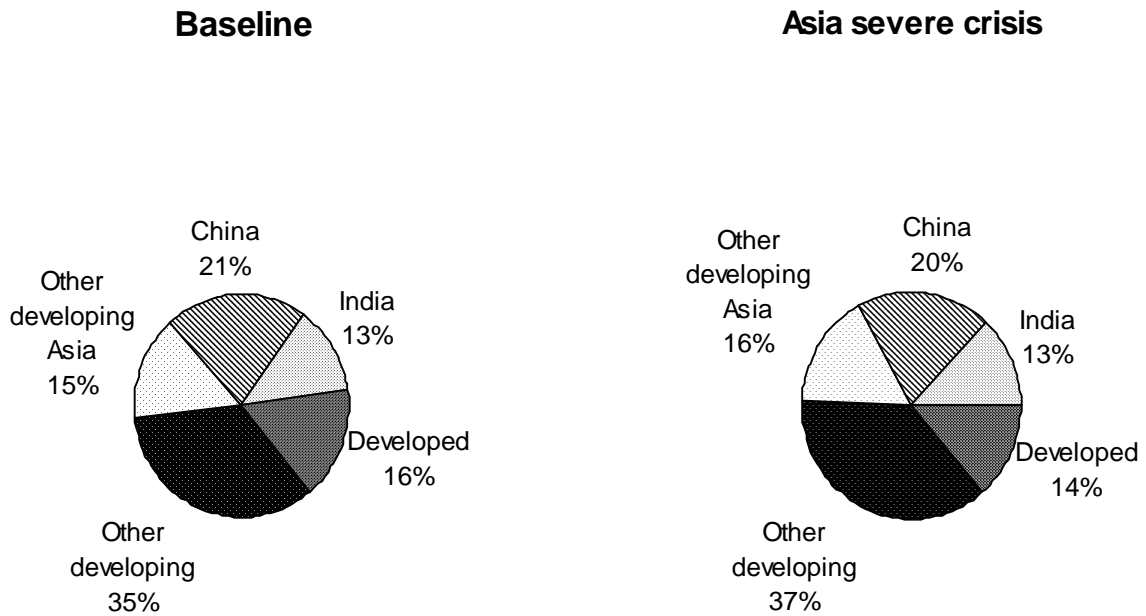**Figure 1. Total Demand for Cereals, 1993 and Projected 2020**

Figure 2. Share of Regions in Cereal Demand Increase, 1993 to 2020

Baseline

Asia severe crisis

at -0.43 and 0.24 percent per year, respectively, during 1993-2020 compared to 0.57 and -2.48 percent per year during 1967-82 and 0.45 and -1.96 percent per year during 1982-94.

Table 2: Per capita and total cereal food demand, baseline, severe and moderate Asian crisis scenarios

	Per Capita Food Demand				Total Food Demand			
	1993	2020			1993	2020		
		Base-line	Severe crisis	Moderate crisis		Base-line	Severe crisis	Moderate crisis
	(kilogram per capita)				*(million metric tons)*			
China	214	205	208	206	251.2	292.7	296.1	293.4
Other East Asia	157	148	152	149	15.2	17.9	18.4	18.0
India	163	176	170	175	147.1	225.4	217.0	223.6
Other South Asia	159	171	163	170	45.7	85.4	81.5	84.5
Southeast Asia	169	170	168	169	78.4	111.5	110.3	111.3
Latin America	128	129	129	129	58.9	84.7	85.1	84.9
WANA	214	210	210	210	79.0	134.4	134.3	134.1
Sub-Saharan Africa	112	118	120	119	57.4	123.4	125.3	124.6
Developing	172	170	169	170	733.5	1,076.4	1069.1	1,075.5
Developed	144	141	140	140	184.2	195.3	193.8	194.9
USA	133	132	131	132	34.8	42.5	42.2	42.4
World	165	165	163	164	917.7	1,271.7	1,262.9	1,270.5

Source: IFPRI IMPACT Simulations

A crucial emerging trend in Asia and other developing regions is the rapid growth in demand for maize and other coarse grains for animal feeds (Table 3). Cereal feed demand in developing countries is expected to expand by a rapid 2.88 percent per year in 1993-2020 (compared to the 0.65 annual expansion in developed countries). This fast growth is due to the strong expansion of the livestock industry, especially in the more rapidly growing developing economies, where consumption of meat will increase dramatically. Developing Asia as a group will account for 48 percent of the increase in feed demand. In China, demand for maize and coarse grains as feeds will increase by 3.57 and 3.02 percent per year, respectively. Thus, the stagnant or declining per capita demands for these cereals as food items will be more than compensated for by rapidly growing feed uses in developing countries.

Under the Asian crisis scenarios, relatively small decreases in global cereal demand are projected: global cereal demand in 2020 is expected to decline by 74 million mt (3.0 percent) in the severe crisis scenario and by 19 million mt (0.8 percent) in the moderate scenario, compared with the pre-crisis baseline scenario results (Figure 1). In Asia, the decline in total cereal demand will be 44 million mt (4.1 percent) in the severe and 9 mt (0.9 percent) in the moderate crisis scenario. The shares of the regions in the increase of cereal demand will change only slightly (Figure 2). Global food demand for cereals also changes very little (by negative 0.7 percent in the severe crisis scenario)

(Table 2). In both alternative scenarios, per capita cereal demand for food in 2020 would increase in some Asian countries and regions (China, other East Asian countries) and decline in others (South and Southeast Asia) compared to the baseline (Table 2). The increase in per capita cereal food demand in China and other East Asian countries is due to increases in the consumption of rice, maize, and other coarse grains (all of which have negative income elasticities of demand) brought about by the slowdown in the income-driven demand transition caused by the crisis. In Sub-Saharan Africa, the decline in world cereal prices induced by the Asian crisis results in an increase in cereal consumption.

Table 3: Cereal feed demand, baseline, severe and moderate Asian crisis scenarios

	1993	2020		
		Baseline	Severe crisis	Moderate crisis
		(million metric tons)		
China	72.6	183.2	154.3	178.0
Other East Asia	11.2	19.3	20.4	20.2
India	3.7	14.8	11.5	13.7
Other South Asia	1.7	3.7	3.2	3.6
Southeast Asia	14.7	31.6	30.4	29.8
Latin America	53.5	93.0	87.5	92.4
WANA	34.3	66.8	65.0	66.3
Sub-Saharan Africa	2.2	5.3	5.2	5.4
Developing	193.9	417.7	377.5	409.3
Developed	442.3	527.0	507.2	518.8
USA	158.2	203.0	202.0	202.1
World	636.1	944.7	884.7	928.1

Source: IFPRI IMPACT Simulations

Changes are larger for cereal feed demand (Table 3). Under the severe Asian crisis scenario, global cereal feed demand in 2020 will decline by 60 million mt, and even in the moderate crisis scenario by 17 million mt compared to pre-crisis levels. Latin America's cereal feed demand will decrease by 6 percent and West Asia and North Africa's by 3 percent under the stronger crisis assumptions. In Asia, China's cereal feed demand will decline by 16 percent, India's by 23 percent, Indonesia's by 5 percent, the Philippines' by 8 percent, and Thailand's by 2 percent. However, feed demand in Malaysia and South Korea is projected to increase by 6 and 9 percent, respectively. In the moderate scenario, feed demand will decrease by 2 percent in Malaysia, but still grow by 6 percent in South Korea, compared to the baseline scenario. The increase in feed demand in these two countries is due to the increase in domestic prices of livestock caused by the currency depreciation; this induces an increase in livestock production that is slightly higher than the investment-induced reduction in production as a result of slower long-term income growth. This countervailing price effect also dampens the reduction in cereal feed demand in other Asian countries.

Projected Demand for Livestock Products

In the coming decades, demand for livestock products is projected to continue to grow rapidly, albeit at lower rates than in the recent past. This demand is driven by changing dietary patterns, especially in the rapidly growing developing economies, causing a shift to more diversified diets with higher per capita consumption of meat, milk and milk products, fruits, and vegetables, and lower (or very slowly growing) per capita consumption of cereals. In the pre-crisis baseline scenario, global meat demand is expected to increase by 64 percent from 188 million mt in 1993 to 309 million mt in 2020 (Figure 3), at an annual rate of 1.86 percent, compared to 2.99 percent per year during 1982-93. Developing countries will account for 87 percent of the increase in meat demand, and developing Asia on its own will account for 61 percent (Figure 4). China will experience the most dramatic increase in meat demand during 1993-2020, accounting for 42 percent of the total growth in demand. Twenty-four percent of the increase in meat demand will be contributed by beef, 41 percent by pigmeat, and 31 percent by poultry. In India, meat demand will grow by 3.04 percent per year during 1993-2020 (from a very low base level of consumption); in other South Asian countries by 3.29 per year; in Latin America by 2.18 percent per year; in Sub-Saharan Africa by 3.41 percent per year, and in West Asia and North Africa by 2.68 percent per year. All Southeast Asian countries are expected to experience annual increases in meat demand above 3 percent, ranging from 3.26 percent in Malaysia to 3.76 percent in Indonesia. As a consequence, the group of developing countries will dominate global demand for livestock products: whereas in 1993 they accounted for less than half of world demand, by 2020 they will account for more than 60 percent. In developed countries, on the other hand, meat demand will increase only slowly as high consumption levels have already been achieved in the past decades.

