

David, Cristina C.

**Working Paper**

## Food: Is a Crisis Looming

PIDS Discussion Paper Series, No. 1996-09

**Provided in Cooperation with:**

Philippine Institute for Development Studies (PIDS), Philippines

*Suggested Citation:* David, Cristina C. (1996) : Food: Is a Crisis Looming, PIDS Discussion Paper Series, No. 1996-09, Philippine Institute for Development Studies (PIDS), Makati City

This Version is available at:

<https://hdl.handle.net/10419/187315>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## Food: Is a Crisis Looming?

*Cristina C. David*

DISCUSSION PAPER SERIES NO. 96-09

The *PIDS Discussion Paper Series* constitutes studies that are preliminary and subject to further revisions. They are being circulated in a limited number of copies only for purposes of soliciting comments and suggestions for further refinements. The studies under the *Series* are unedited and unreviewed.

The views and opinions expressed are those of the author(s) and do not necessarily reflect those of the Institute.

Not for quotation without permission from the author(s) and the Institute.



August 1996

For comments, suggestions or further inquiries please contact:

**The Research Information Staff**, Philippine Institute for Development Studies  
3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines  
Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: [publications@pidsnet.pids.gov.ph](mailto:publications@pidsnet.pids.gov.ph)  
Or visit our website at <http://www.pids.gov.ph>

## Food: Is a Crisis Looming?\*

Cristina C. David\*\*

### Introduction

Concerns for global food security have often been raised in recent years in the context of the debate on the environment, sustainability, and population growth nexus, as well as the impact of agricultural trade liberalization under the World Trade Organization (WTO). These concerns were successfully brought out to the general public through Lester Brown's alarmist articles initially published in the International Herald Tribune (1994) and subsequently referred to in other widely circulated international publications. According to Brown, China's cereal output will fall by at least 20% by 2030 as cultivated area declines and yields stagnate. To maintain the country's 1990 level of per capita consumption, 216 million tons of cereals will have to be imported, an import level that is about double the current level of total world cereal trade. If per capita cereal consumption is assumed to increase up to Taiwan's present levels, China's cereal shortfall will reach 378 million tons.

Brown also states that Africa will experience a cereal deficit of 250 million tons by 2030, a 10-fold increase from its present net imports. Given such huge projected increases in world demand for cereal imports which exporters will have difficulty to meet, he further contends that world market prices of food will be much higher, and the poor will be priced out of the world market. Brown's alarmist projections have gained some credibility with the recent fall in world

---

\* Paper presented at the 10th Asia-Pacific Roundtable, Kuala Lumpur, June 5-8, 1996.

\*\* Research Fellow, Philippine Institute for Development Studies.

cereal reserves and cereal prices. The FAO's director-general has also recently warned that: "After a renewed period of bumper surpluses, we are now back to a situation where the world's grain reserves have fallen below the level considered necessary to guarantee global food security" and "World prices have soared and the low-income, food deficit countries will have to pay out an additional \$3 billion this year for their imports" (AFP 1996).

The purpose of this paper is to review the literature on the prospects of the world food supply-demand situation over the next decade and beyond. A fairly extensive body of literature has recently emerged evaluating future food trade balance because of the growing concern about the sustainability of agricultural production and the slow progress in reducing malnutrition in the developing world. The technical papers written as part of the preparatory work of the FAO-sponsored World Food Summit in November, dealing with all issues related to food security-- production, consumption, trade, and other -- are particularly useful for this purpose.

In the first section, a brief description of the growth patterns of food production, consumption, trade, and world prices is presented. The second section examines the potential constraints for future increases in food production. The various projections of food production, consumption, trade, and world prices, particularly in cereals are summarized in the third section. This section would also include an assessment of Brown's projections on China's and Africa's long-term cereal deficit, vis a vis other studies. In the final section, the implications of projected food supply-demand balance on food security and other issues confronting the food and agriculture sector are discussed.

## Historical Overview

To put the review of medium and long-term food prospects in perspective, the historical trends of food and cereal production, consumption, trade, and world prices are examined in this section.

### Production

Despite growing land constraint, global food production has generally outpaced population growth, increasing food production per capita by 18% within the past 30 years (Fig. 1). Annual growth rate of food production declined over the period, from 3.0% in the 1960s, to 2.3% in the 1970s, and down to about 2.0% between 1980 and early 1990s. But so has population growth rate which fell from 2.1% to 1.9%, and 1.8%, respectively.

The apparent slowdown of world food production per capita by the 1980s has been caused mainly by the downward trend in developed countries' food production per capita, especially the sharp drop among the Eastern European countries due to transition problems encountered in the shift from a socialist a market economy. By contrast, the growth performance of per capita food production of developing countries was higher and consistently on an upward trend.

The remarkably strong growth record of per capita food production was not achieved uniformly across developing regions (Fig. 2). The highest growth rate occurred in Asia due in part to the green revolution in rice and wheat, and in part to the policy and institutional reforms in transition economies such as China and Vietnam. While per capita food production in Latin America showed some small increases and remained just about constant for northeast and north Africa, the poorest performance was by Sub-Sahara Africa where per capita food production was

declining since the 1970s. Because of the low rate of irrigation and unfavorable nature of rainfed conditions, Sub-Saharan Africa was largely bypassed by the green revolution technology. Moreover, pervasive government interventions in agricultural output and input markets have depressed incentives, and limited government resources to finance productivity-enhancing investments in this region.

### **Consumption**

International trade allows growth in food consumption to be higher than domestic food production in countries with low comparative advantage in agriculture. It also stabilizes food availability and prices, and facilitates a wider range of food choices as comparative advantage in particular food commodities depends much on factor endowments and locational factors. The level and composition of food consumption or effective demand, in turn, depends primarily on population, income per capita, and degree of urbanization.

World food availability for direct human consumption in daily calories per capita, as a measure of per capita effective demand, has increased over the past three decades (Fig. 3). This growth is lower than the growth of per capita food production, because an increasing proportion of that production is fed to animals and indirectly consumed through livestock and dairy products. Available food, however, is distributed unequally, as daily per capita food consumption among developed countries is about 3300 calories compared to about 2500 among developing countries in the early 1990s. That difference has actually narrowed from nearly 60% to less than 40% as per capita food availability in developing countries grew annually at a faster rate (3.0%) than developed countries (1.4%) because income elasticity of food demand decreases at higher income levels. Indeed, per capita cereal consumption in developed countries has

declined in absolute terms, while that of developing countries increased, as consumption patterns shift towards livestock, fruits, and other high valued products when per capita income rises.

Fig. 4 shows that wide differences in daily per capita food availability exist among developing countries with Sub-Sahara Africa having the lowest (only 2100 calories per capita) and Northeast/North Africa the highest level (3010 calories per capita). Growth rate of per capita food availability was highest in North East/North Africa and East Asia, reflecting the rapid pace of economic growth in these regions. Since the 1980's, South Asia's food availability has also grown rapidly. With the poor overall economic performance of Sub-Sahara Africa, its per capita food availability has stagnated, declining slightly over the past 30 years.

