

Chapter IV

HUNGER AND MALNUTRITION

1. People in virtually every country suffer from hunger and malnutrition, although the extent and the pattern differ substantially from country to country and from region to region. In this section some general trends and policy issues regarding hunger and malnutrition will be presented. The discussion will, however, mainly refer to the developing regions, where hunger is most prevalent. In fact, estimates of the total number of undernourished in the developing world exceed the total population of the developed world. That the problem of hunger and malnutrition is urgent is highlighted by the fact that the Conference of the Food and Agriculture Organization of the United Nations (FAO), at its twenty-eighth session in October 1995, called for the convening of a World Food Summit, which was held in Rome in November 1996. This Summit renewed the world's commitment to eradicating hunger and malnutrition, and adopted a Plan of Action for all concerned actors.¹

A. HOW MANY PEOPLE ARE MALNOURISHED?

2. Malnutrition refers to a pathological state resulting from too little (or too much) consumption of essential nutrients. There are different aspects of malnutrition, some of which can be measured. But estimation of the number of people who are malnourished is marred by conceptual and measurement problems, as well as by the transient nature of malnutrition. Still, the lack of precise data on the number affected should not preclude policy action, as any casual observation in the developing world confirms the severity of the problem.

3. One way to examine the nutrition situation is to look at the food supply available for consumption (although not necessarily consumed). A country's food supply is equal to its food production and imports minus food exports. When this figure is adjusted for changes in stocks, waste food used for seed and animal feed, and industrial non-food uses, the result is the food supply available for consumption.²

4. In nearly all regions of the world dietary energy supplies have increased since the early 1970s (table 4.1). The exceptions are Eastern Europe and sub-Saharan Africa. However, the increase since 1979-1981 has been negligible in Latin America, and South Asia was the only developing region that recorded an increase in the growth rate of per capita energy supply (ignoring the fact that the negative growth rate in sub-Saharan Africa improved slightly). The decline in energy supplies in sub-Saharan Africa is particularly distressing, as this region also has the lowest level of energy supplies.

5. One disadvantage of using per capita energy supply as a measure of malnutrition is that it assumes the available food is distributed in proportion to requirements. Calculating the number of undernourished makes up for this disadvantage though it introduces some far-

reaching assumptions of its own. Because undernutrition is defined as an insufficient intake of calories, minimum energy requirements must be determined. And they must be set so that they account for, *inter alia*, diseases, body size, physical activity, age and sex. Next, a distribution is needed to calculate the number of people who fall below the minimum requirements.³ Both the cut-off point, which is a weighted average of the age and sex-specific cut-off points, and the distribution vary across countries, but the distribution is assumed to be the same over time. The cut-off points change over time only as far as the age and sex distribution changes over time. The cut-off varied in 1990-1992 from 1,790 kilocalories per capita per day in South Asia to 1,880 in East and South-East Asia.

6. Figure 4.1 shows that in the developing world the absolute number and the proportion of undernourished people fell between 1969-1971 and 1990-1992.⁴ The improvements were particularly encouraging in East and South-East Asia and South Asia, where the number of undernourished declined by about 200 million. In 56 developing countries (out of 98) the percentage of undernourished fell between 1969-1971 and 1990-1992. In 39 countries this percentage increased, and it was stable in three countries.

7. Still about 840 million people in the developing countries were undernourished in the early 1990s (down from 918 million in 1969-1971). East and South-East Asia accounted for the highest number of undernourished people, as before, despite this significant progress. The situation was worst in sub-Saharan Africa as both the absolute number and the percentage of undernourished have increased since 1969-1971. In sub-Saharan Africa the number of undernourished doubled between 1969-1971 and 1990-1992, affecting 43 per cent of the total population in 1990-1992. In Latin America and the Caribbean and in the Near East and North Africa, the number of undernourished increased as well, although as a percentage of the total population there was little change.

1. Children

8. Another way to measure malnutrition is to use anthropometry, that is, measurements of the human body. Anthropometric measures are more directly related to food consumption than the methods described above.⁵ Children's body measurements in particular are sensitive to changes in the intake of protein and calories, in addition to diseases. The most commonly used indicator is the percentage of children whose weight-for-age is more than two standard deviations below the median value of the reference pattern.⁶ This percentage indicates the extent of severe and moderate malnutrition, while a cut-off point of three standard deviations represents severe malnutrition only.