As can be seen in Table 4, per capita meat demand will grow particularly rapidly in China and other East and Southeast Asian countries. In the pre-crisis baseline, China's per capita meat demand is projected to almost double from 33 kilograms in 1993 to 62 kilograms in 2020. This level of consumption is substantially higher than the level projected for Japan (49 kilogram per capita), and is closing the gap to the consumption levels of the developed countries, where per capita consumption levels are stagnant or increasing only slightly. Per capita demand for beef and poultry will more than double in China, but the biggest absolute increase will be in pigmeat, from 25 kilograms per capita in 1993 to 45 kilograms per capita in 2020. Among other East Asian countries, South Korea's per capita demand for poultry is expected to almost triple, from 9 kilograms in 1993 to 26 kilograms in 2020, and its per capita demand for pigmeat will increase from 18 kilograms in 1993 to 45 kilograms in 2020. For developing countries as a group, per capita meat demand is projected to increase from 21 kilograms in 1993 to 31 kilograms in 2020, reaching little more than one third of developed-country meat consumption levels. The increases in per capita demand will be fastest for poultry, at 1.71 percent per year, followed by pigmeat at 1.47 percent per year, and beef at 1.33 percent per year. In developed countries, per capita demand for beef and pigmeat has declined since 1982, with a relative shift in demand to poultry. Per capita poultry demand grew at a strong 2.23 percent per year during 1982-93, and is expected to continue to increase at 0.69 percent per year during 1993-2020. With growth in poultry consumption offset by declining beef and pigmeat consumption, per capita consumption of meat has been virtually constant in the group of developed countries since 1982 and is expected to increase only slightly, from 78 kilograms in 1993 to 83 kilograms in 2020.

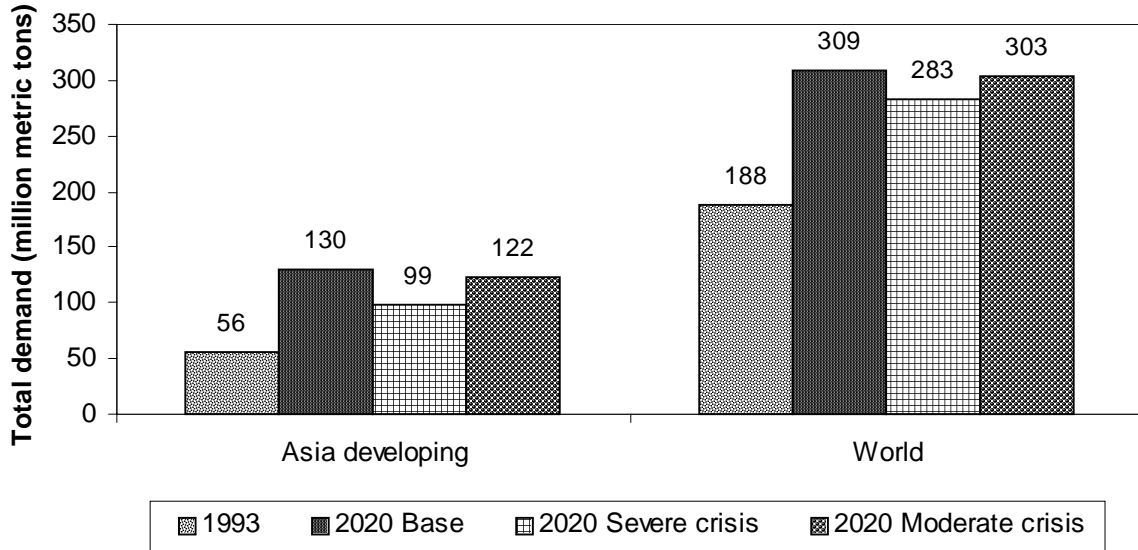**Figure 3. Total Demand for Livestock Products, 1993 and Projected 2020**

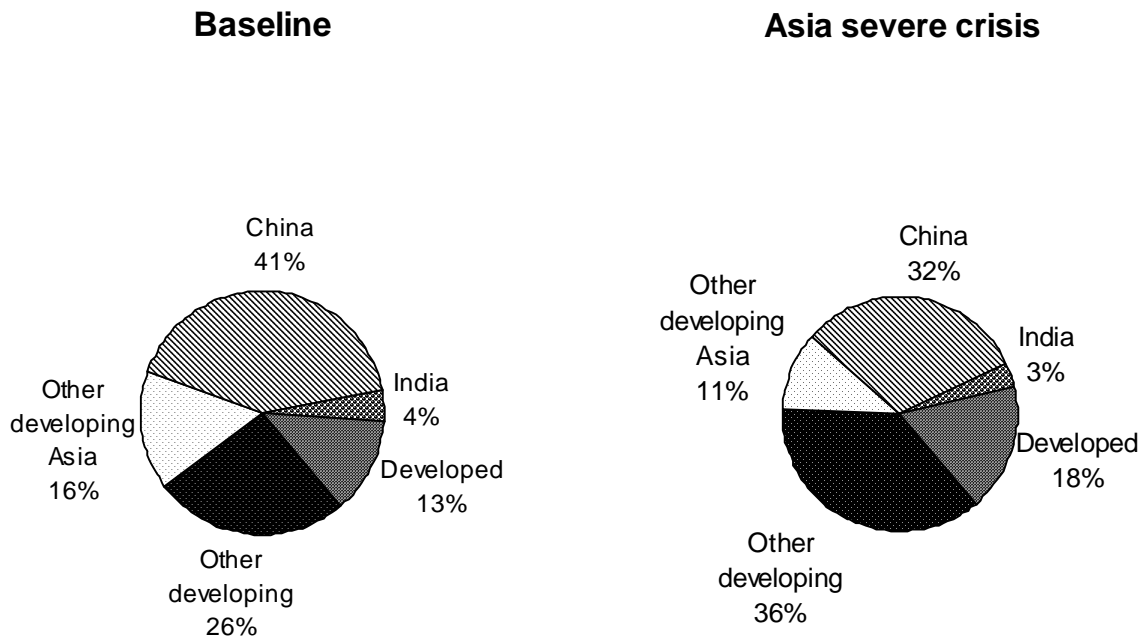**Figure 4. Share of Regions in Meat Demand Increase, 1993 to 2020**

Table 4: Per capita demand for livestock products, 1993 and projected 2020, baseline, severe and moderate Asian crisis scenarios

	1993	2020		
		Baseline	Severe crisis	Moderate crisis
	(kilograms per capita)			
China	33	62	48	60
Other East Asia	44	79	55	67
India	4	7	6	6
Other South Asia	7	10	9	10
Southeast Asia	15	27	19	24
Latin America	46	58	61	59
WANA	20	23	24	24
Sub-Saharan Africa	9	11	11	11
Developing	21	31	26	30
Developed	78	83	84	83
USA	118	121	121	121
World	34	40	37	39

Source: IFPRI IMPACT Simulations

The locus of the biggest demand shifts resulting from the Asian crisis will be in livestock products, which are more price- and income- sensitive than cereals. In the alternative Asian crisis scenarios, livestock demand will contract considerably: global demand for meat will decline by 8 percent to 283 million mt in the severe crisis scenario, and by 2 percent to 303 million mt in the moderate crisis scenario (Figure 3). The countries in developing Asia will be hit hardest by the effects of the crisis: China's meat demand will plunge by 23 percent (and by 4 percent even in the moderate crisis scenario) from a pre-crisis value of 88.9 million mt in 2020. Meat demand in both Indonesia and the Philippines will decrease by 32 percent in the severe crisis scenario, and by 21 and 7 percent, respectively, in the moderate crisis scenario. South Korea's meat demand will drop sharply, by 39 percent in the severe and by 26 percent in the moderate crisis scenario, from a pre-crisis value of 4.7 million mt in 2020. China's share in the increase in global meat demand between 1993 and 2020 will drop to 32 percent in the severe, and to 40 percent in the moderate crisis scenario (Figure 4). The share of other Asian developing countries will drop from 20 percent in the baseline to 14 percent in the severe, and to 17 percent in the moderate crisis scenario. Consequently, the share of the developed countries in the increase in meat demand will grow from 13 percent in the pre-crisis scenario, to 18 percent in the severe crisis scenario, and 14 percent in the moderate crisis scenario. In the group of developing countries, the biggest drop in livestock demand in the severe crisis scenario will be for pigmeat (19 percent), followed by poultry (13 percent), and beef (8 percent).