The progress in addressing food availability problems is remarkable in the light of the near doubling of population. Whereas 80% of the developing countries population lived in countries where per capita food supplies were extremely low -- under 2100 calories -- this ratio is now down to less than 10%. The nature of the food problem, however, depends not only on the average level of food availability or consumption but on the distribution of such supplies within each country. FAO's estimate of incidence of undernutrition considered both average and distribution of food supplies in deriving the numbers of persons in developing countries which can be considered as chronically undernourished. The latter is based on some notion of nutritional threshold level (ranging from 1760 cal/capita/day for Asia to 1985 cal/capita/day for Latin America) which is set equal to 1.54 times the basal metabolic rate (Alexandratos 1995).

Table 1 shows the proportion of chronically undernourished population declining significantly, from 36% in 1970 down to 20% by 1990. However, that 20% still represents a sizeable number -- nearly 800 million -- of undernourished population. Although considerable

progress has been made in bringing down the rate of undernutrition in East and South Asia, these regions continue to account for two-thirds of total undernourished. In Sub-Saharan Africa, the number of undernourished are increasing rapidly, at a rate even higher than population growth in the region as the proportion of undernourished rose slightly from 35% to 37% between 1970 to 1990.

### **International Trade**

With the exception of the mid-1980's, agricultural trade has generally grown faster than production, contributing to the growing integration of the world economy (Fig.5). The share of developing countries in total food imports has increased to 28%, while their share in food exports decreased from 30% in 1974 to 26% in 1994. Consequently, most developing country regions have become net importers of food, except for Latin America which remains a significant exporter.

For cereals, self-sufficiency ratio declined from 98% in the early 1960's to 92% by the early 1990's. Across regions, this ratio currently ranges from about 65% in the Near East and North America to a high of 102% in South Asia, with East Asia at 96% and Latin America and Sub-Saharan Africa at about 87%. Developed countries have increased export shares because of the inherent comparative advantage in agriculture of land-surplus countries in North America and Australia, and also because of subsidized exports of highly protected commodities in the European Union and other developed countries.

Although developing countries have become more import dependent on food, the proportion of agricultural imports to total merchandise imports have substantially diminished from 25%, down to about 10% by 1990 (Table 6). In terms of food imports, this ratio currently



represents only about 5% of total imports in South and Southeast Asia, 10% in Latin America, 12% in West Asia and 15% in Africa. It should be emphasized also that increased import demand has been largely induced by changing preferences towards wheat, livestock (and thus feed grains) and other high valued food as incomes increase. Developing countries as a whole tend to have much less comparative advantage in producing these commodities domestically. International trade has enabled developing countries to meet increasing levels and changing patterns of food demand more cheaply.

### **World Prices**

The historical long-term decline in the agricultural terms of trade in world markets depicted in Fig. 7 reflects the adequacy of global food supply relative to effective demand. Perceptions of a world food crisis in the 1970's as a result of the sharp increases in world commodity prices in 1972 and 1973 turned out to be a short-run phenomenon, as world prices collapsed in the late 1970's and continued its downward trend into the 1990's. A confluence of events caused that price peak including the production shortfalls in South Asia and many Southeast Asian countries, the short cereal crop in the US, Europe and former USSR, and the failure of the Peruvian anchovy catch which is a major source of protein for livestock; all due to adverse weather conditions. The shortage was also exacerbated by the USSR's decision to increase grain imports, rather than accelerate slaughter of livestock as a response to the fall in domestic grain production. Quick recovery was also hampered by the sharp increases in domestic prices of fertilizer, farm machineries, and energy with the oil crisis in 1973.

The declining trend in agricultural terms of trade was caused in part by reduced import demand for cereals following the success of the green revolution technology in many parts of

Asia, generally depressed world economy, and growing protectionism coupled with subsidized exports in many developed countries. Even with the recent increases in world grain prices as import demand rose and world stocks dropped, the long-term decline of world agricultural and cereal prices in real terms have not been significantly altered.

### **Constraints to Future Production**

In spite of the overall progress in raising the global food-population balance over the past three decades, concerted efforts have been made recently to draw public attention about the future world food problems. In 1992 and 1993, the UN-WHO-FAO sponsored a series of meetings related to the International Conference on Nutrition that highlighted the continuing large number of chronically undernourished population worldwide. Because of the international community's apparent complacency regarding the future world food situation, IFPRI has conducted a series of research, conferences and seminars, and publications under the theme of "A 2020 Vision for Food, Agriculture, and the Environment" since late 1993. The objective is to seek solutions to the problem of ensuring adequate future food supplies, while protecting the world natural resources for future generations. Preparations are currently underway for convening the World Food Summit at FAO in Rome in late 1996, where world leaders are expected to renew their commitment to eradicate hunger and malnutrition and achieve lasting food security for all through appropriate policies, strategies, and plan of action.

Current concerns about the future food-population balance stem from a number of factors:

Declining per capita land and water resources. The annual growth rate of new arable land has decreased progressively from 0.38% in the 1960's, 0.32% in the 1970's, and 0.19% in the 1980's. In highly populated countries, the land frontier has effectively closed; and with

continuing urbanization, cultivated area is expected to decrease in absolute terms. Among developing countries, major expansion of cultivable land area would be limited to South America, where much of these lands are still under forest, and thus conversion to agricultural land will entail environment costs. In Sub-Saharan Africa which is also characterized by a relatively low man-land ratio, the high cost of market and water infrastructure would be a major constraint to opening new land for agricultural production.

With rapidly growing demand for water among households and industrial users, the opportunity or scarcity cost of water for agriculture has risen rapidly. Moreover, as the irrigation development has exhausted locations with nearby sources of surface water and began to over extract groundwater sources, the cost per hectare of irrigation expansion has increased significantly (Rosegrant and Svendsen 1993).

Deteriorating quality of land and water resources. There are some evidence that land and water resources are being degraded through soil erosion, water logging, salinization of irrigated lands, and pollution of surface and ground water, with consequent negative effects on agricultural productivity. Fishery resources are overexploited and forest covers have dwindled in many areas. Resource degradation may be due to agricultural intensification (increased cropping intensity and high fertilizer and pesticide applications) or to rapid growth of other economic activities and urbanization under policy and institutional frameworks that essentially ignore environmental effects.

Approaching technological frontier. Maximum yield ceilings achieved under experimental conditions with the rice and wheat green revolution technologies have levelled off (Pingali et al. 1990). In fact, growth rate of yield per hectare has slowed and even stagnated

in many years. Although significant yield gaps remain between farm and experiment station yields, greater concern for the health and environmental costs of higher pesticide and fertilizer applications limit the farmers' ability to close that gap. In the meantime, the potentials for further technological advance through biotechnology and other scientific breakthroughs, and thus for accelerating productivity growth, are quite uncertain.

Falling public expenditures for agriculture. Official development assistance (bilateral and multilateral) to agriculture of developing countries in constant 1985 dollars has decreased from around \$11 billion/year in the early 1980's to not more than \$8 billion/year in the early 1990's (FAO 1996). In the same period, agriculture's share in total official development finance also fell from 24 percent to 16 percent. The decline in external funding for agriculture reflected budgetary squeeze in many developed countries, as well as the lower social rate of returns to agricultural investments as world commodity prices collapsed in the 1980s. The same factors have also lowered domestic public expenditure for agriculture in many developed and developing countries. Consequently, public expenditures at the international and national levels for productivity-enhancing investments, specifically irrigation infrastructure and agricultural research are reported to have fallen since the 1980s (Rosegrant and Svendsen 1993; FAO 1996).