9. The percentage of malnourished children continued to decrease between 1985 and 1995 in China, South-

TABLE 4.1. PER CAPITA DIETARY ENERGY SUPPLIES
(Kilocalories, three-year average)

Region	Energy supply			Average annual growth rate	
	1969-1971	1979-1981	1990-1992	1969-1971 to 1979-1981	1979-1981 to 1990-1992
World	2,440	2,580	2,720	0.5	0.5
Developed countries	3,190	3,280	3,350	0.3	0.2
Industrialized countries	3,120	3,220	3,410	0.3	0.5
Transition economies	3,330	3,400	3,230	0.2	-0.5
Developing countries	2,140	2,330	2,520	0.9	0.7
Latin America and the Caribbean	2,510	2,720	2,740	0.8	0.0
Sub-Saharan Africa	2,140	2,080	2,040	-0.3	-0.2
Near East and North Africa	2,380	2,850	2,960	1.8	0.3
South Asia	2,060	2,070	2,290	0.0	0.9
East and South-east Asia	2,060	2,370	2,680	1.4	1.1
Least developed countries	2,060	2,040	2040	-0.1	0.0

Source: FAO, *The Sixth World Food Survey*, (Rome, FAO, 1996).

Note: Regional classifications are those of the FAO. Israel and South Africa are classified as industrialized countries. Near East and North Africa includes, *inter alia*, Afghanistan, the Islamic Republic of Iran and Turkey, but excludes the Sudan. Transition economies as a category is part of the developed country groupings and includes the former Soviet Union and the former Yugoslavia.

East Asia, and Latin America and the Caribbean, although the decrease was small and the percentage of children malnourished is still high in South-East Asia (table 4.2). The total number of malnourished children also fell in these regions, except in Middle America and the Caribbean, where the number of malnourished children remained stagnant.

10. Such progress was, however, not shared in sub-Saharan Africa and South Asia. On the contrary, malnutrition among children worsened between 1990 and 1995. This was also the case in the Near East and North Africa, but the levels and incidence were much lower. South Asia is the region with the highest incidence rate and where more than half of all the malnourished children of the developing world live. In sub-Saharan Africa no progress has been made since 1980, when the prevalence of underweight children was lower than in 1985. Any improvement continues to be elusive in the 1990s.

11. This pattern is supported by a more detailed analysis of the anthropometric surveys. There are 38 countries in which more than one nationwide survey has been conducted, the latest in the 1990s. Of these 38, the percentage of underweight children has risen in nine countries, six of which are in Africa, two in Latin America and the Caribbean, and one in Asia. In another nine countries, there have been no changes (rather evenly distributed among the regions). And in the remaining 20 countries the percentage of underweight children has declined.⁷