As can be seen in Table 4, per capita demand for livestock products in 2020 will also contract most markedly in Asian countries, led by other East Asian countries - mainly South Korea - from 79 kilograms in the baseline to 55 kilograms in the severe and 67 kilograms in the moderate crisis scenario; and China, from 62 kilograms in the baseline to 48 kilograms in the severe and 60 kilograms

in the moderate crisis scenario. However, despite the sharp declines in meat demand due to the Asian crisis, growth in meat demand will remain relatively strong in Asia: under the severe Asian crisis scenario, developing Asian countries will still account for 35 percent of global meat demand in 2020, and under the moderate Asian crisis scenario for 40 percent, compared with the 42 percent in the pre-crisis scenario. Thus, although the contraction of demand in Asia due to the Asian crisis could be large, it will not threaten Asia's increasingly important role in the growth in global food markets. In addition, global meat demand will still be dominated by developing countries. In the severe crisis scenario, the group of developing countries will account for 59 percent of global meat demand in 2020, and in the moderate crisis scenario for 62 percent.

Projections for Crop and Livestock Area/Number and Yields

Projected Production, Area, and Yield Growth for Cereals

The increase in global cereal demand projected for the 1993-2020 period will have to be met through increases in harvested area or yield. Under the pre-crisis baseline scenario, world wheat production is projected to accelerate at an average annual rate of 1.26 percent during 1993-2020, compared to the 1.20 percent achieved during 1982-94. This is mainly due to a recovery from low growth in developed countries that had been induced by price declines for cereals in world markets and policy changes in some developed regions. Growth in maize production is projected to slow down to 1.52 percent annually in 1993-2020, compared to 1.93 percent per year in 1982-94; growth in rice production is also expected to decline to 1.19 percent annually in 1993-2020, compared to 1.94 percent per year in 1982-94. Production of other coarse grains will recover from negative growth in 1982-94 to 1.11 percent per year in 1993-2020.

Growth in area will contribute little to future cereal production growth: under the baseline scenario, global cereal crop area will continue to increase between 1993 and 2020, but only by 49 million hectares, at an annual rate of 0.25 percent, compared with the annual rate of 0.37 percent during 1967-82 and the negative trend of 0.24 percent per year during 1982-94 (Figure 5). Sixteen percent of this increase will be allocated to wheat, 35 percent will go to maize, 40 percent to other coarse grains, and only 8 percent to rice. Developing countries are projected to account for 87 percent of the expansion in cereal crop area, almost two-thirds of which will be in Sub-Saharan Africa, where crop yields are very low. In developing Asia, on the other hand, only 5 million hectares will be added to the existing cereal crop area.

With global cereal crop area barely increasing, growth in crop yield rates will account for most of the projected production increases. However, although yield growth rates vary by commodity and country, there will be an overall decline in the rates of growth in crop yields compared to the already reduced rates in the post-Green Revolution period of 1982-94 (Table 5). The global annual cereal yield growth rate is projected to continue to decline from 2.24 percent in 1967-82, and from 1.51 percent in 1982-94 to 1.04 percent in 1993-2020. Continued improvement in yield growth, but at lower levels, is projected for the group of developing countries, at 1.22 percent per year during 1993-2020. In some Asian countries, increased intensity of land use has already led to substantially higher input requirements in order to sustain yield gains (Rosegrant and Pingali 1994; Morris and Byerlee 1996). This will make increases in yield gains in this region even more challenging. For the group

of Asian developing countries, the cereal yield growth rate is projected to drop by half from the annual trend of 2.40 percent during 1982-94 to 1.20 percent in 1993-2020. In India, growth in yields is expected to sharply decline from 3.25 percent per year in 1982-94 to 1.47 percent in 1993-2020; in China, the decline will be from 2.46 percent to 1.01 percent; and in Southeast Asia, from 1.88 percent to 1.35 percent per year in the same periods. Yield growth is also projected to decline in developed countries: from the annual trends of 1.69 percent in 1967-82 and 1.30 percent in 1982-94 to 0.89 percent in 1993-2020.

The prospects for production, area, and yield growth will change significantly under the crisis scenarios, leading to further yield slowdowns among the Asian countries. In the severe crisis scenario, growth in global cereal production will slow to 1.18 percent per year (compared to 1.30 percent per year under the pre-crisis baseline scenario), and in the moderate crisis scenario to 1.27 percent annually. Wheat will experience the biggest drop, and grow only at 1.12 percent per year in 1993-2020 (compared to the 1.26 percent per year in the baseline).

Global cereal crop area in 2020 will decline by 8 million hectares in the severe crisis scenario compared to the baseline projection, a 16 percent decline in the projected 1993-2020 increase of 49 million hectares (Figure 5). This decline will be evenly shared between the group of developed and developing countries. Among the developing countries, West Asia and North Africa will experience the biggest drop in cereal crop area, from 60 million hectares in the pre-crisis scenario to 58 million hectares. In contrast to other countries and regions, cereal crop area in Asian developing countries will increase slightly, by 362 thousand hectares in the severe and by an even higher 449 thousand hectares in the moderate crisis scenario, compared to the pre-crisis baseline scenario. In this region, the currency depreciation-induced domestic price increases more than compensate for lower international prices and income-induced reductions in investment in crop production.

In the severe crisis scenario, the global annual cereal yield growth rate in 1993-2020 will drop to 0.97 percent, and in the moderate scenario to 1.03 percent, compared with the baseline growth of 1.04 percent (Table 5). India, China, and other South Asian countries will be hit hardest in both scenarios, whereas growth in yields is projected to improve in South Korea and the group of Southeast Asian countries due to higher domestic prices from the currency depreciations. In the moderate scenario, the annual yield growth for the Asian developing countries would recover to the pre-crisis rate.

Projected Production, Numbers and Yield Growth for Livestock Products

Driven by the rapid increases in demand for livestock products, meat production is expected to increase much more rapidly than cereal production in the coming decades. However, similar to the case of cereals, growth in global meat production will slow down compared to past trends, at 1.86 percent per year in 1993-2020, compared to 2.96 percent annually in 1982-94. In developing countries, the rate of growth of meat production will decline from the rapid 5.96 percent per year in 1982-94 to a still strong annual 2.79 percent in 1993-2020, which will be accounted for mainly by pigmeat (45 percent) and poultry (27 percent). Global meat production is projected to increase by 121 million mt, from 188 million mt in 1993 to 309 million mt in 2020 (Figure 6). Production will

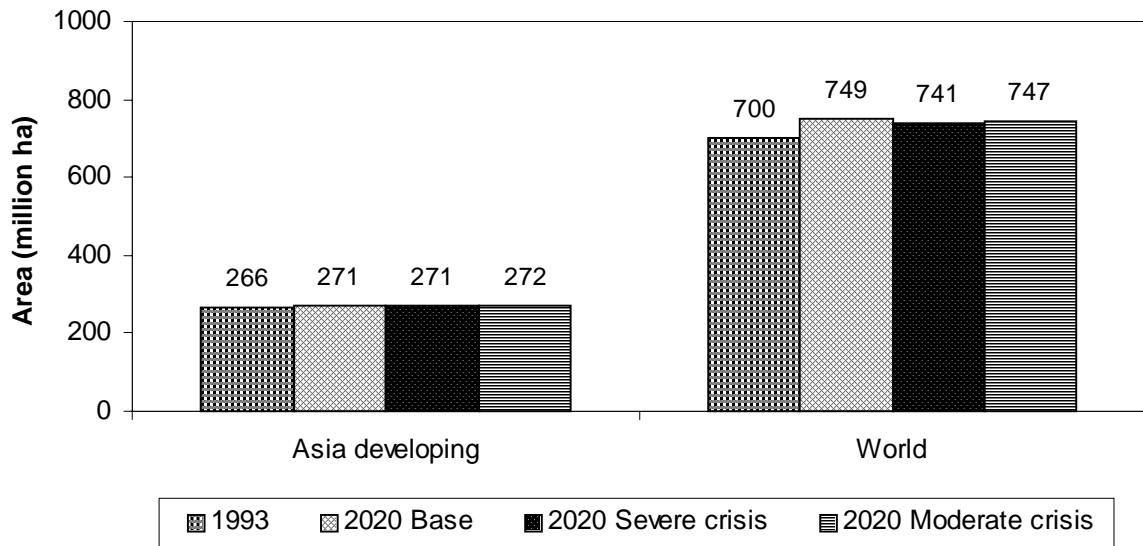**Figure 5. Area Harvested for All Cereals, 1993 and 2020**
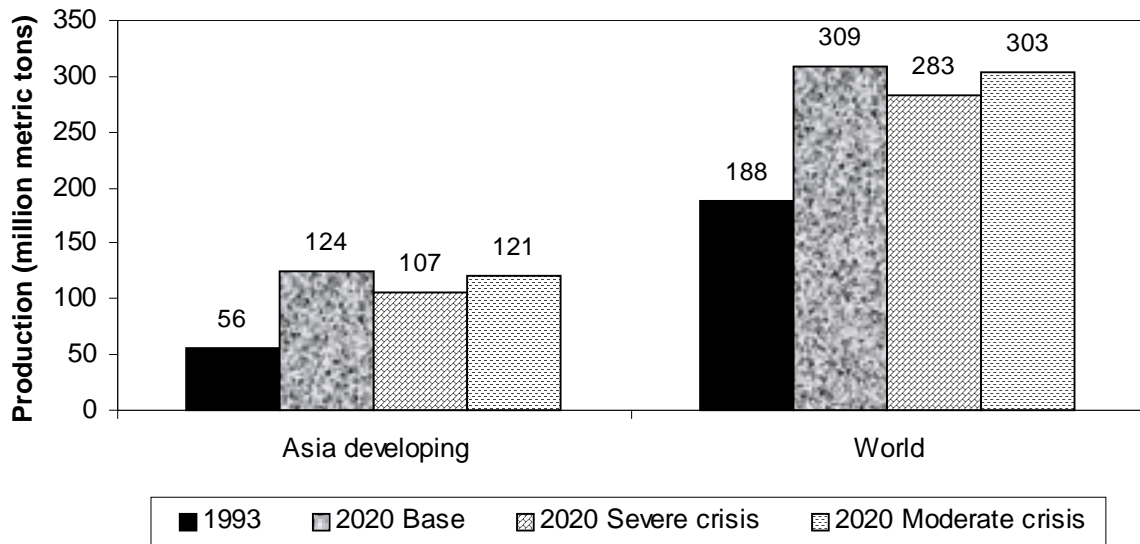