### Prospects of the Food Economy

A number of recent projection studies for the year 2000 and beyond (Mitchell and Ingco, 1993; Rosegrant, et al., 1995; Alexandratos 1995) provide quantitative assessments of the future food supply-demand balance. These studies are based on different methodologies and coverage of commodity groups and projection periods. It is remarkable, however, that they have arrived

at generally consistent conclusions at the global level, although there may be significant differences for some regions.

Cognizant of the above food supply constraints, all of these studies indicate a continuation of the historical slow down in production growth rate (Table 2). Compared to the 1980-1992 growth rate of 2.0%, agriculture into the early 21st century is expected to grow at about 1.8% per year, and cereals at a somewhat lower rate of 1.5%. Growth rates of production (both agriculture and cereals alone) and consumption among developing countries as consistent with the historical patterns would be much higher than those of developed countries (at least double). However, growth rate of demand would be lower than production in developed countries, while the opposite would be the case for developing countries. Hence, developing countries as a group will increasingly become net importers of food, mainly from land-surplus developed countries. That would be due not so much to deteriorating food production-population balance but rather to changing taste preferences towards wheat, livestock (and feed grains), and other high-valued food commodities. Increases in import demand will slightly reduce food self-sufficiency ratio in developing countries, from 92% in 1990 to 90% in 2010. But concomitantly, the proportion of chronically undernourished will be halved from 20% in 1990 to 11% in 2010.

Projected import demand of developing countries is relatively modest (Table 3). Judging from projected trends in world food prices, there would be no food crisis in the next two or three decades. Two separate world price projections presented in Table 4 indicate a continuing decline beyond year 2000. In fact, recent estimates of world price effects of agricultural trade liberalization expected to occur in the medium and long-term under the overall direction of the World Trade Organization show these increases to be relatively modest. These are typically less

than 10%, and thus would not be sufficient to reverse the projected declining trends in real world prices.

The declining real world food prices in the face of slower growth of production suggests that future world demand for food, particularly cereals, will also increase less rapidly in the future than in the past for the following reasons: (a) the growth rate in population will continue to decline; (b) the proportion of population with relatively high levels of income and food consumption characterized by low income elasticities for food will increase; and (c) many poor countries or population groups with relatively high income elasticities for food are unlikely to achieve rapid economic growth. In addition, projected gap in food production and demand in developing countries will not substantially widen because the resulting higher world prices in the short run will induce increases in domestic production.

#### **The Case of China and Africa**

The above prospective assessment of the world food situation contradicts Brown's alarmist prediction on China and Africa's cereal deficits by year 2030. In Table 5, the various recent projections of China's cereal net import demand are reported. Although only Brown's projection period extends to 2030, it is clear that import demand projections into the early 21st century in the other studies are much lower. Brown's projections were not based on any explicit demand and supply modelling effort, but on certain assumptions about growth in population, demand per capita, and production. In contrast, the other studies were based mostly on econometrically derived demand and supply models, and experts' judgments on the prospects for technological change and other factors affecting growth of cultivated area and productivity.

Except for the Huang et al's study which was limited to China, but based on the most detailed country modelling effort, the other studies used a complete world demand-supply framework.

The most conservative projection of import demand was by Rosegrant et al., at 22 million tons by 2020, about equal to the FAO-Alexandratos and USDA-ERS estimates for 2010 and 2006. Huang et al's projected net imports of cereals by 2020 is higher at 43 million tons, about 3 times more than their historic high in the early 1990's. It is interesting to note that their projected net imports increased only slightly between 2000 and 2010 and remained about the same by 2020, as projected growth in demand for cereals slow down and public policy and investments maintained a moderate growth of production. In any case, it is highly unlikely that net imports of cereals will reach 100 million tons by 2030. These studies also consistently indicate that wheat will dominate China's grain imports, followed by corn and other feed grains, reflecting shifts in taste preferences towards wheat and livestock products and away from rice, as per capita income grows and the rate of urbanization increase.

The difference in China's projected net import demand for cereals between Brown and other studies is caused mainly by former's extremely pessimistic view on future grain production. According to Brown, domestic grain production by 2030 will be 20% lower than present levels, and only about equal to the 1973 level of cereal production. Such sharp fall is based on Brown's belief that rapid urbanization will significantly reduce cultivated area and yields will not increase to offset the lower cultivated land area.

It should be noted, however, that China's cereal production continued to grow at an annual rate of 1.8% between 1985 and 1994, even after the positive impact of the institutional and price policy reforms in the late 1970's has been reaped. Although all China specialists

expect growth rate of cereal production to decrease with declining land availability and rising cost of productivity-enhancing investments, cereal production beyond year 2000 is projected to grow at about 1% per year.

Brown also asserts that Africa will require 250 million tons of grain by 2030, a ten-fold increase from its present level of imports. As in China, these projections appear vastly exaggerated compared to other estimates. FAO's projection of grain import demand for Sub-Saharan Africa, which accounts for about 85% of continental Africa for 2010, is only 19 million tons. Assuming the same growth rate in import demand between 2010 and 2030, that will only be about 50 million tons. In Rosegrant et al's modelling effort, the projected net grain import for Sub-Saharan Africa would even be lower at 26 million tons in 2020.

Alexandratos and de Haen (1995), in fact, argues that Brown's projection is not to be taken seriously. Assuming domestic production grows at the same rate of population, that level of net imports would imply a per capita consumption of 290 kg, a nearly 60% increase between 1990 and 2030. Sub-Saharan Africa must attain middle income status to have such a consumption level by then, which does not seem to be a realistic prospect. On the other hand, if consumption per capita is assumed to remain constant, the implied production would only be 34 kg, an unbelievably lower level of grain production per capita compared to the current level of 140 kg.

### **Production Potentials**

Although most analysts have contradicted Brown's alarmist scenario, they have nonetheless generally taken a conservative estimate of future production growth. Alexandratos (1995), for example, pointed out that average growth rates of per capita agricultural production of developing countries as a whole have not been generally lower in the recent years compared



to earlier periods. This is true for countries which have low as well as high shares of agriculture in their total economy. And with the exception of China, growth rate of per capita agricultural production in the more agriculture-based countries accelerated in recent years, particularly in South Asia.

Alexandratos further argues that the slow down in agricultural growth since the 1980's primarily reflects production adjustments in the main cereal exporting countries in response to low world prices and the need to control the growth of stocks and the transition problems encountered by Eastern Europe. That flexibility implies that production can also be easily expanded when shortfalls in supplies raise world market prices. And agricultural trade liberalization underway would actually increase flexibility in domestic production adjustments to change in world market conditions.

