

The Hard (and Sometimes Hopeful) Facts About This Hungry World

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It is the best of times. Per capita food production in 1977 was near record levels in both developed *and* developing countries. World production of grains in 1977 was 9 per cent over 1974 production. World production in 1978 is forecast by the U.S. Foreign Agricultural Service to be up 4 per cent over 1977, despite controls that reduced U.S. wheat production by 10 per cent. The foreign grain crop in 1978 is expected to establish a new record. The result is an anticipated 5 per cent boost in grain stocks carried into 1979. World grain stocks are expected to total 192 million metric tons by the beginning of crop year 1979 and constitute 14 per cent of utilization, compared to 11 per cent in 1975. Expected stocks will be near levels deemed adequate by U.N. Food and Agriculture Organization standards and more than adequate if based on an analysis by D. Gale Johnson of the University of Chicago and by the U.S. Department of Agriculture.

Under one component of assistance, the Food Aid Convention, the United States recently doubled its food aid commitment to developing countries. The president authorized U.S. officials in Geneva negotiating a new convention agreement to guarantee that the U.S. will deliver up to half the global food target of 10 million metric tons of grain annually that was set by the World Food Conference in 1974. The new pledge greatly expands the existing U.S. annual commitment of 1.9 million tons under the Food Aid Convention established in 1967, which committed developed countries to donate food to developing countries.

It is also the worst of times. Millions of people in developing *and* developed countries will die prematurely in the next decade from diseases associated with malnutrition. In developed countries the principal malnutrition problem will continue to be overeating—a factor in cardiovascular and other diet-related diseases that accounts for over half the deaths in the United States. In developing countries the principal malnutrition problem will continue to be inadequate calorie and protein

consumption—a factor in premature death from chicken pox, measles, malaria, whooping cough, and other diseases that ordinarily do not kill. Outright starvation is now rare, but acute food shortages persist in several areas. The most serious is in Ethiopia, where severe drought is compounded by armed conflict. The fact that few people die of outright starvation does not diminish frustration over a world stubbornly separated into camps of overnutrition and undernutrition. Both “camps” could gain by sharing.

It would be unfortunate if the mixed but realistic world food picture depicted above leads pessimists to give up the struggle or optimists to be satisfied with current trends. The intent of this report is to forge the positive and negative elements into a synthesis for public policy. Before suggesting a food policy stance for the United States I examine eight propositions describing the world food situation.

1. World food production per capita is greater than at any time in history, and more people have more to eat.
2. More people consume inadequate amounts of food today than at any time in history.
3. The nexus between these seemingly inconsistent propositions and the crux of the global malnutrition problem is uneven distribution of resources rather than low volume of food production and consumption.
4. The growing nutrition deficit measured by the shortfall of food intake below requirements in developing countries will have to be closed largely by improvements in food production and distribution in the countries experiencing such deficits.
5. If distribution problems can be resolved, the world's resources and technology are adequate to provide satisfactory diets for all inhabitants of the world for at least the remainder of the twentieth century.
6. The major impediment to eradicating world malnutrition is *man*, not nature.
7. The world undernutrition problem reflects a broader income problem—policies to deal with the food problem must also address the poverty problem.
8. The long-term solution to the world food problem lies in reduced population growth.

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Since 1955 agricultural production has increased nearly 3 per cent per year in developing countries, a slightly higher rate than in developed countries (Figure 1). However, per capita food production has grown only .5 per cent per year in developing countries and 1.4 per cent in developed countries. By these measures the world is making progress in feeding itself.

Regional data in Figure 2 provide more detail. The developed countries and regions in general display favorable per capita production trends—even the Soviet Union has made impressive gains in food production per capita despite major imports of grains in recent years. The picture is less happy in South Asia (Bangladesh, India, and Pakistan) and West Asia (including a number of OPEC countries that can afford to import food). The food problem is most severe in Africa, the only region showing a declining capacity to feed itself.