Figure 6. Total Meat Production, 1993 and 2020

Table 5: Yield growth rates, all cereals, 1967-2020

	1967-82	1982-94	1993-2020		
			Baseline	Severe crisis	Moderate crisis
	(percent per year)				
China	3.88	2.46	1.01	0.93	1.00
Other East Asia	2.45	-0.29	0.87	0.95	0.93
India	2.69	3.25	1.47	1.34	1.45
Other South Asia	1.96	1.42	1.54	1.43	1.53
Southeast Asia	2.96	1.88	1.35	1.39	1.39
Asian developing countries	3.14	2.40	1.20	1.12	1.20
Developing	2.87	1.87	1.22	1.15	1.21
Developed	1.69	1.30	0.89	0.81	0.86
World	2.24	1.51	1.04	0.97	1.03

Source: Historical growth rates, FAOSTAT, FAO 1997; projected growth rates, IFPRI IMPACT Simulations

be particularly strong in the Asian developing countries, more than doubling from 56 million mt in 1993 to 124 million mt in 2020. In the group of developed countries, production will increase only relatively slowly, by 24 million mt from 100 million mt in 1993. More than two-thirds of the increase in global production during 1993-2020 will be accounted for by growth in the numbers of livestock slaughtered (Table 6), mainly due to the domination of numbers growth (1.86 percent per year) in the expansion of developing-country production. China and Southeast Asia will experience the highest growth in the numbers of livestock slaughtered, at 2.17 and 2.07 percent per year, respectively. In developed countries, on the other hand, weight growth (carcass weight per animal) will drive production at 0.52 percent annually during 1993-2020.

In the severe Asian crisis scenario, global meat production will plunge by 26 million mt (8.4 percent) and in the moderate crisis scenario by 6 million mt (1.9 percent); in the group of developing Asian countries, meat production will fall by 17 million mt (14.0 percent) and 3 million mt (2.5 percent) respectively, compared with the pre-crisis values (Figure 6). Both numbers and yield growth will contribute to this decline in production. However, the extent to which production will decline (or even increase for a few countries) under the Asian crisis scenarios will vary considerably depending on an interplay of prices, supply and demand elasticities, and the intersectoral investment multipliers. As can be seen in Table 6, the global annual numbers growth rate during 1993-2020 will decline to 0.99 percent in the severe and to 1.20 percent in the moderate crisis scenario, compared with the baseline rate of 1.26 percent; and the annual yield growth rate will drop to 0.53 and 0.57 percent, respectively, compared with 0.59 percent in the baseline scenario. India and China will experience the biggest declines in both number and yield growth rates, whereas the Southeast Asian countries are less affected. In South Korea, the domestic price impact of the currency depreciation on production will outweigh the dampening effect of the income/investment multiplier, and the annual growth rates for livestock numbers and yield will improve under both scenarios, from 2.21 and 0.47 percent in the baseline scenario to 2.59 and 0.54 percent in the severe and 2.44 and 0.50 percent in

Table 6: Number and yield growth for livestock products, 1993-2020, baseline, severe and moderate Asian crisis scenarios

	Number growth			Yield growth		
	Baseline	Severe crisis	Moderate crisis	Baseline	Severe crisis	Moderate crisis
	(percent per year)					
China	2.17	1.62	2.08	0.86	0.67	0.83
Other East Asia	1.49	1.67	1.63	0.76	0.78	0.77
India	1.37	1.10	1.34	1.46	1.13	1.39
Other South Asia	0.98	0.89	1.00	1.68	1.33	1.60
Southeast Asia	2.07	2.02	2.07	1.06	1.04	0.98
Latin America	1.25	1.09	1.23	0.93	0.93	0.95
WANA	1.60	1.60	1.59	0.89	0.85	0.88
Sub-Saharan Africa	1.92	1.85	1.92	1.39	1.37	1.46
Developing	1.84	1.54	1.80	0.93	0.82	0.92
Developed	0.27	0.08	0.19	0.52	0.50	0.51
USA	0.54	0.41	0.48	0.63	0.59	0.61
World	1.26	0.99	1.20	0.59	0.53	0.57

Source: IFPRI IMPACT Simulations

the moderate crisis scenario, respectively. North Africa and West Asia's livestock production is little affected by the crisis. In Latin America, however, numbers growth will decrease significantly due to the decline in world prices.

Projections for World Prices and International Trade of Cereals and Meats

Projected Cereal and Meat Prices and Trade in the Pre-crisis Baseline Scenario

The baseline projection results of IMPACT indicate that global food production will grow fast enough for real world prices of food to continue to fall, but at much slower rates than in the past two decades. Over the 27-year period, world wheat prices are projected to decline by 6.1 percent, compared to the much bigger drop of 28 percent between 1982 and 1995, and rice prices will fall by 3.5 percent, compared to the previous decline of 42 percent (Figure 7). Prices for other coarse grains will experience the biggest decline, 9.8 percent over 1993 values. Maize prices will actually increase over the projections period by 1.6 percent, compared to the 43 percent drop between 1982 and 1995. The weighted average price for all cereals will decline by 4.3 percent by 2020. Moreover, projected real cereal prices will be particularly strong through the year 2010. Aggregate cereal prices are projected to increase by 4.9 percent through 2010, wheat prices by 2.0 percent, maize prices by 3.2 percent, rice prices by 11.5 percent, and only the price for other coarse grains will decline by 1.6 percent. It is only after 2010 that the combination of continued declines in the rate of population growth and declining income elasticities for cereals, will reduce demand growth enough to cause real cereal prices to drop more sharply.

Prices for livestock commodities will also remain relatively strong throughout the projections period, with price declines in the range of 5 to 8 percent (Figure 8). The average meat price will decline by 7.4 percent between 1993 and 2020. Both beef and pigmeat prices declined by 22 percent between 1982 and 1991, but will decline by only 7.6 and 5.6 percent, respectively, during 1993-2020. The price for sheep and goat meat is expected to decrease by 7.2 percent during 1993-2020, compared to a drop in the proxy price of lamb of 33 percent between 1982 and 1991. The price of poultry is expected to decrease by 6.0 percent, compared to a decline of 18 percent between 1982 and 1991. Livestock prices will decline more smoothly over the projections period, compared with cereal prices, with the price of beef declining by 5.6 percent by 2010; pork by 2.9 percent; sheep and goat meat by 3.6 percent, and poultry by 5.8 percent.

The slow decline in cereal and livestock prices will be accompanied by rapidly increasing world trade in food, with the primary impetus for expanded trade being generated by the group of developing countries increasing its food imports from developed countries. In the pre-crisis baseline scenario, world trade in cereals is projected to increase by 137 million mt, from 185 million mt in 1993 to 323 million mt in 2020 (Figure 9). Among the cereals, wheat imports will show the biggest absolute increase, 66 million mt, from 91 million mt in 1993 to 156 million mt in 2020. Net cereal imports by developing countries will increase by nearly 150 percent (Figure 10), with Asia accounting for the largest increase (70 percent), followed by West Asia and North Africa (26 percent).

Net cereal imports in Asian developing countries will increase by close to 350 percent over the projections period, from 27 million mt in 1993 to 122 million mt in 2020 (Figure 9). The details of this rapid increase are shown in Figure 11. China will lead Asia in net cereal imports, accounting for over one-half of the increase in cereal imports, followed by South Asian countries other than India - mainly Pakistan - at 19 percent. India, and the other East Asian countries - mainly South Korea - will both account for 11 percent of the increase in net imports of cereals. Japan's net cereal imports, on the other hand, are expected to barely grow over the projections period, from 29 million mt in 1993 to 33 million mt in 2020, because of slow growth in demand.