There are also reasons to believe that higher productivity growth in developing countries can be promoted by further policy and institutional reforms and by greater public investments in land and irrigation development and agricultural research. In China, for example, average grain yields are not so high as previously reported, because official data on land area have been reportedly understated by as much as 30%. This suggests a considerable scope for increasing grain yields, even at the same level of technology because government grain prices, particularly rice, continue to be undervalued, despite liberalization of retail prices (Huang and David 1994). D. Gale Johnson (1994) indeed lamented that China does not have a grain problem, but a series of policy problems in the pricing and procurement of grains. Furthermore, the full benefits from a private economy have not been obtained as farm households do not as yet have full property rights over land, as is also the case in Japan, Taiwan, and South Korea. As labor becomes

increasingly scarce and larger farm sizes are called for to facilitate adoption of labor-saving technologies, voluntary, market-driven land transactions possible only with full land property rights system would be the most efficient means of adjustment to that farm production structure. In Japan and Taiwan that adjustment was initially addressed through part-time farming, but that route has now exhausted its limits and therefore large inefficiency costs are incurred with the continued prohibitions in land market sale and rental.

In other transition economies, e.g., the former USSR, Burma, and Cuba among developing countries, the potentials for accelerating food production are high as the process of dismantling and reforming socialized agriculture has only begun recently. State-owned enterprises continue to act as monopolists and monopsonists in output and input markets, and the domestic economy insulated from the international trade developments. For the former Soviet Union, the transition to market economy will significantly reduce crop waste and losses in harvesting, marketing, transporting, and processing agricultural products, and increase productivity of feeds in livestock production (Johnson 1993). The rice economy of Burma, the leading rice exporter in the early 1900s, can be quickly revived with appropriate policy and institutional reform, following the experience of Vietnam, which became the third largest rice exporter soon after removing central state monopoly on international trade in rice and agricultural inputs.

Outside the transition economies, considerable scope for improving allocative efficiency in agriculture, particularly in grain crops, remain. In many developing countries, government parastatals continue to incur high budgetary costs in procurement, storage and marketing of grains which could have been better spent on productivity-enhancing investments. At the same

time, these market interventions distort seasonal and geographic price variations and domestic price level away from their social opportunity cost and prevent the domestic food economy from being more integrated into the world market. Yet, it has been well established that even for large countries, the lowest cost and most effective approach to national food security is through the use of international markets, with a modest domestic storage program (Johnson 1991).

### **Implications on Food Security**

What do these prospective food-supply-demand balance mean for food security? To many countries, food security is often equated with self-sufficiency, particularly rice self-sufficiency. To others, food security can be pursued by being self-reliant, i.e., relying on international trade if that will mean more efficient allocation of resources, and thus greater national income and more stable domestic supply and prices as domestic production is inherently unstable.

The debate between the two definitions is rooted on fears about riskiness of relying on international trade because of perceived instability in price and supplies in world markets and possibilities of politically motivated trade embargoes. These instabilities have been reduced by the development of futures market and expansion of transport and handling facilities for international trade; and further reductions can be expected with the agricultural trade liberalization under the WTO. Moreover, food is supposed to be exempted from political trade embargoes; trade embargoes can easily be overcome by third country exports; and the WTO can now be another instrument for preventing food trade embargoes. Governments espousing rice

self-sufficiency in the name of food security are now, more often than not, motivated by the objective of protecting farmers -- Japan, South Korea, and the Philippines.

Food security as defined in recent FAO documents means a situation where all households have the physical and economic access to adequate food for all members. That is, food should be characterized by availability, accessibility (income and price), and stability (supply and prices). This should prevail not only at a global and national levels, but most important at the household level. Food insecurity is not so much a question of availability of food supply or adequate domestic production, but one of effective demand or sufficient level of income, particularly in poor countries. Food security, therefore, is a question of rate of economic growth and distribution of income within countries, rather than level of food production.

Of course, there are still countries where food and agricultural production continue to be the main source of income by the majority of population, and hence rapid growth of food production and food security means the same thing. In these countries such as those in Sub-Saharan Africa and South Asia, productivity-enhancing public investments, and appropriate policy and institutional frameworks for accelerating agricultural development are critically needed to increase income and alleviate food insecurity. For other developing countries, the issue related to food and agriculture, is how to alleviate the burden of adjustment of the farm sector as comparative advantage in food and agricultural production declines in the process of economic development, particularly in land scarce countries. In Japan, Taiwan, South Korea, and many

European countries, that burden has been alleviated by increasing agricultural protection. But with the establishment of the WTO, the use of that policy instrument will not be permitted as developing countries lose comparative advantage in agriculture.

## References

- Alexandratos, Nicholas (ed.) 1995. World Agriculture: Towards 2010. Food and Agriculture Organization (Rome) and John Wiley and Sons (New York, Chichester, Brisbane, Toronto, Singapore).
- Alexandratos, Nicholas and H. De Haen. 1995. "World Consumption of Cereals: Will It Double by 2025?" Food Policy, Vol. 20, No. 4.
- Brown, Lester. 1994. "Questions for 2030: Who Will be able to Feed China?" and "When China's Scarcities Become the World's Problem", International Herald Tribune; 28 and 29 September 1994, respectively.
- Crosson, Pierre and J. R. Anderson 1994. "Demand and Supply: Trends in Global Agriculture", Food Policy. Vol. 19 No. 2 p. 105-119.
- FAO. 1996. "Food and International Trade", Technical paper for the World Food Summit, Food and Agriculture Organization, Rome.
- \_\_\_\_\_. 1996. "Food, Agriculture, and Food Security: The Global Dimension", Technical paper for the World Food Summit, Food and Agriculture Organization, Rome.
- \_\_\_\_\_. 1996. "Food Security Assessment", Technical paper for the World Food Summit, Food and Agriculture Organization, Rome.
- Huang, Jikun and C. C. David. 1994. "Policy Reform and Agricultural Incentives in China," Unpublished paper.
- Huang, Jikun, S. Rozelle, and M. W. Rosegrant. 1995. "China's Food Economy to the 21st Century: Supply, Demand, and Trade", Unpublished paper.
- Johnson, D. Gale. 1994. "Does China Have a Grain Problem?" China Economic Review, Vol. 4, No. 1, p.1-4.
- \_\_\_\_\_. 1993. "Trade Effects of Dismantling the Socialized Agriculture of the Former Soviet Union". Comparative Economic Studies, Vol. 35, No. 4.
- Mitchell, Donald O. and M. D. Ingco. 1993. The World Food Outlook. Washington D. C.: World Bank.
- Pingali, P., P. Moya, and L. Velasco. 1990. "The Post-Green Revolution Blues in Asian Rice Production: The Diminishing Gap Between Experiment Station and Farmer Yields," IRRI Social Science Division, Los Baños.

Rosegrant, Mark W., M. Agcaoili-Sombilla, and N. D. Perez. 1995. Global Food Projections to 2020: Implications for Investment. International Food Policy Research Institute.

Rosegrant, Mark W. and M. Svedsen. 1993. "Asian Food Production in the 1990s: Irrigation Investment and Management Policy", Food Policy, Vol. 18, No. \_\_\_\_.

fn:asiakuar.txt  
ccd/07-29-96

Table 1. Estimates of chronically undernourished population among developing countries by region.