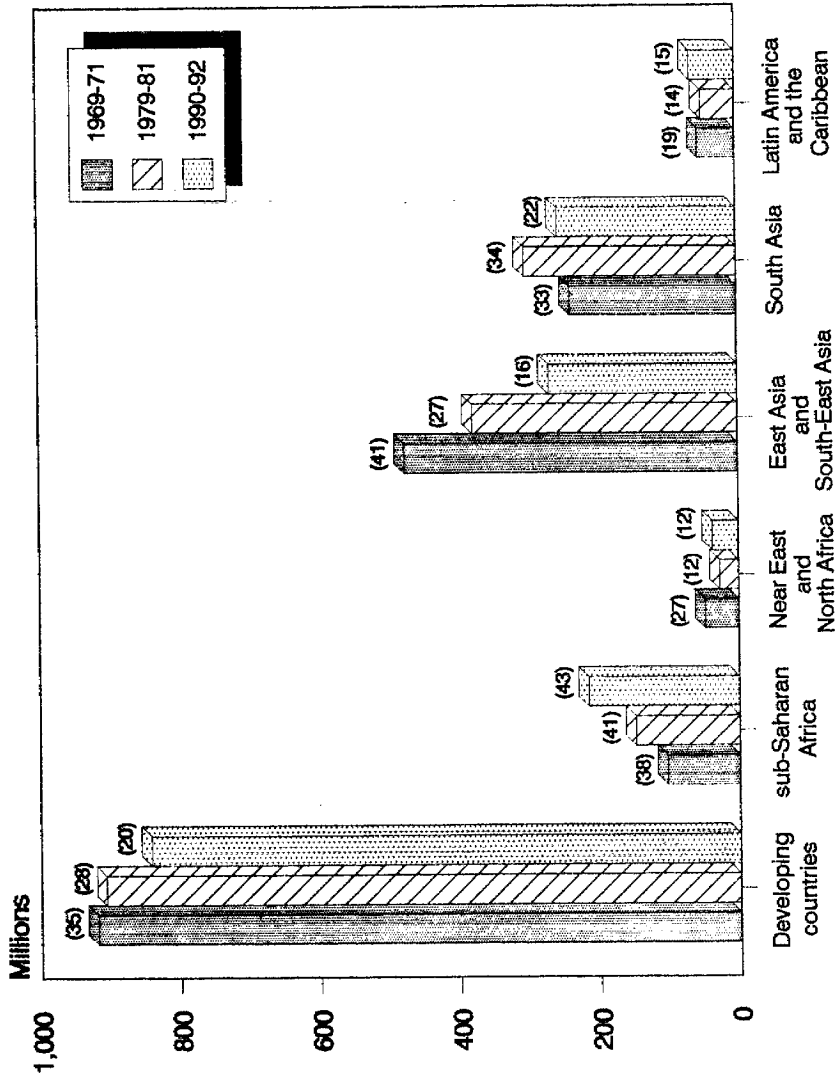
12. There is no clear consensus on why the incidence of malnutrition among children in South Asia is so much

higher than in Africa or anywhere else for that matter. A number of factors, among them, poverty, inequality, food production and government intervention, would lead to the opposite expectation or, at least, to an expectation of equal incidence. Some of the difference can be attributed to the higher mortality rates among children in Africa. Mortality can be explained partly by malnutrition, but after a child dies, he or she can no longer be counted as malnourished.⁸ Lower birth weights, higher incidence of diseases and lower levels of hygiene in South Asia are other likely factors. (Better access to health care might prevent these factors from translating into higher death rates.) Finally, feeding patterns, factors relating to breastfeeding and the introduction of other foods probably play a role as well.⁹

2. Micronutrient deficiencies

13. Even if the calorie content of food is sufficient, it may lack certain nutrients which are crucial for human health. In fact, micronutrient deficiencies are much more common than energy deficiencies. The three nutrients most often monitored are vitamin A, iodine and iron (see table 4.3). These nutrients can be added to food at little expense, a cost-effective method for preventing diseases. Vitamin A deficiency causes blindness and affects the development and function of several other body parts, particularly the immune system. In 1995 about 2.8 million children under the age of five suffered from vitamin A deficiency, showing signs of clinical xerophthalmia. An additional 251 million had insufficient vitamin A and had on average a 20 times greater risk of death or severe

Figure 4.1. Prevalence of undernutrition in developing regions, 1969-1971, 1979-1981 and 1990-1992



Source: FAO, The Sixth World Food Survey (Rome, FAO, 1996).

Note: Numbers in parentheses are percentages of total population.

TABLE 4.2. PREVALENCE OF UNDERWEIGHT CHILDREN

Region	Percentage underweight			Number underweight (millions)		
	1985	1990	1995	1985	1990	1995
All developing regions	33.8	30.4	30.9	165.7	160.2	167.3
Middle America and the Caribbean	14.0	12.7	12.2	2.5	2.4	2.5
South America	8.7	7.4	5.2	3.0	2.6	1.9
Sub-Saharan Africa	29.2	28.7	31.2	25.9	26.7	33.4
Near East and North Africa	13.9	10.9	11.4	4.3	3.7	4.0
South Asia	55.2	50.1	50.6	87.9	84.4	90.1
South-East Asia	36.0	33.8	32.0	20.2	19.6	19.1
China	21.5	17.5	15.6	21.8	20.7	16.3

Source: Administrative Committee on Coordination/Subcommittee on Nutrition, "Preliminary Results for the Third Report on the World Nutrition Situation" (7 February 1996).