A major beneficiary of increased cereal import demand from developing countries will be the main cereal exporters, particularly the United States, whose cereal exports are expected to increase by nearly 60 percent, from 85 million mt in 1993 to 135 million mt in 2020. In addition, Eastern Europe and the former Soviet Union are expected to take advantage of the increased import demands in developing countries, shifting from a large net importing position of 27 million mt in 1993 to become large net exporters (of 33 million mt) by 2020.

Under the pre-crisis baseline scenario, world net trade in livestock products will expand proportionally even more rapidly than cereal trade, although from much lower levels. Global net trade is projected to increase from 8.1 million mt in 1993 to 15.9 million mt in 2020, an increase of 95 percent over 1993 levels. Developing countries will dramatically increase their imports of livestock products. Asia will be the primary importer of meat products by 2020, at 5.8 million mt, followed by West Asia and North Africa, at 3.4 million mt, and Sub-Saharan Africa, at 0.5 million mt (Figure 12). Latin America, on the other hand, will improve its exporter status, from 0.6 million

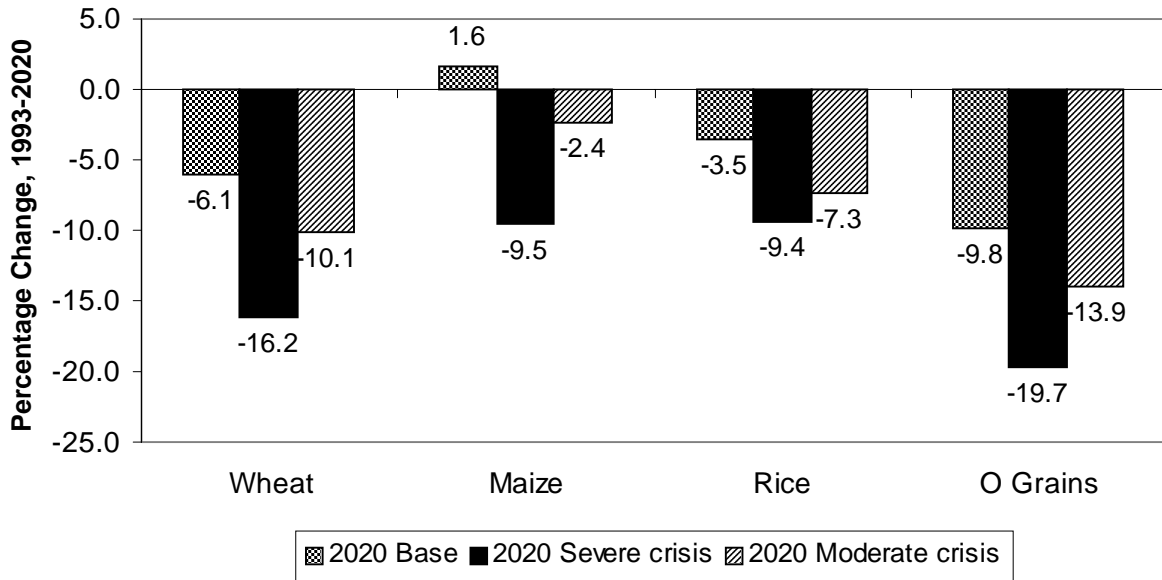**Figure 7. Changes in Projected Real Prices for Cereals, 1993-2020**

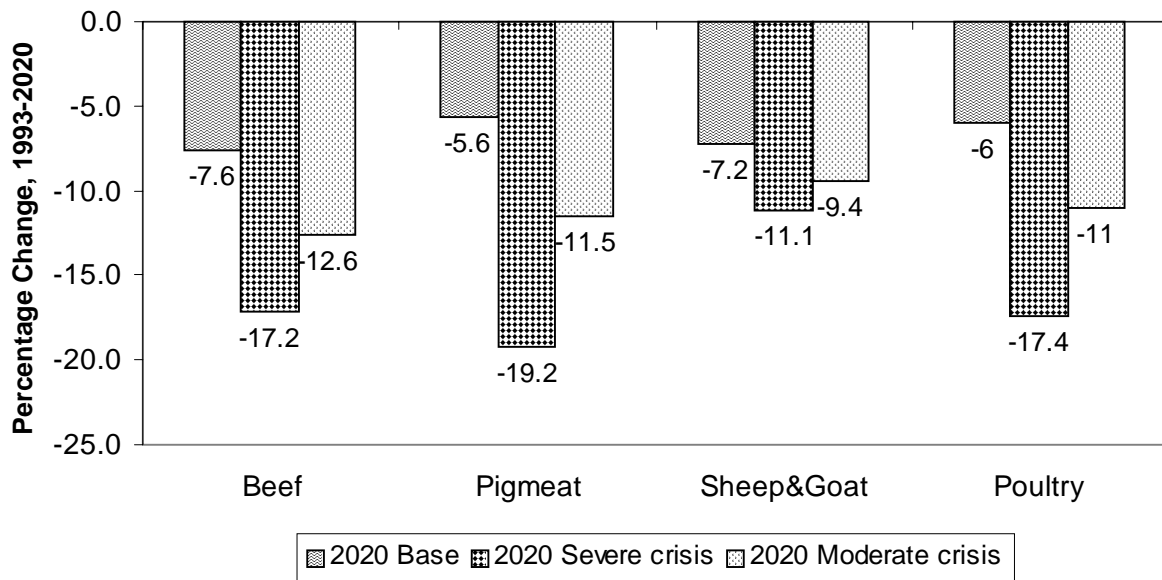**Figure 8. Changes in Projected Real Prices for Meats, 1993-2020**

Figure 9. Cereal World Trade and Net Imports of Developing Asia, 1993 and 2020
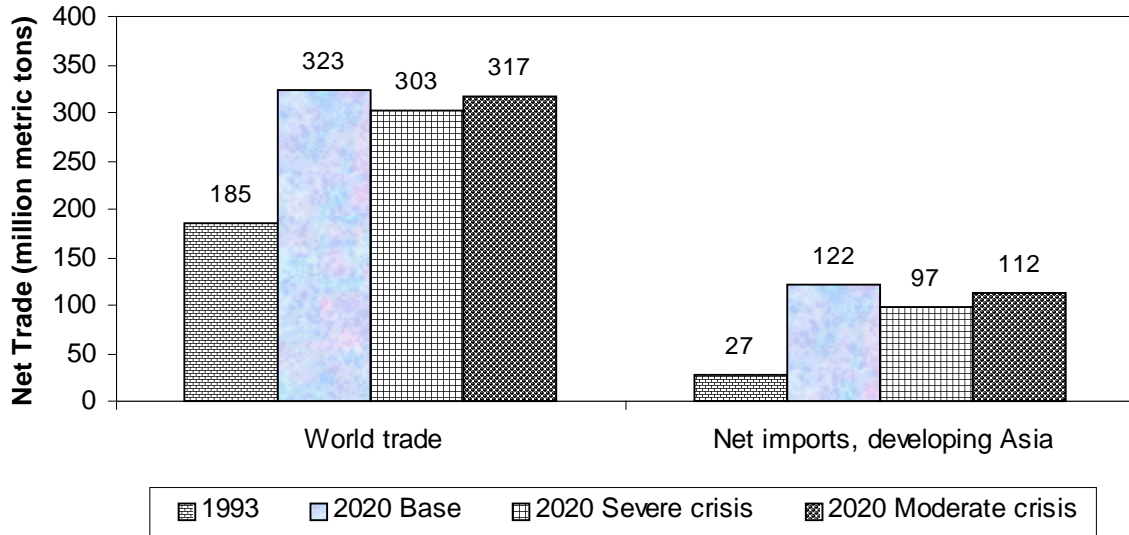