Despite generally favorable trends in food production per capita, malnutrition seems to be growing. Based on FAO's Fourth World Food Survey, victims of undernourishment increased from 400 million in 1970 to 455 million in 1975. The World Bank estimates that over a billion people are undernourished.

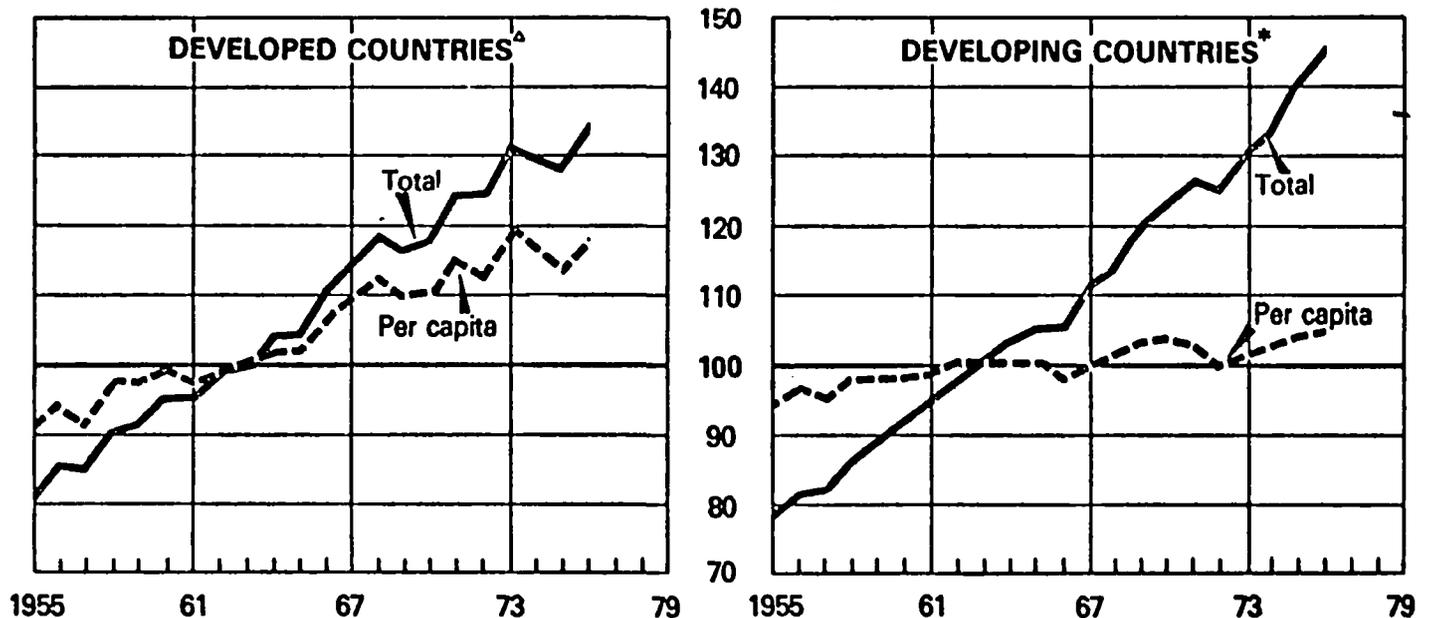
Recent projections to 1990 by the International Food Policy Research Institute, reported by Nathan Koffsky, point to a growing shortfall of cereal production below demand in developing market economies. The deficit in these countries, with a total population of 2 billion in 1977 and an estimated 2.9 billion in 1990, is projected to grow from 36 million metric tons of grain-equivalent in 1975 to 120-145 million tons in 1990. The most serious problem is in low-income countries (less than \$300 GNP per capita in 1973), largely in Asia and sub-Saha-

ra Africa. Their food deficit, 12 million tons in 1975, is projected to grow to 70-85 million tons in 1990.

These estimates are based on food gaps arising from the market. Just to maintain the 1975 level of food consumption per capita will require additional imports of 35 million tons of grain by 1990. Based on the shortfall of consumption below minimum adequate dietary standards, production is projected to fall 110 million tons short of the supplies required to eliminate undernutrition in low-income, food-deficit countries by 1990.