Note: The sample includes 95 countries. Regional classifications are those of the Subcommittee. Near East and North Africa includes, *inter alia*, Cyprus, Iraq, and Turkey. South Asia includes, *inter alia*, the Islamic Republic of Iran. The data are estimates based on a statistical relation between the percentage of underweight children (which are obtained from surveys conducted in different years between 1970 and 1995) and a number of explanatory variables such as GDP per capita.

TABLE 4.3. POPULATIONS AT RISK OF AND AFFECTED BY MICRONUTRIENT DEFICIENCIES, MOST RECENT ESTIMATES (Millions)

Region	Iodine deficient		Vitamin A deficient*		Iron deficient or anemic
	At risk	Affected (Goitre)	At risk	Affected (Xerphthemia)	Affected
World	1,571	656	251	2.8	2,150
Americas	167	63	16	0.1	94
Africa	181	89	52	1.0	206
Europe	141	97	-	-	27
Eastern Mediterranean	173	93	16	0.1	616
South-East Asia	486	175	125	1.5	149
Western Pacific	423	139	42	0.1	1 058

Source: WHO, Nutrition: Highlights of Recent Activities in the Context of The World Declaration and Plan of Action for Nutrition, (Geneva, WHO, December 1995), p. 5.

Note: Regional classifications are those of WHO. Europe includes Turkey, Eastern Europe and the successor states of the Soviet Union. Eastern Mediterranean includes Western Asia, Djibouti, Egypt, Libya, Morocco, Somalia, Sudan and Tunisia, but excludes Algeria, Ethiopia and Eritrea. Western Pacific includes, *inter alia*, Australia, China, Japan, Malaysia, New Zealand, the Republic of Korea and Viet Nam.

* Estimates for vitamin A deficiency are for children under five years of age.

infection. Nevertheless, recent progress has been made in several countries in reducing vitamin A deficiencies, for example, by fortifying foods such as sugar.

14, Iodine deficiency disorders are the most important causes of preventable brain damage among fetuses and children. In the early 1990s about 1.6 billion people lived in areas where the soils lacked sufficient iodine, and 656 million people suffered from goitre, almost half of them living in Asia. In the past few years significant progress has been made in salt iodization, which is the easiest solution. The number of countries with national salt iodization programmes increased from 46 in 1990 to 83 in 1995, out of 118 countries in which iodine deficiency is a significant health problem. The success of salt iodization makes it possible to reach the goal adopted by the World Summit for Children in 1990 and the International Conference on Nutrition in 1992 of virtually eliminating iodine deficiencies by 2000.

15, Iron deficiency and anaemia negatively affect children's physical and cognitive development and immune systems and cause fatigue and reduce work capacity in adults. Pregnant women are particularly prone to anaemia, which can retard foetal growth, increase the probability of low birth weights and increase rates of perinatal mortality and maternal death. More than 2 billion people were affected by iron deficiency or anaemia in the early 1990s. It is estimated that more than half of the pregnant women in developing countries suffer from anaemia.

3. Famines

16, As a final indicator of hunger, we analyse its most extreme form: starvation. A situation in which a sudden collapse of food consumption leads to widespread starvation and death is referred to as a famine. Fortunately, the number of famines have declined in recent decades. The only cases of widespread famine in recent years have been associated with civil wars, such as in Somalia in 1991-1992 and in the Sudan intermittently over the past 10 years. The growing infrequency of famines is mainly a result of successful and timely government intervention. This does not mean, however, that the danger of a famine does not loom in peaceful situations, only that it can be prevented. Intervention, however, critically depends on Governments' institutional and financial capacity, preparedness and commitment. In the case of civil wars these conditions are rarely fulfilled, and international action is often required. However, the modalities of such international intervention are not well articulated, which has led to considerable unnecessary suffering.¹⁰