Figure 10. Net Cereal Imports of Major Developing Regions, 1993 and Projected 2020
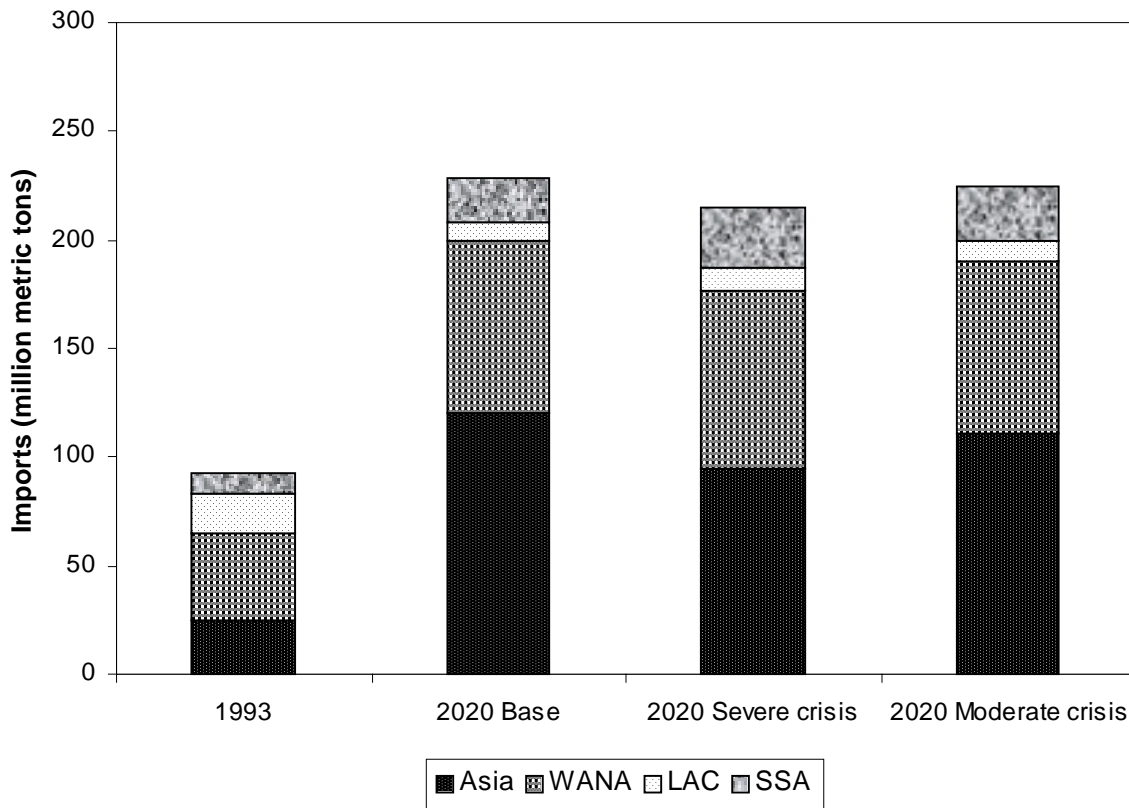
Figure 11. Net Cereal Imports of Developing Asia, 1993 and Projected 2020
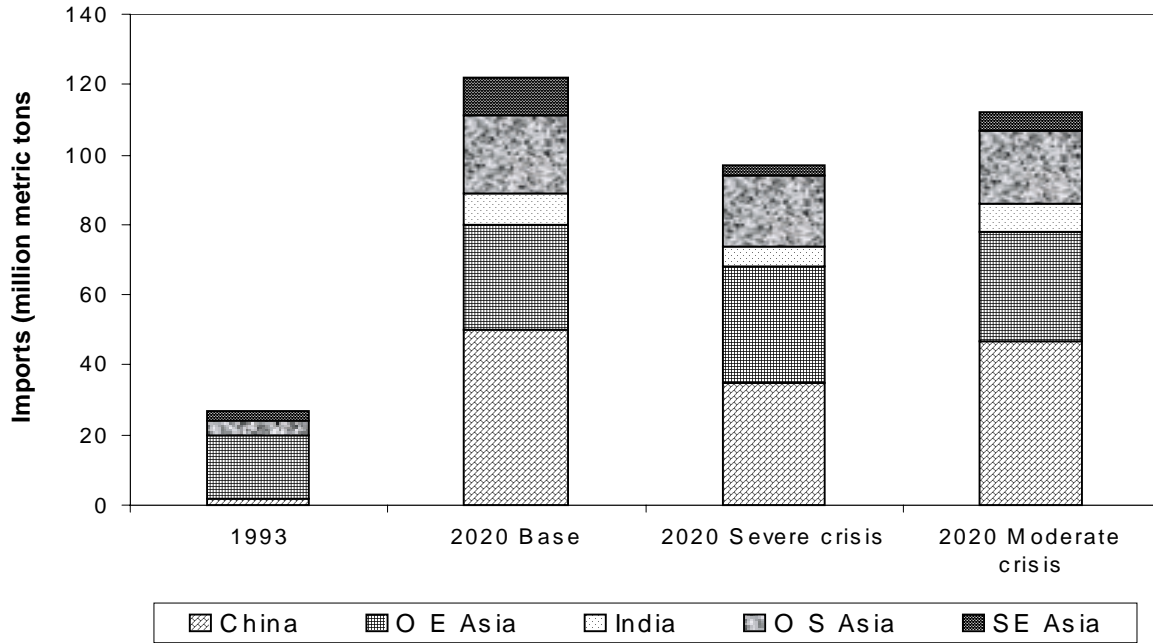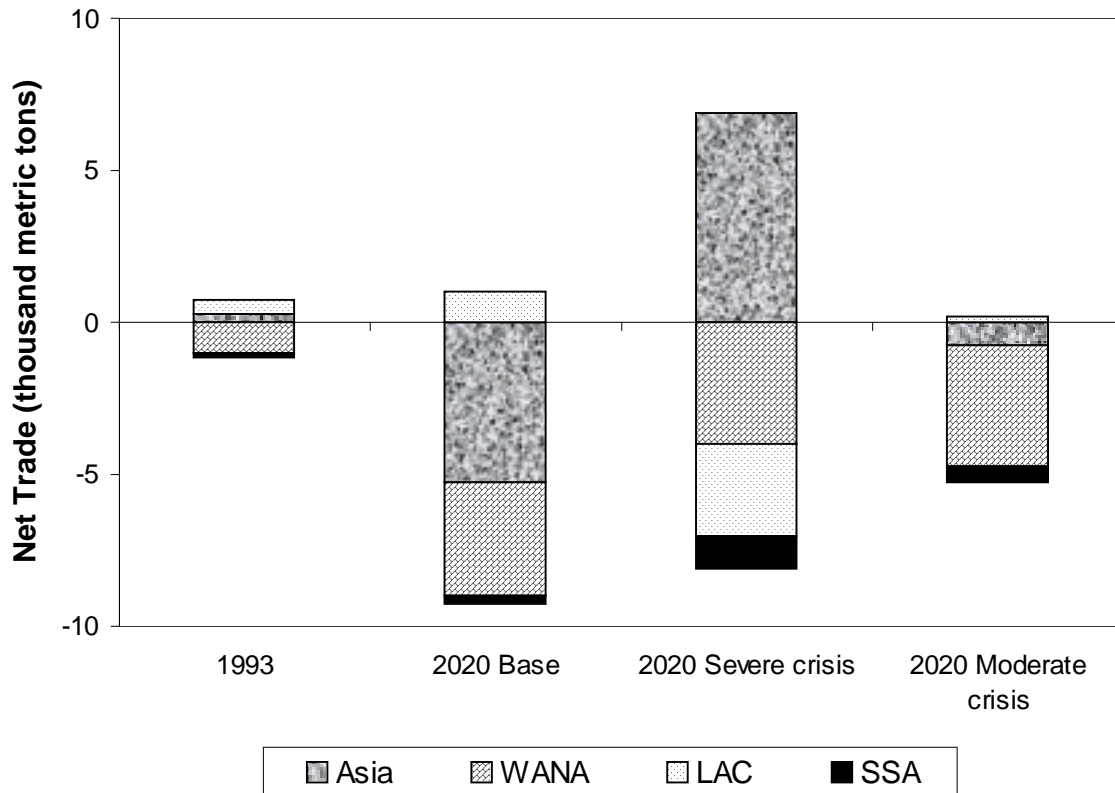

Figure 12. Net Trade in Livestock Products of Major Developing Regions, 1993 and Projected 2020

mt in 1993 to 1.2 million mt in 2020. Again, the developed countries will satisfy most of the increased importing demands, led by the United States, at 3.4 million mt, closely followed by Western Europe at 3.3 million mt, and Australia, at 2.2 million mt.

The Impact of the Asian Economic Crisis on World Cereal and Meat Prices and Trade

The Asian crisis scenarios have significant impacts on world prices and trade. Due to the dramatic declines in developing-country food demand due to the crisis, prices are expected to decline sharply compared to the pre-crisis scenario. Between 1993 and 2020, wheat prices will decline by 16.2 percent in the severe and by 10.1 percent in the moderate crisis scenario, maize prices by 9.5 and 2.4 percent, rice prices by 9.4 and 7.3 percent, and prices for other grains by 19.7 and 13.9 percent, respectively (Figure 7). The drop in livestock prices will be even stronger. The pigmeat price would be most affected with a price drop of 19.2 percent in the severe and 11.5 percent in the moderate crisis scenario (Figure 8). Beef prices will decline by 17.2 and 12.6 percent, and poultry prices by 17.4 and 11.0 percent, depending on the severity of the crisis.