Not everyone doubts the ability of developing countries to purchase additional food imports. Fred Sander-son of the Brookings Institution points out that exports of nonoil-exporting developing countries have been growing at a rate of 7 per cent per year in real terms for two decades, while exports of manufactured products have grown at twice this rate and account for a third of all exports. Even if total export growth slows to 5 per cent per year, additional grain imports of 60 million tons in 1985 (based on projections of FAO, the International Food Policy Research Institute, and the U.S. Department of Agriculture) can be purchased with only 3 per cent of projected export proceeds, about the same percentage as in 1976. Prospects are less favorable for developing countries with less than \$200 per capita income in 1973. Incomes in these countries have grown slowly, and financing their projected grain deficit by 1985 will require 8 per cent of their total export earnings. These countries, accounting for a fourth of the grain deficit, will still be poor in 1985 and will experience severe balance of payment constraints. Without massive development efforts they will make little progress in closing their nutritional deficit.

Figure 1
Index of World Agricultural Production
% of 1961-65 Avg.

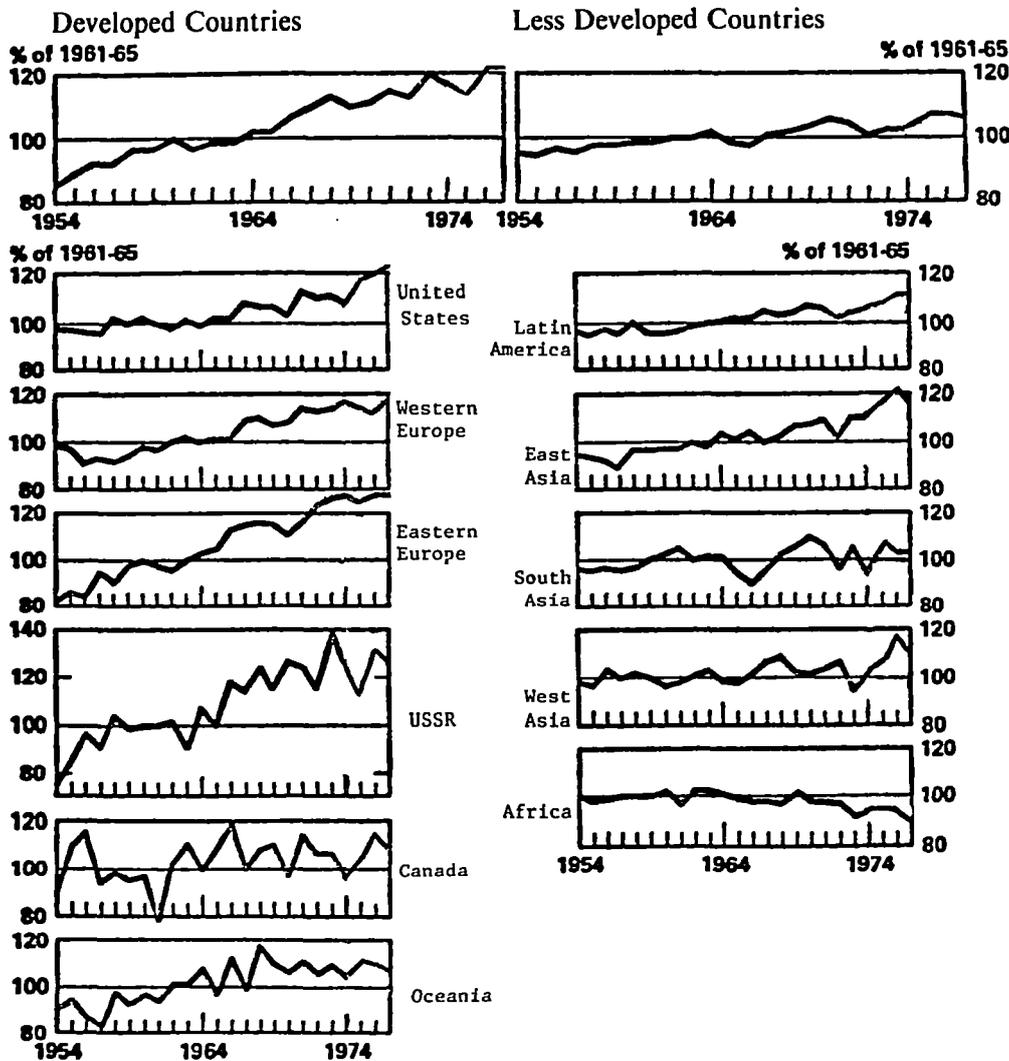


^Δ Includes United States, Canada, Europe, USSR, Japan, Republic of South Africa, Australia, and New Zealand.

* Includes Latin America, Asia (except Communist Asia) and Africa (except Republic of South Africa).

Source: U.S. Department of Agriculture.

Figure 2
Food Production Per Capita
 (Calendar Years 1954-77)



Source: USDA Economic Research Service, *The World Food Situation and World Agricultural Situation*.

Distribution problems and population growth patterns explain the paradox of increasing undernutrition in the face of increasing per capita food production. Population growth has been most rapid in food-short, low-income countries. Growth in income per capita does not solve the problem. Reutlinger and Selowsky in *Malnutrition and Poverty* show that within a country with adequate average food consumption per capita a small proportion of the population consumes more than it needs while the lowest income groups consume markedly less than they need. Felix Paukert in the *International Labor Review* provides evidence that the distribution of income in market economies becomes more unequal during early stages of development. The share of income received by the bottom 60 per cent of income recipients falls as gross domestic product (GDP) per capita increases to \$300 per year, and it does not recover its initial share (30 per cent for less than \$100 GDP) until incomes reach \$1,000 per year. Countries with \$2,000 and over per capita income had the least income inequality among the fifty-six countries studied.