B. POLICY ISSUES

17, If effective policy does not require an exact count of the number of malnourished people, it does need an accurate analysis of the causes. The determinants of malnutrition are often analysed in terms of food entitlements. Food entitlements are determined by the endowment of a person or family (land, labour, livestock) and the amount of food they can acquire through trade or production. Malnutrition results if food entitlements are inadequate because the piece of land the household cultivates is too small or yields too little, because the income earned is insufficient or because of unemployment. Prices are particularly important determinants of food entitlements. In

Africa, for example, many smallholders in some areas, as many as 70 per cent, are net buyers of food.¹¹ Starvation ensues if food entitlements fail when employment, wages, output prices or yields collapse, or food prices escalate. This situation can, for example, result from a natural disaster, which can destroy the livelihoods in a limited area, affecting the country's total food supply little or not at all if the area produces non-food products. However, because of the lack of purchasing power in the stricken area, the market will not deliver food, and intervention to restore food entitlements is called for.

18, Of course, the lack of food entitlements is closely related to poverty. Thus it is often asserted that the most important determinant of hunger and malnutrition is poverty. Policies to alleviate this root cause and the related cause, unemployment, are discussed elsewhere in this report. Here, some specific policy issues regarding nutrition are pertinent.

1. Production

19, Agricultural production is one of the most important determinants of food entitlements in developing countries. Increased agricultural production generally contributes to higher incomes and more employment, both major determinants of entitlements for farmers who sell their output and buy food, as well as for agricultural workers. Food production has three additional links with food entitlements.¹² Many people, primarily subsistence smallholders, produce the food they consume. Moreover, food production is a major determinant of food prices, which affects the ability of net buyers to purchase food. Finally, the ability to maintain a food stock to smooth out production shortfalls is influenced by food production.

20, Asia in particular, but Latin America as well, has seen large gains in food production since the mid-1960s as a result of the Green Revolution: the increased use of new high-yielding varieties of seeds in combination with irrigation and fertilizers. This has contributed greatly to increased energy supply (depicted in table 4.1). On the other hand, Africa is the only region in which food production per capita has been declining since the early 1970s. Africa has benefited little from the Green Revolution technology that changed agriculture in Asia. This failure can be attributed largely to the lack of seeds suitable to African conditions, weak local research capacity and a poorly developed support system to foster adoption, which would include extension services, credit and infrastructure. Thus research is needed to develop low-risk, low-cost seed varieties for rain-fed agriculture in Africa that do not need many external inputs, such as pesticides and fertilizer, and are resistant to drought and disease.¹³

21, Generally, the ability to increase production is limited, particularly for smallholders, by labour (seasonally), underdeveloped human resources and access to land, credit, transport, marketing, infrastructure and inputs such as seeds, fertilizer and extension services. A number of these constraints require policy interventions, in part because they involve public goods. Price incentives are also important, but often they are only necessary but not sufficient conditions, as the non-price constraints are generally the most crucial. Thus the aggregate supply response to changes in producer prices is typically low and only becomes large in the long run (as many as 10 to

20 years) if complemented by investments to alleviate non-price constraints.¹⁴

2. Targeted intervention

22. The impact of policy measures aimed at increasing production will not be felt immediately. Moreover, these measures might fall short of providing food entitlements to the landless and urban poor, or even the smallholders. Additional measures are therefore needed to alleviate malnutrition. Indeed, Governments have used a number of targeted measures, ranging from food subsidies, to employment schemes, to enhanced food entitlements.¹⁵

23. As part of structural adjustment programmes implemented since the early 1980s, food subsidies have been reduced in many developing countries—explicitly through budget allocations and implicitly through overvalued exchange rates when food is imported. Untargeted food subsidies, which can account for a large share of government expenditures and often benefit the non-poor to a considerable extent, have in many cases been replaced by targeted interventions, such as selected subsidies, food rations, food stamps and food supplements. Targeting has been based on the selection of an “inferior” food (presumably consumed mostly by the poor), geographical area, income, employment status, season and attendance at health clinics. But there are several problems regarding abuse and leakages, the information needed to design targeted programmes and the capacity to administer them. In the end, the efficiency of different instruments must be balanced against their effectiveness in the prevailing political and economic situation.