Global net cereal trade will decline by 20 million mt in the severe and by 6 million mt in the moderate Asian crisis scenario (Figure 9). Net imports by developing countries will decline by 13 million mt in the severe and by 3 million mt in the moderate crisis scenario, compared with the pre-crisis baseline scenario (Figure 10). Among the developing countries, Asia's net cereal imports will experience the biggest drop in the severe crisis scenario at 26 million mt, importing at a level 21 percent below the pre-crisis value. Among the Asian developing countries, China will experience the biggest absolute decline in net cereal imports, 16 million mt in the severe and 3 million mt in the moderate crisis scenario (Figure 11). In relative terms, however, net cereal imports will contract most in Southeast Asia, by 55 percent (6 million mt) in the severe and 46 percent (5 million mt) in the moderate Asian crisis scenario over projected pre-crisis imports. The contraction in Asian cereal imports will directly affect the traditional cereal exporting countries. Cereal exports of developed countries will fall by 13 million mt, or 5.4 percent under the severe crisis scenario. Combined U.S. and European cereal exports in 2020 would contract 7 percent from 171 million mt to 158 million mt. Under the moderate crisis, however, changes in developed country exports will be relatively small.

Livestock trade patterns will undergo significant shifts in the crisis scenarios. The biggest impact will be again in Asia, whose substantial projected net importing position of 5.8 million mt projected in the baseline scenario will shift to an exporting position of 7.6 million mt in the severe Asian crisis scenario (Figure 12). The increase in domestic livestock prices in Asia due to the depreciation exacerbates the slowdown in growth in demand for livestock due to the fall in income growth. The increase simultaneously dampens the slowdown in production growth that is caused by the investment effects of slower income growth. The result of these changes is the shift from importer to exporter status for many of the Asian countries seen in Figure 13. China leads the change in the livestock trade pattern, shifting from a projected slight import position of 0.3 million mt in 2020 in the pre-crisis baseline scenario to become a large net exporter, mainly for pigmeat and poultry, at 3.5 million mt in the severe crisis scenario. In the moderate crisis scenario, China reverts back to 1993 import and export levels. Southeast Asia will experience a similar shift in its trading position, from importing 1.5 million mt in the pre-crisis scenario to exporting 3.5 million mt in the severe crisis

scenario. Only South Asian countries other than India will maintain their net importing status in the severe crisis scenario.

Declining world prices of livestock will also cause substantial changes in the trade patterns of other regions. The combined region of West Asia and North Africa and Sub-Saharan Africa will both increase their net imports of livestock products in the two crisis scenarios (Figure 12). Imports in the former region will increase by 0.7 million mt in the severe and by 0.4 million mt in the moderate crisis scenario, and in the latter by 1.0 million mt and 0.2 million mt, respectively. Due to the large price declines in the severe crisis scenario, Latin America will shift from projected exports of 1.2 million mt of livestock products in the baseline scenario to net imports more than twice the size, 2.6 million mt, in the severe crisis scenario. In the moderate crisis scenario, the region will resume a slight net exporting position in 2020. Combined U.S. and European meat exports would plunge by 87 percent, from 6.7 million mt under the pre-crisis scenario to 0.9 million mt in severe crisis scenario. In the moderate crisis scenario, U.S. and European exports of livestock products are projected to be 4.1 million mt.

In addition to the dramatic changes in trade volumes under the severe Asian crisis scenario, financial implications would be enormous for the traditional net exporters. As shown in Table 7, combined with substantial price declines due to decreased Asian demand, the gross value of net trade for the agricultural commodities included in IMPACT would drop significantly in these countries. For the United States, the value of net trade across all IMPACT commodities would decline by US$12.3 billion annually under the severe Asian crisis scenario and by US$5.6 billion per year even

Table 7: Gross value of net trade across IMPACT commodities for selected countries, 1993 and 2020, baseline, severe and moderate Asian crisis scenarios

	1993	2020		
		Baseline	Severe crisis	Moderate crisis
		(thousand US$)		
United States	18,416	38,292	25,969	32,721
Western Europe	-2,981	4,936	-2,360	2,321
Other developed countries*	12,947	15,027	12,084	13,760
Japan	-9,305	-12,100	-10,633	-11,262
China	434	-11,166	2,285	-8,137
Other developing Asia	-881	-18,210	6,221	-8,563

*includes Australia, Canada, Israel, New Zealand, and South Africa.
Note: Agricultural commodities included in IMPACT are beef, pork, sheep&goat meat, poultry, eggs, milk, wheat, maize, other coarse grains, potatoes, sweet potatoes and yams, cassava and other roots and tubers, high quality indica rice, standard rice, japonica rice, soybeans, meals, and oils.

Source: IFPRI IMPACT Simulations

Figure 13. Net Trade in Livestock Products, Asian Developing Countries, 1993 and Projected 2020
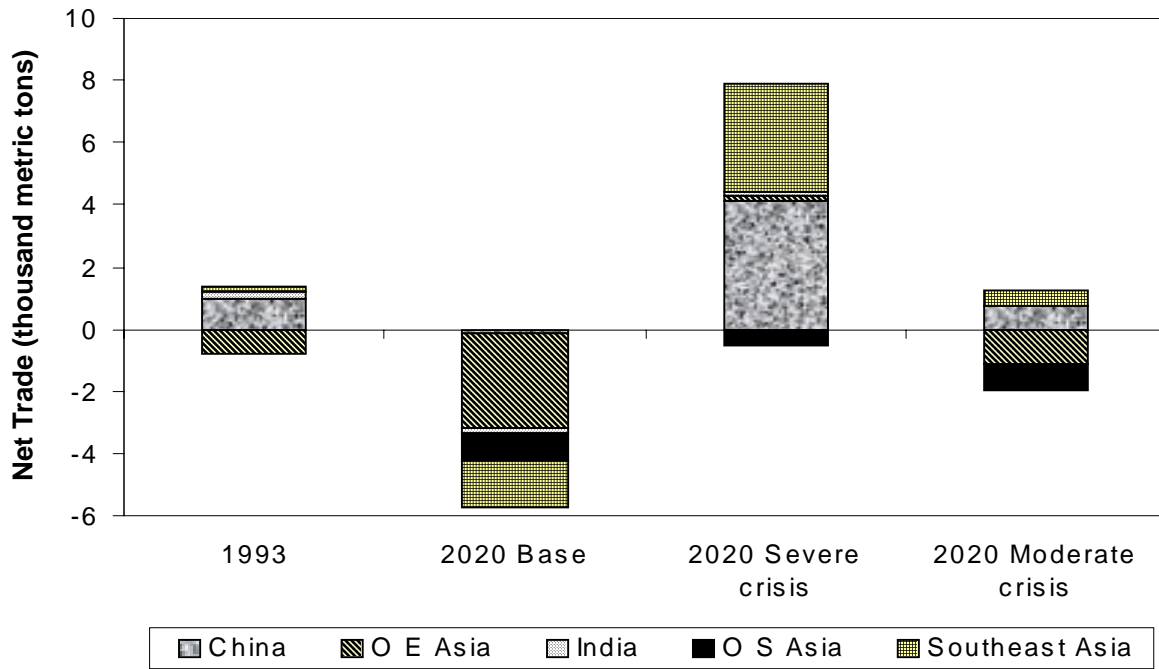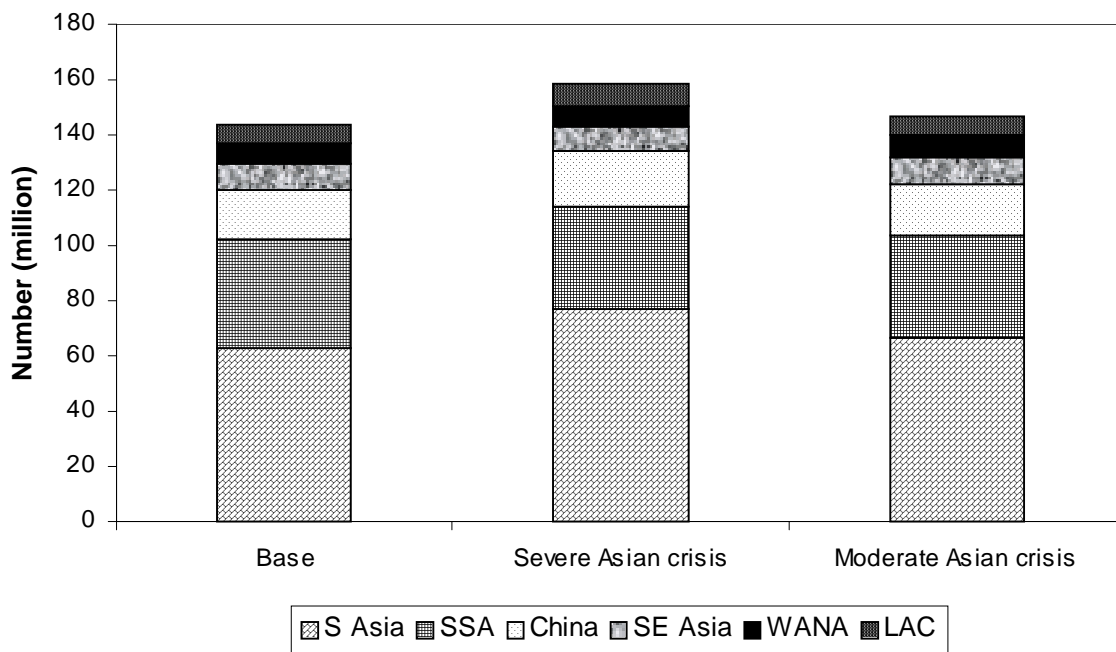

Figure 14. Projected Number of Malnourished Children in 2020, Baseline, Moderate and Severe Asian Crisis Scenarios

under the moderate scenario, from a baseline value of US$38.3 billion. For Western Europe, the annual declines would be US$7.3 billion and US$2.6 billion per year, depending on the severity of the crisis, compared with a gross value of exports US$4.9 billion in the pre-crisis scenario. In the severe crisis scenario, Western Europe would have a trade deficit for IMPACT commodities. As described above, under the severe crisis scenario, Asian countries will take up part of the slack in international trade, taking advantage of their improved exporting positions.