The food distribution problem is apparent among, as well as within, countries. Table 1 shows increasing

dependence on North America (U.S. and Canada) for grains, which account for nearly three-fourths of food moving in world trade. In the 1934-38 period only one major world region, Western Europe, was a net importer of grains, an average of 24 million metric tons per year. By 1975-76 only one world region, North America, was a major exporter of grains, 95 million metric tons. As the major source of food exports, the United States plays the key role in responding to food shortfalls wherever they occur. At issue is the ability of the U. S. to expand exports to meet emerging world food needs.

By itself the United States potentially has the capacity to feed the world. Based on a world population of four billion in 1974, each man, woman, and child could be supplied 3,000 calories per day (actual consumption was 2,400 calories per day) from 2.2 trillion pounds of grain providing 2,000 calories per pound. This could be supplied with corn-equivalent production in the United States as follows: 77.4 bushel yield on 317 million cropland acres actually harvested in 1973, plus 96 million acres of potential cropland with high conversion potential based on the Conservation Needs Inventory, plus 38.8 bushel yield on 57 million acres of potential cropland with medium conversion potential, plus 19.4

bushel yield on 112 million acres of potential cropland with low conversion potential. Although this output is physically feasible, great sacrifice would be required by Americans to produce it. Our standard of living would fall as resources are converted from current nonfarm uses to massive irrigation development, fertilizer and pesticide production, transportation, and farm labor. Environmental costs in the form of fertilizer runoff and erosion would be high. Crop production would not be processed through animals but would be consumed directly with a minimum of processing. Some livestock produced from grassland unsuited for cropping would provide limited meat supplies, adding animal protein to diets.

Table 1. The Changing Pattern of World Grain Trade, by Region, Selected Years 1934-1976. (Million metric tons; + indicates net exports, - indicates net imports)

Region	Annual Average				
	1934-38 ^a	1948-52 ^a	1960-61 ^b	1970-71 ^b	1975-76 ^b
North America	+5	+23	+39	+56	+95
Western Europe	-24	-22	-25	-30	-19
Australia & New Zealand	+3	+3	+6	+12	+11
Eastern Europe & USSR	+5	na	0	+1	-36
Africa	+1	0	-2	-5	-15
Asia	+2	-6	-17	-37	-46
Latin America	+9	+1	0	+4	+4

Note: Inequality of imports and exports due to variations in reporting periods and different marketing years.