	% of population			Number (million)		
	1969/71	1979/81	1988/90	1969/71	1979/81	1988/90
Sub-Saharan Africa	35	36	37	94	129	175
Near East/North Africa	24	10	8	42	23	24
Latin America & Caribbean	19	13	13	54	47	59
East Asia	44	26	16	506	366	258
South Asia	34	31	24	245	278	265
Total	36	26	20	941	843	781

Source: Adapted from Alexandratos, N. (1995).



Table 2. Projected growth rates of agricultural and cereal production and demand (%).

	World	Developed Countries	Developing Countries					
			Total	Sub-Sahara Africa	Near East N. Africa	Latin America	East Asia	South Asia
1990-2010 (FAO)								
Agriculture								
Production	1.8	0.7	2.6	3.0	2.7	2.3	2.7	2.6
Demand	1.8	0.5	2.8	3.3	2.8	2.4	2.8	2.8
Cereals								
Production	2.0	1.0	2.1	3.4	2.3	2.3	2.0	1.8
Demand	2.0	0.5	2.3	3.4	2.6	2.4	2.0	2.1
1990-2020 (IFPRI)								
Cereals								
Production	1.5	1.0	1.9	3.0	2.4	1.9	-----1.8-----	
Consumption	1.5	0.8	2.0	3.1	2.2	1.7	-----1.9-----	

Table 3. Projected net imports of cereals (million tons).

	2010 (FAO)	2020 (IFPRI)
Developed Countries	-162	-189
Developing Countries	162	189
Sub-Sahara Africa	19	26
Near East/North Africa	72	68
Latin America & Caribbean	26	15
East Asia (incl. China)	35	} 78
South Asia	10	

Table 4. Projected trends in real world prices of agricultural commodities (1990=100).

	1990*	1995*	2005**	2020**
World Bank				
Agriculture	100.0	113.5	98.8	-
Food	100.0	100.0	90.1	-
Cereals	100.0	103.8	81.2	-
Rice	100.0		87.8	-
Wheat	100.0		74.3	-
Corn	100.0		78.0	-
Rosegrant et al.				
Cereals	100.0		-	80.5
Rice	100.0		-	78.4
Wheat	100.0		-	84.6
Corn	100.0		-	77.1
Meat	100.0		-	90.1

\* Based on actual prices

\*\* Based on projected prices

Source: Adopted from:

World Bank (1995) Commodity Markets and the Developing Countries, A World Bank Quarterly.

Rosegrant, M. W., M. Agcaoili-Sombilla, and N. D. Perez (1995). Global Food Projections to 2020: Implications for Investment. International Food Policy Research Institute.

Table 5. Selected projection of China's net imports of cereals.

	Projection Year	Net Imports (million mt)
Brown (1994)	2030	216-378
Rosegrant, Agacaoili, and Perez (1995)	2020	22
Huang, Rozelle, and Rosegrant (1995)	2020	43
	2010	43
	2000	40
USDA-ERS (1994)	2006	20
Alexandratos (1995)	2010	22 <sup>a</sup>

<sup>a</sup> Refers to East Asia, including China.

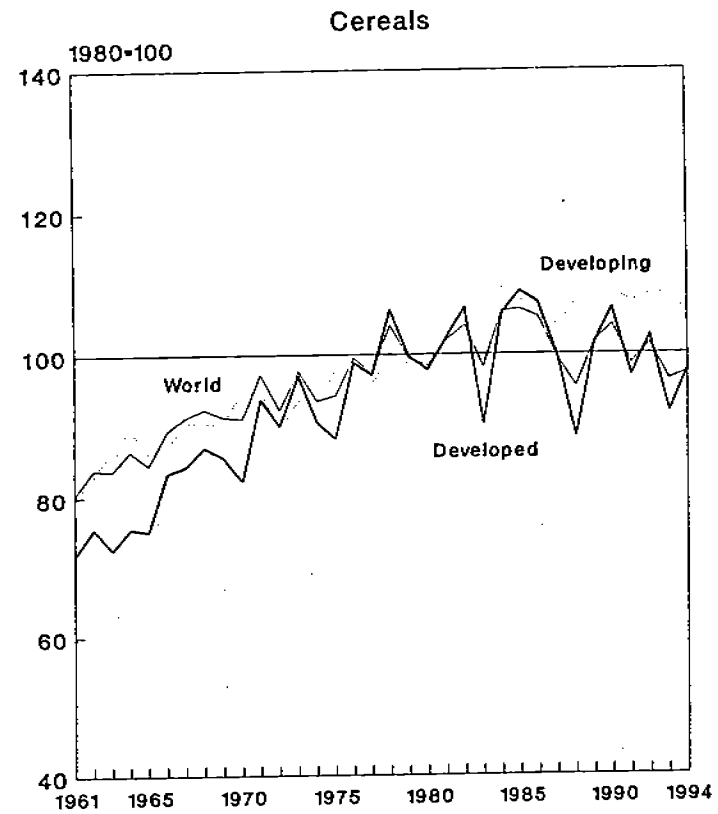
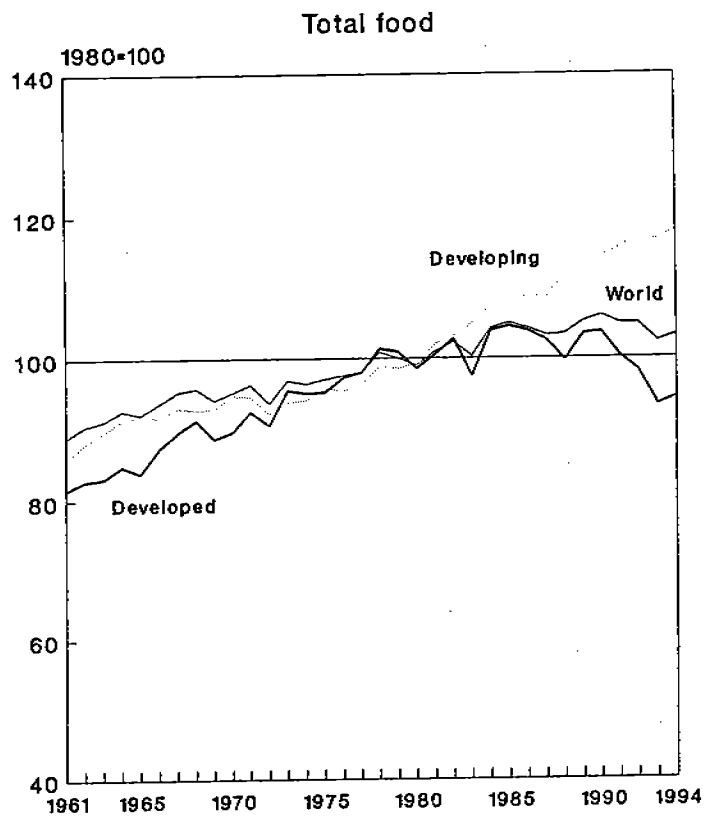


Fig. 1 Trends in total food and cereal production per capita in the world and developed and developing countries.