Calorie Consumption and Malnutrition

Worldwide, per capita availability of food is projected to increase by around 10 percent between 1993 and 2020, from about 2,700 calories per person per day in 1993 to about 2,900 calories (Table 8). Improvement in per capita food availability is projected for all major regions. The largest absolute increase is expected in China and the lowest in Sub-Saharan Africa. The projected average food availability of about 2,360 calories per person per day in 2020 for Sub-Saharan Africa, however, is only slightly above the minimum required for a healthy and productive life. In addition, developing-country calorie availability per person per day will only reach 85 percent of the developing-country level by 2020.

Table 8: Daily per capita calorie availability, 1993 and 2020, baseline, severe and moderate Asian crisis scenarios

	Calories per capita per day			
	1993	2020		
		Baseline	Severe crisis	Moderate crisis
Latin America	2,730	3,030	3,088	3,054
Sub-Saharan Africa	2,199	2,355	2,383	2,372
West Asia and North Africa	3,030	3,165	3,205	3,179
South Asia	2,370	2,800	2,582	2,747
Southeast Asia	2,525	2,938	2,647	2,808
China	2,680	3,141	2,881	3,087
South Korea	3,223	3,362	3,240	3,280
Developing	2,523	2,852	2,714	2,818
Developed	3,223	3,369	3,400	3,379
USA	3,585	3,753	3,813	3,777
World	2,684	2,945	2,838	2,919

Source: IFPRI IMPACT Simulations

The Asian crisis will negatively affect global calorie availability. The overall daily per capita calorie availability in 2020 is projected to drop from 2,945 calories to 2,838 calories in the severe and to 2,919 calories in the moderate crisis scenario. In the group of developing countries, daily per capita calorie availability will drop from 2,852 to 2,714 calories in the severe, and to 2,818 calories

in the moderate crisis scenario. The developed countries will experience an increase in per capita calorie availability, from 3,369 calories in the pre-crisis scenario to 3,400 calories in the severe and 3,379 calories in the moderate crisis scenario. Among the developing countries, as would be expected, Asia will experience the biggest drop in calorie availability. Southeast Asian countries will be hit hardest in the severe crisis scenario, with a decline of 291 calories per person per day, a 10 percent reduction; followed by China, with a drop of 260 calories per person per day, an 8 percent drop. Latin America, Sub-Saharan Africa, and West Asia and North Africa, however, will experience slight improvements in daily per capita calorie availability in both Asian crisis scenarios due to price-induced increases in food consumption.

The degree of food insecurity measured by the number of malnourished pre-school children (0 to 5 years of age) is directly influenced by the performance of the agricultural sector, the purchasing power parity of the local population, and the import capability from global food markets. In Asia, growth in the agricultural sector due to the introduction and successful adoption of Green-revolution technologies has been instrumental in reducing poverty. In Indonesia, for example, growth rates in the agriculture sector averaged 4.2 percent annually during 1975-85, and then slowed down to 3.4 percent per year in 1986-96. At the same time, the incidence of poverty decreased from over 40 percent in rural areas in 1976 to 14 percent in 1997. However, the Asian economic crisis threatens to reverse this trend (FAO 1998).

Under the pre-crisis baseline projection, over the next three decades, child malnutrition is expected to decline in the group of developing countries by 23 percent. However, the number of malnourished children will increase in Sub-Saharan Africa, from 27 million children in 1993 to about 39 million children in 2020. More progress can be seen for South Asia, home to more than one-half of the world's malnourished children, but some 66 million children will still be malnourished in the region in 2020. These results show the paradox facing global food policy: declining world food prices and buoyant international trade coexisting with sustained or increasing malnutrition in much of the world.

Under the Asian crisis scenarios, food security in Asia will decline substantially compared to the pre-crisis baseline scenario (Figure 14). In the severe crisis scenario, the number of malnourished children in the group of developing countries will increase by 15 million, from 143 million to 158 million children by 2020. In the moderate scenario, the increase would still be 3 million. In the severe crisis scenario, the number of malnourished children will increase from 65.6 million to 76.7 million in South Asia; from 16.4 million to 19.1 million in China; and from 10.1 to 12.2 million in Southeast Asia. At the same time, - and concomitant to daily per capita calorie availability - the number of malnourished children will decline slightly in the other developing regions: in West Asia and North Africa, from 6.4 million to 6.3 million; in Sub-Saharan Africa, from 38.6 million to 37.8 million; and in Latin America, from 6.4 million to 6.2 million. These slight improvements are due to increased food consumption because of the decline in international food prices induced by the Asian crisis.

Conclusion

This paper assessed the possible long-run effects of the Asian economic crisis on long-term global food supply and demand by comparing pre-crisis baseline projections with severe and moderate crisis scenarios. Many important long-term trends are robust across the three scenarios, although the detailed results vary. The long-term prospects for food supply, demand, and trade indicate a strengthening of world cereal and livestock markets. Even under the severe Asian crisis scenario, world prices of these commodities will decline much more slowly than in the past several decades. The stronger price picture is the result of the continued gradual slowing in the rate of growth in both production and demand. Growth in crop area will be slow. Therefore, crop yield growth will account for nearly all of production growth. However, in most countries and regions the gradual slowdown in crop yields, which began in much of the world in the early 1980s, will continue. Livestock production will grow considerably faster than crop production - especially in Asia - but will also slow down relative to the production growth in the past decade.

Countering the continued gradual slowing of production will be a decline in the growth rate in food demand. Population growth rates will be declining throughout the projections period, particularly in developing countries. Rising incomes and rapid urbanization in developing countries will change the composition of demand. Direct per capita food consumption of maize and coarse grains will decline as consumers shift to wheat and rice with increasing incomes. As incomes rise further and lifestyles change with urbanization, there will be a secondary shift from rice to wheat. Growth in incomes in developing countries will also drive strong growth in per capita and total meat consumption, which will in turn induce strong growth in feed consumption of cereals, particularly maize. Per capita meat consumption in developed countries will be nearly constant, with slow declines in beef and pigmeat consumption offset by slow growth in poultry consumption. These trends will lead to an extraordinary increase in the importance of developing countries in global food markets. Under the baseline scenario, a full 84 percent of the increase in global cereal consumption, and nearly 90 percent of the increase in global meat demand between 1993 and 2020 will come from the developing countries. By 2020, developing countries will account for 65 percent of global cereal demand and 63 percent of global meat demand. Under the baseline scenario, Asia emerges as a major player in global cereal and livestock markets in the coming decades. This role is unlikely to be threatened by the current economic crisis in the region.

Developing countries as a group will not be able to fully meet their rapidly growing food demand through growth in their own production. Cereal import demand from developing countries will grow rapidly, more than doubling during the projections period. Partially offsetting the increase in demand from developing countries, Eastern Europe and the former Soviet Union will shift from significant cereal importers to substantial export positions. Traditional developed-country exporters, led by the United States, will significantly expand cereal exports. The growth in cereal trade remains quite strong even under the severe crisis scenario. Although cereal imports drop by 20 percent in Asia, lower world prices cause increased imports in other developing regions, and total developing country cereal imports decline by only 6 percent.

The Asian crisis scenarios will have far larger repercussions on global supply, demand, and markets for livestock. In the pre-crisis baseline, global net trade in livestock products will nearly double, with increased Asian imports accounting for much of this growth, and U.S. and European

exports expanding rapidly. But under the severe crisis scenario, China and several Southeast Asian countries will shift from import to export positions in livestock, virtually eliminating growth in developed-country livestock exports. The sharp reductions in meat exports and smaller cutbacks in other agricultural commodity exports, combined with lower world commodity prices, would result in large reductions in agricultural export earnings of developed countries under the severe crisis scenario. The United States is projected to lose US$12 billion annually, and Western Europe and other developed countries US$10 billion. Losses would also be substantial in the moderate crisis scenario. How the Asian economic crisis plays out will have a decisive impact on the direction and magnitude of global livestock trade and export earnings of developed countries.

The most devastating impact of a severe crisis would be on the food security of Asian countries. For Asia as a whole, an additional 16 million children would be malnourished in 2020 than under the baseline scenario. The improvements in calorie availability in other developing regions will barely impinge on the total increase in the number of malnourished children of 15 million, reaching 158 million malnourished preschool children by 2020.

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