^aCalendar years. ^bFiscal years.

Source: Provided by Patrick O'Brien, Economic Research Service, USDA, from U.N. Food and Agriculture Organization, Production and Trade Yearbooks, 1954-74, and unpublished USDA data.

Extremely high commodity prices (just how high is unknown) would be required to generate such change in the level and mix of food production and consumption. Farm output resulting from prices below those extremely high levels but well above current levels has been estimated by Yeh, Tweeten, and Quance in the *American Journal of Agricultural Economics*. They calculate that if the ratio of prices received to prices paid by farmers were held at 180 per cent of the 1967 average from 1975 to 1985, production would be two-thirds more than expected demand by 1985. This additional output could potentially provide nearly 800 million metric tons of grain equivalent—far more than any food gaps projected for 1985. Expanded outlays for research and extension would further expand farm resource productivity to meet world food needs.

Other sources of food from the United States to feed the world are potentially feasible. The health of Americans would improve if average daily caloric intake were reduced by 15 per cent—to 3,000 calories per day. This change in diet would free 6 billion bushels (158 million metric tons) of grain to approximately double the 2 billion bushels of feed grains and 1.1 billion bushels of wheat currently exported.

Without question, the United States alone could produce enough food to eliminate current and emerging world food deficits. In concert with other developed countries and oil-rich countries, the job would be easier. But if Americans possessed the will to cut food consumption and the generosity to commit food exports to close the world food deficit, it is by no means clear that such a commitment would be desirable in view of troublesome issues of food distribution, dependency, and disincentives to producers in developing nations. The burden of increasing food output rests primarily with developing nations themselves.

The potential to expand food output in developing countries exists. That is, the capacity to expand food production is by no means restricted to developed countries. The FAO "Indicative World Plan" shows land used for crops and the potential use, by regions, in 1962:

	Million hectares	% of suitable land
Africa, south of Sahara	152	50
Asia and Far East	211	84
Latin America	130	23
Northeast Africa	19	100

Overall, only 45 per cent of the land suitable for cropland in these regions was used for crops. These figures have changed since 1962, but it remains true that cropland acres could probably be doubled. Of course one must not overlook such serious problems as costs of capital to develop the land, soil erosion and leeching, as well as limited opportunity to expand acreage in heavily populated areas such as South Asia and Egypt.

Many heavily populated developing countries with limited cropland must expand yields. Fortunately yields can be increased markedly in critical countries—international comparisons of grain yields in Table 2 provide some clues. It may be unrealistic for India to achieve the paddy rice yields of Japan, but obtaining yields already realized in China and Taiwan would approximately double production. The potential exists to raise fertilization rates and wheat yields in India to those of the United States. The land/man ratio for India, Pakistan, and Burma is considerably more favorable than that for China, Taiwan, and Japan.

In developing countries as a whole, grain yields are less than a third those of developed countries; fertilizer use per acre is a fifth that of the United States and a tenth that of Western Europe and Japan. Even in the densely populated countries of South Asia, crop yields could be tripled in the next fifty years. Fertilizer production must be expanded, and sufficient raw materials exist (if supplies are not shut off for political reasons). Per Pinstrup-Andersen, when he was an economist at the International Fertilizer Institute, estimated that, at 1976 usage rates, known reserves of phosphate rock are adequate to supply the world's needs for seven hundred years and potash reserves are adequate for 3,600 years. Nitrogen is abundant in the air but currently requires fossil fuel to process it into commercial fertilizer.