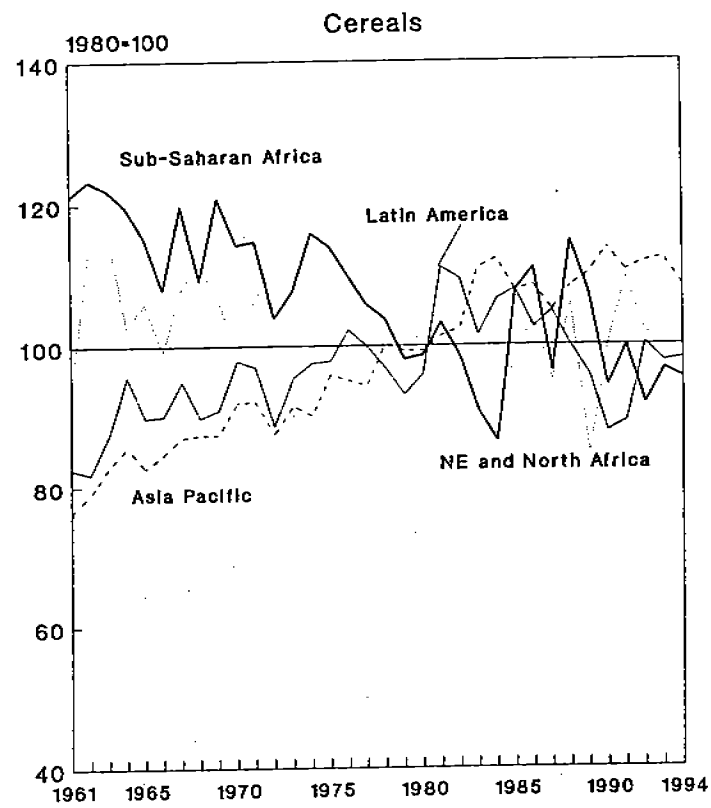
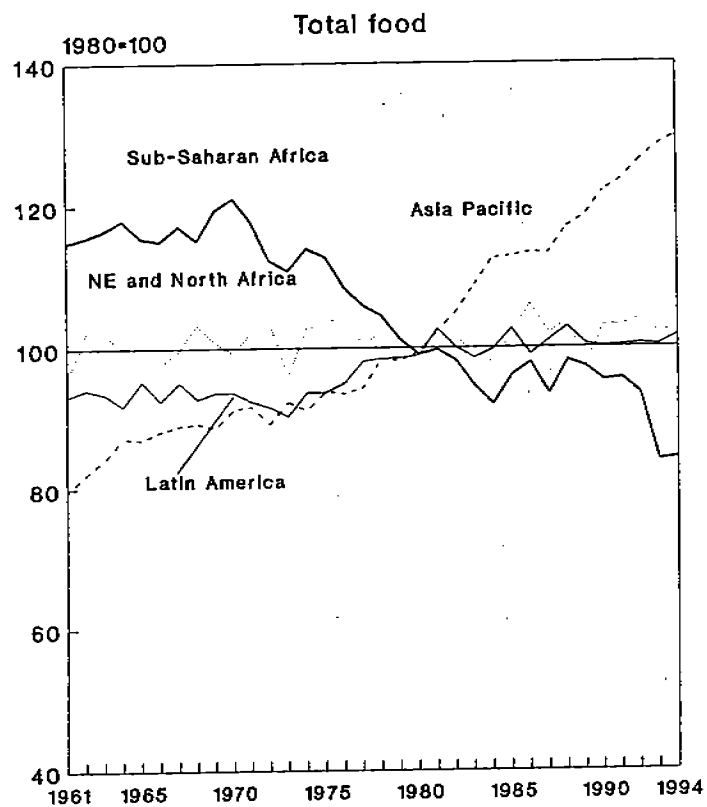


Fig. 2 Trends in total food and cereal production per capita by region.

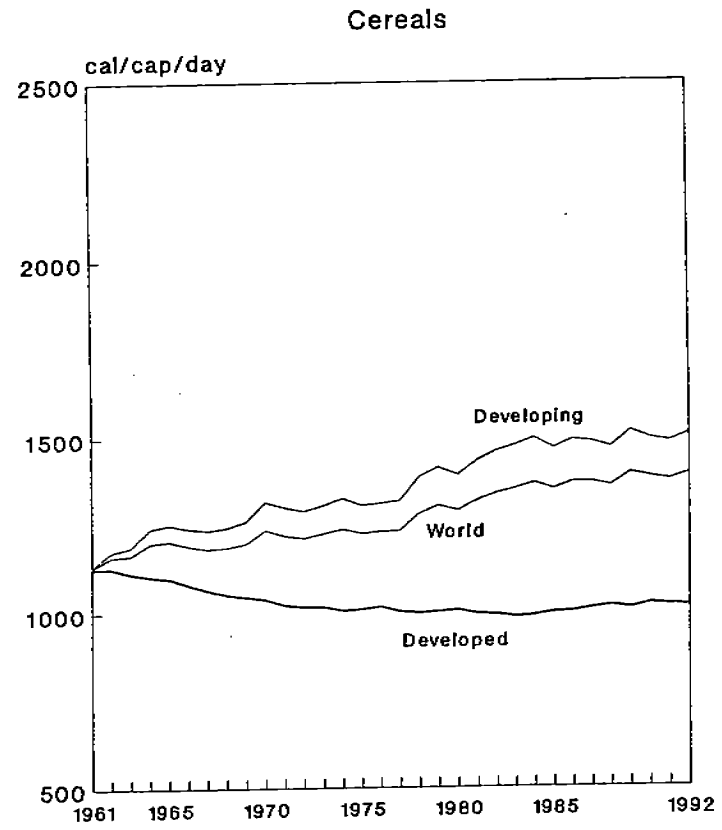
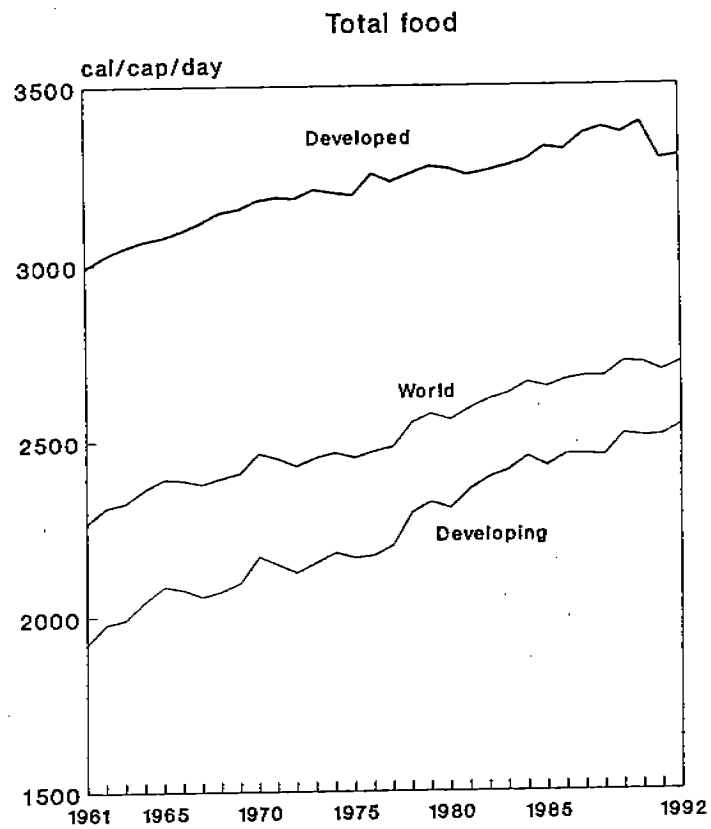


Fig. 3 Trends in the total food and cereal availability in the world and developed and developing countries.