24. Public employment programmes are a form of intervention that has gained popularity since the 1980s, partly because targeting these programmes is easier. They can deal simultaneously with a number of problems, such as food entitlements, famine prevention, poverty and weak infrastructure. In countries where poor infrastructure forms a major constraint to economic development, public employment programmes that hire workers to construct infrastructure, such as roads and irrigation systems, will have benefits far exceeding the nutritional effects on participants. These benefits, however, depend in part on the capacity to design and implement such programmes, and their integration into mainstream public planning. Moreover, advance preparation in case of disaster, such as a drought, can greatly improve the long-term benefits of the programmes. Finally, targeting the poor is crucial to success. The poor can best be reached by focusing on the causes of poverty, such as a lack of infrastructure, concentrating on regions where poverty is highest, and relying on self-targeting by setting a low (but sufficient) wage rate (below the market rate).

3. Trade

25. In the developing countries fluctuations in domestic production are partly smoothed by international trade.¹⁶ During the 1980s world stocks of cereals as a percentage of world consumption never fell below 17 per cent, the minimum requirement to ensure world food security, as calculated by FAO.¹⁷ Since 1993, however, stocks of the main exporters (the United States and the European Union) have been declining. Thus, in 1995 stocks declined to 14 per cent of world consumption, the

lowest level in more than 20 years. In mid-1996 FAO predicted that this percentage would be about the same or slightly higher in 1997. As a result, cereal prices increased steeply between 1993 and 1996,¹⁸ increasing the costs of food imports for several countries suffering from food production shortfalls, countries in North Africa in 1995, for example.

26. These global demand and supply conditions in the early 1990s were partly weather-related but a number of structural phenomena were at work. Net imports of cereals by the developing countries have been increasing since the early 1970s, affecting all major developing regions, except South Asia. The rise was particularly large in the Near East and North Africa. Net imports are expected to increase in all developing regions until 2010. On the other hand, the economies in transition are expected to recover slowly from the decline in production in the early 1990s, become net-exporters of food in the near future, and progressively increase net exports thereafter.¹⁹ The balance is expected to be covered as it has been in the past by net food exports from the developed countries, despite the reforms of the Common Agricultural Policy in the European Union and the implementation of the Agreement on Agriculture of the Uruguay Round of multilateral trade negotiations, which will reduce import protection and export subsidies of agriculture and is likely to slow down the increase of net exports from the developed countries.

NOTES

¹This section has benefited from the background papers for the World Food Summit.

²No correction is made for food losses and wastage at the retail and household level. The extent of overestimation is, however, likely to be relatively small in developing countries, although more significant in developed countries. See FAO, *The Sixth World Food Survey* (Rome, 1996), pp. 40 and 129.

³This distribution is assumed to be log-normal with a mean equal to the average daily energy supply per capita and a coefficient of variation which is based directly or indirectly on household surveys. It is therefore assumed that distribution within the household is equal, which is a problematic assumption. See, for example, Eileen Kennedy and Howarth E. Bouis, *Linkages Between Agriculture and Nutrition: Implications for Policy and Research* (Washington, D.C., IFPRI, 1993), p. 4. The methodology is described in FAO, *The Sixth World Food Survey* (Rome, 1996).

⁴FAO introduces in *The Sixth World Food Survey* a new concept: food inadequacy. It states that this concept is similar to undernutrition because both refer to energy deficiencies relative to requirements. They are, however, not identical for three reasons. First, food inadequacy does not account for the increased energy requirements of adults when the person is infected. (This is taken into account for children.) Second, the body might not be able to absorb the food consumed in cases of severe infection. Third, some scholars have argued that there may be a range of variation in energy requirements to which the body can adapt. The methodology, however, partly accounts for this, because the minimum energy requirements refer to the lower end of the range of inter-individual variations as a result of body weight and activity levels, and below which it is unlikely that individuals can adapt without any risk to health (despite the fact that these inter-individual variations are not directly related to the possibility of metabolic adaptation). The first two factors will lead to underestimation and the third to overestimation of the true prevalence of undernutrition. What is measured is therefore food inadequacy, which must be seen as an approximation of the true extent of under-

nutrition. Here, we refer to food inadequacy as undernutrition. See FAO, *The Sixth World Food Survey* (Rome, 1996), pp. 3-5 and 44.