Table 2. International Comparisons of Rice and Wheat Yields and Practices

Country	Yield (100 kgs. per ha.)		NPK Fertilizer Use (kg. per ha.)	Area Irrigated (%)	Multiple Cropping Index	Land/Man Ratio (arable hectares per capita)
	Paddy Rice	Wheat				
India	16.2	13.8	16.4	17	119	0.28
Punjab	30.5	24.1	40.3	50	134	0.29
Pakistan	23.3	11.9	13.7	65	111	0.29
Burma	15.6	5.5	1.8	5	111	0.64
China	30.9	12.0	39.6	40	147	0.15
Taiwan	34.2	—	292.6	58	184	0.06
Japan	58.5	23.1	439.8	55	126	0.05
United States	52.5	22.0	82.0	8	102	0.91

Source: Marilyn Chou, David Harmon, Jr., Herman Kahn and Sylvan Wittwer, *World Food Prospects and Agricultural Potential* (Praeger, 1977), p. 211.

Chou, Harmon, Kahn, and Wittwer provide even more optimistic estimates of capacity. They judge that harvested acres could be more than doubled and yields could be increased 50 per cent through fertilization and another 50 per cent by irrigation (Table 3). Recognizing simultaneous opportunities for using additional fertilizer, irrigation, high-yielding varieties, land and multi-cropping—all this creates the potential for increasing food production twenty times. Many consider such estimates optimistic, but there can be no doubt that the potential for additional food output is great indeed.

To recognize that man, not nature, is the chief obstacle to economic progress is to shift the spotlight from the agricultural scientist and technician to the social scientist and moral philosopher for solutions to world food problems. Unfortunately the tools of science are but blunt instruments when confronting attitudes and institutions that block mankind's progress. Moral dilemmas are inescapable.

If individual producers are to increase food output, it requires efficiency, savings, and investment. Producers are efficient if they respond to price incentives that increase net income in a market economy. Compelling evidence indicates that producers in developing countries respond to price incentives. But responding to price incentives is not enough. Greater income does not sustain economic progress if increased net income is consumed rather than saved. Because the producers with the lowest incomes in less-developed countries are near subsistence, it is difficult to forego consumption for future gain and they thus save little. Saving too is not enough. The consumption that is foregone must be invested in items such as improved seeds, fertilizers, pesticides, and irrigation equipment that have favorable payoffs in relation to costs.

Because the requirements for capital are massive relative to what developed nations will donate, the responsibility for generating capital rests largely with developing countries themselves. The key to economic progress ultimately is "old-fashioned" attitudes of thrift and industriousness. In Marxist countries these can be institutionalized with major propaganda campaigns extolling the virtues of hard work and the evils of materialism (consumption). Forced savings occur as the state confiscates a portion of current production and invests this in

social overhead such as roads and schools. In free enterprise societies, economic progress depends much more on individual decisions. We know all too little of what accounts for an industrious labor force with a high propensity to save and invest, such as the labor force in Japan, South Korea, Taiwan, Singapore, and other market economies with rapid economic growth despite few natural resources.

Propensities to save and invest are highest among the less poor in developing market economies. Economic growth tends to be most rapid when gains from economic growth are not taken away from the producer by taxes. But then the result is a serious conflict between equity and efficiency measured by aggregate income growth. One way to minimize the equity-efficiency dilemma is to develop educational programs that raise rates of savings and investment among low-income producers. If generating a work ethic is critical to progress out of poverty, is the U.S. justified in providing economic aid that is contingent upon recipients mounting educational (propaganda?) campaigns to generate the work ethic? Does the right to food also entail the responsibility to provide an internal environment conducive to economic progress?

Efficient use of resources by producers requires able management in the form of human capital and capital technologies (improved seeds, etc.) that must be developed by institutions such as schools and agricultural experiment stations. Developed nations can help to finance institutions that have high economic payoffs. Such assistance can reduce farmers' tax burdens and the attendant disincentives to produce.

Table 3. Potential Increase in Food Production From Adoption of Conventional Techniques.

	Factor of
Increased agricultural land harvested	2.5
Multicropping	1.5
Average yield per crop improved by	
Fertilizer	1.5
Irrigation	1.5
HYVs	2
Other inputs	1.2
Multiplicative totals	20

Source: Chou, et al., p. 300.