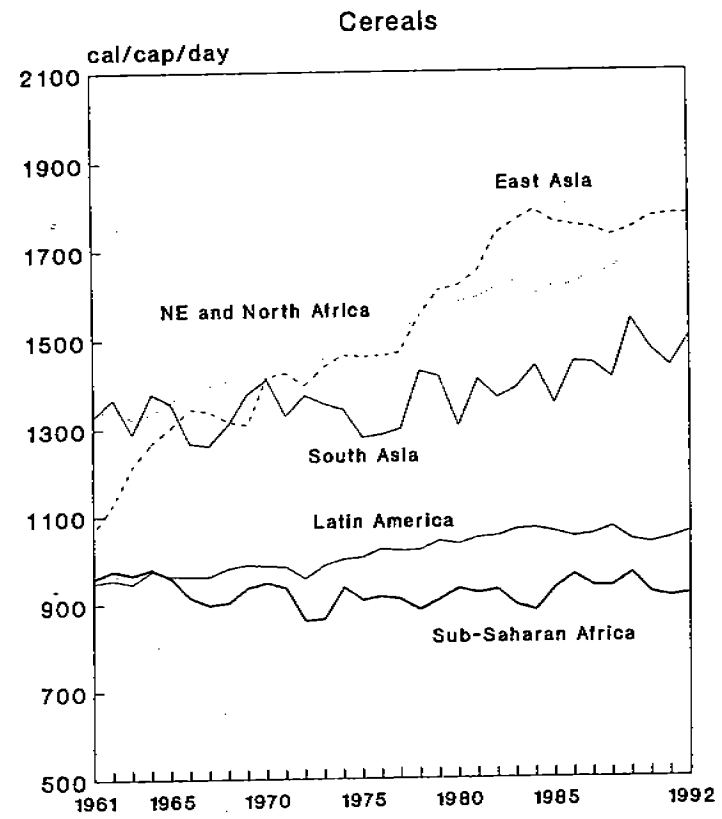
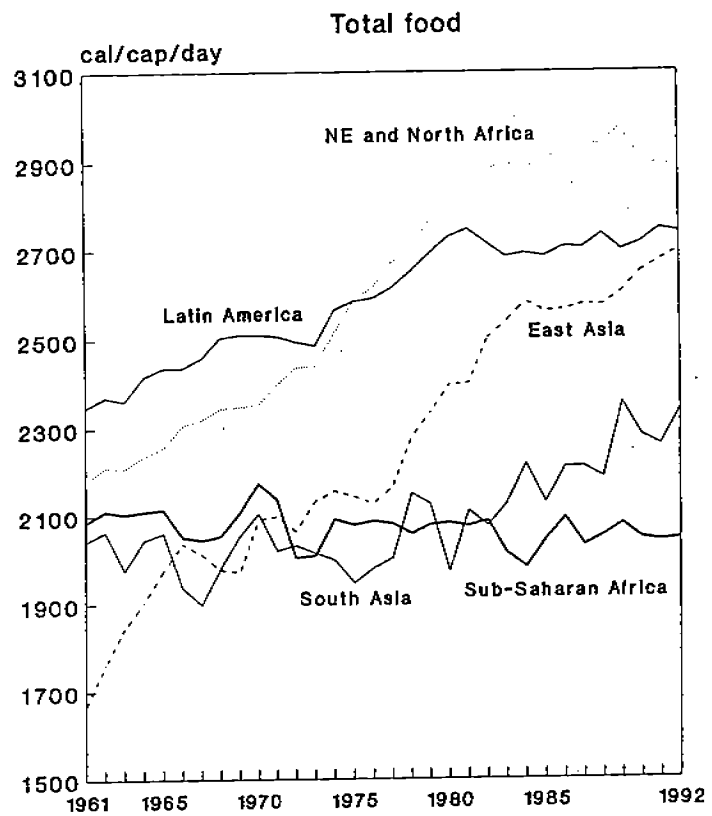
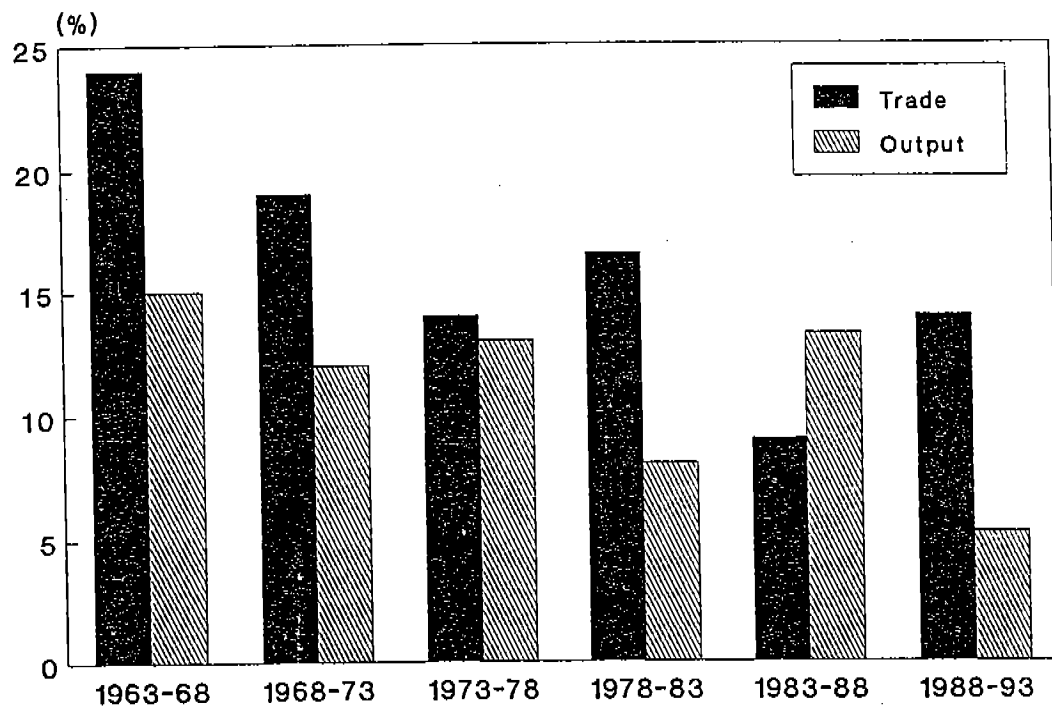


Fig. 4 Trends in total food and cereal availability by region among developing countries.





Source: GATT, International Trade, 1985-86 and 1994.