⁵However, anthropometric measures are inadequate if the child reduces his or her activity to leave enough energy to grow according to standards. Underestimation of the prevalence of undernutrition is, therefore, possible. See *ibid.*, pp. 6 and 64.

⁶As recommended by WHO, the measurements of body sizes are compared to standard sizes of children in the United States who are assumed to be well-nourished. Studies have shown that growth of normal, healthy and adequately nourished children in other countries, independent of ethnicity, almost always approximates these reference standards. See FAO and WHO, *Nutrition and Development: A Global Assessment*, revised edition (Rome, 1992), p. 11.

⁷*The Progress of Nations, 1996* (New York, UNICEF, 1996), p. 20. A survey of seven states in India (which accounts for a large share of South Asia) confirms the model estimates of table 4.2, showing that the percentage of underweight children is rising.

⁸When a malnourished child dies, both the numerator and the denominator of the percentage of malnourished children decline, but the numerator decreases more in percentage terms (unless all children are malnourished). Thus, the prevalence of malnutrition declines.

⁹For a discussion of these factors, see Vulimiri Ramalingaswami, Urban Jonsson and Jon Rohde, "The Asian enigma", *The Progress of Nations, 1996* (New York, UNICEF, 1996), pp. 11-17.

¹⁰For an analysis of famines and its prevention see *World Economic Survey 1993* (United Nations publication, Sales No. E.93.II.C.1), chap. VI. The classic reference on the analysis of famines is Amartya Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (Oxford, Clarendon Press, 1981).

¹¹Michael T. Weber and others, "Informing food security decisions in Africa: empirical analysis and policy dialogue", *American Journal of Agricultural Economics*, vol. 70, No. 5 (1988), pp. 1044-1052; Ridwan Ali and Barbara Pitkin, "Searching for household food security in Africa", *Finance and Development*, vol. 28, No. 4 (December 1991), pp. 3-6.

¹²See Amartya Sen, *Hunger and Entitlements* (Helsinki, WIDER, 1987), pp. 10 and 11.

¹³The research for a green revolution in Africa could be partly financed with the potential revenues from the gene banks, which are now under the auspices of FAO, as described in a proposal in *World Economic and Social Survey 1995* (United Nations publication, Sales No. E.95.II.C.1), pp. 140-142.

¹⁴See World Bank, *Adjustment in Africa: Reforms, Results, and the Road Ahead* (Oxford and New York, Oxford University Press, 1994), p. 148.

¹⁵See, for example, FAO, *The State of Food and Agriculture, 1995* (Rome, 1995), pp. 65-69; FAO, "Food security and nutrition", World Food Summit Technical Paper, No. 9, provisional version (Rome, FAO, June 1996), pp. 24-26 and 30; Michael Lipton and Martin Ravallion, "Poverty and policy", in Jere Behrman and T. N. Srinivasan, eds., *Handbook of Development Economics*, vol. 3B (Amsterdam, North-Holland, 1995), pp. 2551-2657; Per Pinstrup-Andersen, "Targeted nutrition intervention", *Food and Nutrition Bulletin*, vol. 13, No. 3 (September 1991), pp. 161-169; and Joachim von Braun, ed., *Employment for Poverty Reduction and Food Security* (Washington, D.C., IFPRI, 1995).

¹⁶In the developed countries this smoothing takes place particularly by reducing the amount of grains fed to animals in periods when grain prices are high. About 20 per cent of the world's cereal production is used for feeding livestock. In 1972-1974, for example, the drop in the United States feed consumption was as large as the global production shortfall.

¹⁷See *World Economic Survey 1993* (United Nations publication, Sales No. E.93.II.C.1), p. 145.

¹⁸For example, wheat and maize prices increased by more than 60 per cent.

¹⁹Nikos Alexandratos, "The outlook for world food and agriculture to the year 2010", in Nurul Islam, ed., *Population and Food in the Early Twenty-First Century: Meeting Future Food Demand of an Increasing Population* (Washington, D.C., IFPRI, 1995), pp. 25-48.