Factors such as taxes, price controls, and tenure patterns—which are all human devices—frequently stand in the way of progress when the producers' incentives are stifled by lack of reward for their efforts. To what extent should U.S. economic assistance be conditioned upon removing these barriers? Is the U.S. justified in providing economic aid bonuses to developing nations that generate strong programs of land reform and family planning?

Strong governments are required to provide an orderly economic environment conducive to progress. Such governments must resist pressures to consume inordinate amounts of current production for transfer payment programs and must instead emphasize government spending on capital investment programs with high economic payoff that private groups will not fund. An exception may be made on equity grounds for transfer payments to the elderly poor. Such payments can reduce birth rates by displacing the need for a large number of children as security for old age.

Adam Smith pointed out two centuries ago that pursuit of self-interest by each individual in the market leads to the greatest good for all. That proposition applies only in markets characterized by many buyers and many sellers, where resources are somewhat equally shared. Atomistic markets have been replaced by the agglomeration of power élites in landed aristocracies, trade unions, and unrepresentative governments. Unlike Smith's *atomistic* greed, which is turned into the good of all by the invisible hand of the market, *organized* greed leads to exploitation. The source of malnutrition can be traced in part to the collective avarice that is apparent in landownership patterns, trade barriers, exploitative governments, and other institutions.

Evidence showing how self-serving protectionism contributes to inefficiency and to a food system's lack of responsiveness to shocks is clear. D. Gale Johnson has calculated the grain reserves necessary to meet all shortfalls in food production except those occurring once in twenty years. World carryover of 174 million metric tons of grain is required if each major country or region carries its own stocks but does not share them. World carryover of only 18 million metric tons is required if all countries pool reserves to meet shortfalls wherever they occur.

Trade barriers substantially reduce opportunities to share in meeting world food shortfalls by decreasing consumption and increasing production. Prices supported well above world market levels in the European Community (E.C.) and other Western nations insulate domestic consumers and producers from the vicissitudes of world supply and demand, but they do so at a cost. A world food crisis that sends prices upward gives no signal to E.C. consumers to reduce consumption or E.C. producers to increase output. The burden of adjusting production and consumption falls on other markets. World price change must be large to bring about needed adjustments in markets. The consequence of protectionism is to raise instability in world prices. I have estimated that trade barriers, compared to free trade, have tripled the price response to a change in world food

supplies. These price gyrations work considerable hardship on developing nations.

Pursuit of self-interest in developed countries has generated quotas, tariffs, and other barriers to trade in the labor-intensive products (for example, footwear, textiles, and clothing) in which developing countries have a comparative advantage. The most important contribution developed countries can make to help developing countries finance food imports is to keep their doors open to exports. Fred Sanderson of the Brookings Institution estimates that complete liberalization would add \$6-\$7 billion to the 1974 base level of developing countries' manufacturing exports and a somewhat smaller amount to agricultural exports. The World Bank estimates that trade barriers cost developing countries \$24 billion a year in lost exports of manufactured goods alone.

In market economies, households tend to be quite rational in allocating their resources to produce or purchase food, shelter, clothing, and medical care in such a way as to increase well-being. Too little food production and consumption is closely associated with too little of other goods and services—in short, with poverty. Studies in this country repeatedly show that efforts to force improved nutrition with the Food Stamp program have no more impact on diets than does additional income. The same conclusion probably applies to the poor in developing countries. This consideration suggests that the most efficient way to improve the nutrition of low-income households is to raise incomes through investments that expand the level and productivity of resources. This conclusion downplays the provision of food aid from the U.S. except for emergency, self-help development, or infant-maternal care programs. Because food production constitutes the greatest claim on resources in developing countries and because these resources have few alternative uses, efforts to increase income must emphasize food production.