Fig. 5 Growth of agricultural trade and output, 1963-93  
(% change in each period)

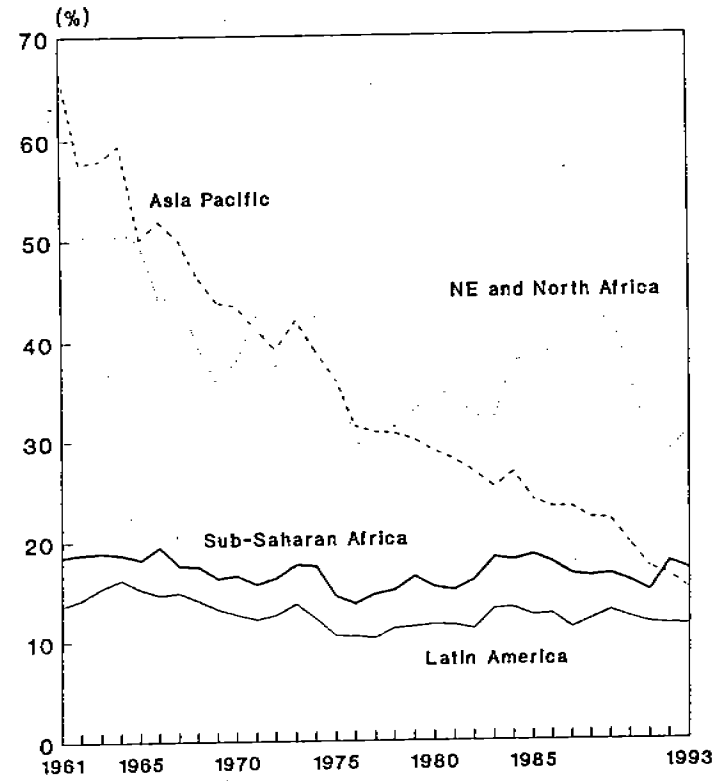
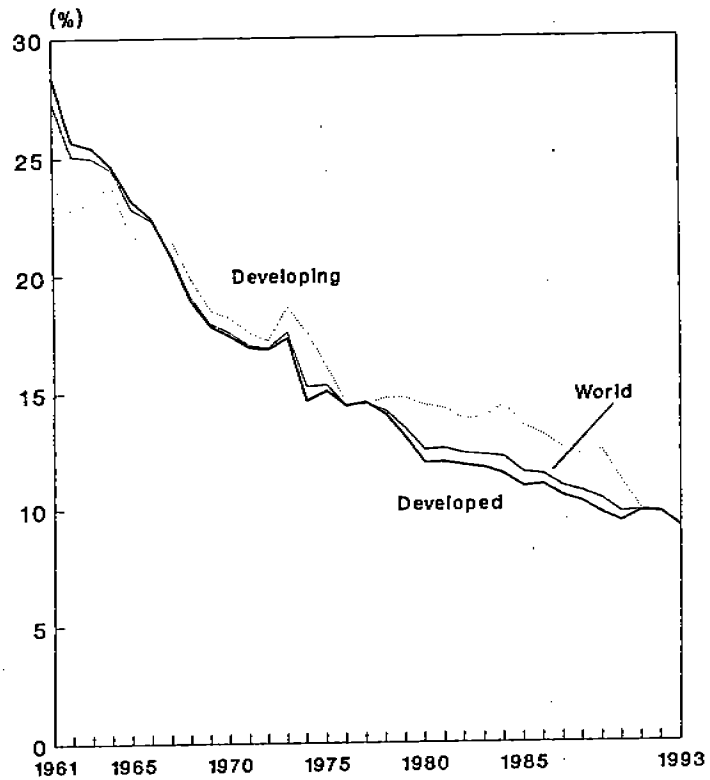


Fig. 6 Trends in the ratio of agricultural imports to total imports, 1961-1993.

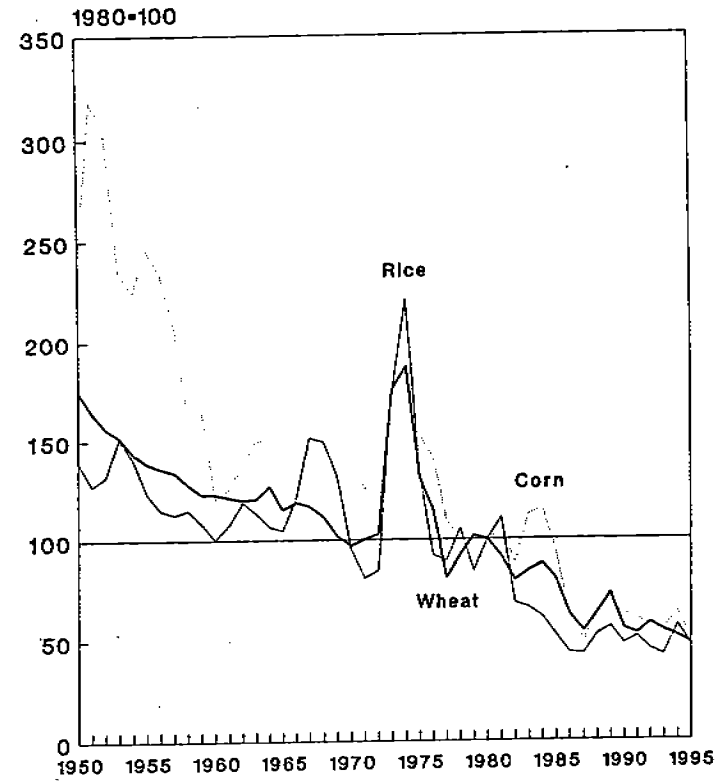
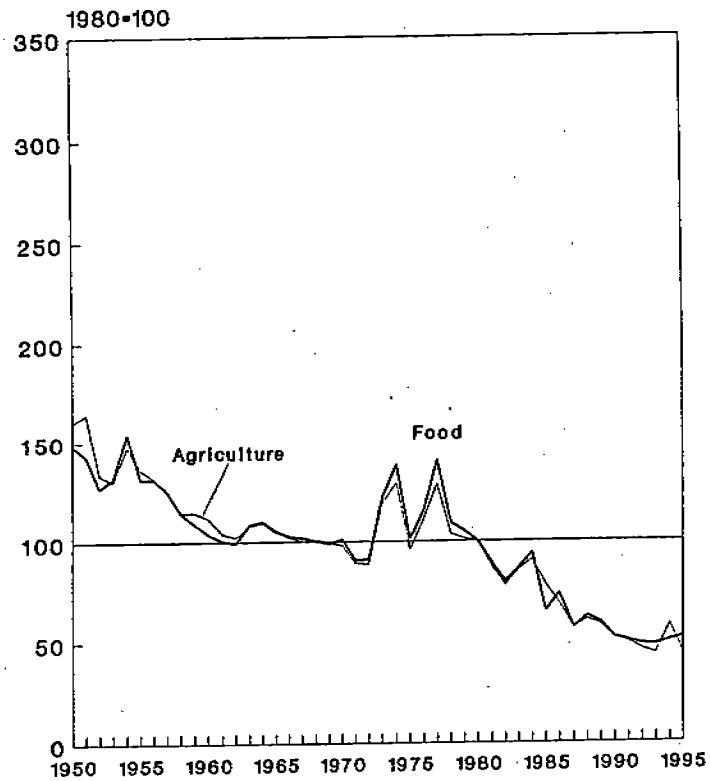


Fig. 7 Trends in the agriculture/food terms of trade in world market and real world prices of rice, wheat and corn.