Population growth—2.5 per cent annually in developing countries and less than 1 per cent annually in developed countries—accounts for the difference between total and per capita food production growth rates in Figure 1. Population growth is slowing in developing countries, but many have growth rates near 3 per cent per year. With three-fourths of the world's population, the developing countries account for 85 per cent of the world's population growth. If population growth in developing countries slows to 2 per cent per year and developed countries grow only .5 per cent per year, by the turn of the century five-sixths of the world's population will live in developing countries.

A 2 per cent population growth rate doubles population every thirty-five years and multiplies population a thousand times in 350 years. The world's resources cannot sustain such growth, and the only long-term solution to the world food problem is reduced population growth. A widely held view is that the way to reduce birth rates is to raise per capita income. Increased income will reduce infant mortality and provide food security, thus decreasing the need for children as social security for parents.

Unfortunately, the income approach to birth control in developing market economies is a "Catch 22"—incomes cannot be adequately raised without lower birth rates; and lower birth rates cannot be achieved without more income. My research indicates that increasing income does reduce birth rates but at too slow a rate to release developing market economies from the low income-high birth rate cycle. Finding other means to reduce birth rates is critical to solving the population problem, and that in turn is critical to solving the food and income problem.

Based on the propositions discussed above, the following four items suggest a policy stance for the United States:

1. *A commodity reserve program for emergency food relief.* Commodity reserves constitute the first line of defense against hunger and are critical to deal with food shortages arising from unpredictable weather and pestilence. Ideally such a program should be internationally supported and administered. But if other developed nations hold back for lack of reserves to contribute, this nation has the resources to shoulder responsibility. An emergency food reserve of 20 million tons of grain is necessary to deal with future food crises. For price stabilization, carryover reserves of grains need to be at least 60 million tons. Only the price stabilization reserve need be maintained if an emergency reserve of funds is set aside and made available to food-critical developing countries to purchase supplies out of the stabilization reserve. Emergency aid would be provided as a grant and channeled through charitable agencies, where possible, to insure that benefits actually get to the hungry.

2. *Remove trade barriers to imports from developing countries.* Overall benefits to developing countries can be enhanced by removing trade barriers jointly with other developed countries through multilateral trade negotiations. International commodity agreements to stabilize prices of developing country exports such as sugar can also be beneficial. Buffer stocks may serve as a useful device to stabilize prices under commodity agreements, but care must be taken to avoid high minimum prices that generate burdensome surpluses.

3. *Maintain a strong domestic program of basic agri-*

cultural, nutritional, and family planning research. Basic research benefits developed as well as developing countries. Strong research institutions in developing countries are necessary to adapt technology to local or regional conditions. But developing nations are unable to support basic research that may eventually revolutionize food production and indefinitely postpone the Malthusian specter.

4. *Gradually raise the proportion of GNP committed by the U.S. to international development from the current .25 per cent to the United Nations' target of .7 per cent.* Food aid would be used principally for emergencies, but it could also be allocated for selected maternal and infant nutrition programs and for self-help development efforts. To give nations the flexibility to acquire the mix of resources that contribute most to their economic development, the majority of economic assistance would not be provided as food. Aid would be provided with continuity and mainly as grants, with per capita aid allocations greatest to nations with lowest per capita income. Accordingly, aid would be restricted to the purchase of items conducive to economic development such as fertilizer, fertilizer plants, irrigation equipment, and plant-breeding expertise. Incentives and penalties could be provided to encourage countries to develop sound family planning, land reform, human rights, and economic development policies. If the U.S. balance of payments problem continues severe, recipient nations might be required to spend a high proportion of aid on U.S. products.

If U.S. grain stocks are in excess supply and production is controlled, grain purchases from aid funds would be discounted at a rate equal to the minimum cost of paying U.S. farmers not to produce. For example, if the government is paying farmers forty cents to reduce grain output by a dollar, a 40 per cent discount would be granted developing nations for grain purchases to close their nutritional shortfall.

I have offered, then, twelve propositions. Eight are descriptive of where we are, four are prescriptive, suggesting where we should be going. The key issues are philosophical as well as technical, moral as well as economic. In this best of times and worst of times ours is the responsibility to make decisions that will help shape times to come.