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World food markets into the 21st century: commodity risk management policies†

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Recent concerns about future global food production seem poorly based. The rapid phase of growth in food consumption is over for most of the world's population because of increased incomes and, besides, population growth rates continue to slow. Thus, the rate of growth of food production needed in the future is much lower than it has been for the past 40 years. Production and price instability will continue, perhaps with lessened intensity because of reduced government intervention. With private agricultural interests now facing greater exposure to price and production risks, especially in developing countries, there needs to be greater emphasis on financial market instruments for managing these risks.

1. Introduction

Questions about the ability of the world to feed its growing human population become very topical from time to time. Such apprehension usually intensifies following a sharp run-up in prices of major foodstuffs as happened after the sharp grains price increases in 1973–74. In recent years there has been a drumbeat of concern raised by those with mainly environmental worries about depletion and degradation of soils and water supplies. In the past year these anxieties have been reinforced by the publication of Lester Brown's (Brown 1995) gloomy forecasts of grain consumption and production in China and by the sharp increase in grain prices in the year to June 1996.

Pessimistic forecasts about the adequacy of food supplies made in the past have subsequently turned out to be wrong. Is there any reason to believe that recent forecasts of long-term crises in food supplies should have greater credibility? In this article I describe the performance of world food production, primarily grain production, over the past 40 years or so. I also

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describe what has been happening to food consumption and point to some important changes in demand which many commentators ignore in making forecasts of the world food outlook. I present the prospects for world food production as seen by the major agencies undertaking outlook work, compare their forecasts and discuss reasons for any differences.

I then discuss which post-Uruguay Round developments may pose the greatest threat to instability in world food markets and the situations in which such instability will pose problems. I also discuss how such instability may best be managed.

2. The past 40 years' performance in food production

Despite periodic concern about the world's ability to feed itself, it has in fact been feeding itself at ever-improving levels and at lower real prices – even with a much larger population. World output of cereals, the main food source for the majority of consumers, has increased by 2.7 per cent per year since 1950 while population has grown by about 1.9 per cent per year, i.e., almost a 1 per cent per year per person increase. Cereal yields alone have increased more rapidly than world population since 1950 – at 2.25 per cent per year. This increased production has allowed per person calorie consumption in developing countries to increase by about 27 per cent since the early 1960s. These facts do not mean that all people have adequate diets, but diets for most of the people in developing countries in aggregate have improved substantially.

This picture is very different from what was often forecast. Paul Ehrlich in 1968 was very pessimistic about the world food situation.

> Americans are beginning to realise that the undeveloped countries of the world face an inevitable population-food crisis. Each year food production in undeveloped countries falls a bit further behind burgeoning population growth, and people go to bed a little bit hungrier. While there are temporary or local reversals of this trend, it now seems inevitable that it will continue to its logical conclusion: mass starvation. (Ehrlich 1968:17)

Ehrlich's understanding of what was happening in the 1960s was wrong and 30 years later what he thought he saw happening or forecast still has not happened. In fact, the global food situation has continued to improve.

The FAO's food production index estimates that in industrial countries there was a 28.9 per cent increase in per person food production from 1961 to 1991 and a 19.3 per cent increase for developing countries. Within developing country regions, Asia experienced the largest increase (33.3 per

cent), followed by Latin America (12.7 per cent). The food situation in Sub-Saharan Africa is the main exception to these developments with many African countries experiencing stagnant or even declining per person production. Population growth in Sub-Saharan Africa as a whole has been about 3 per cent per year while food production has grown by 2 per cent per year. The problems there as with most cases of a worsening food situation are mostly to be blamed on bad government policies rather than the inadequacies of the natural resources. In Sub-Saharan countries there is a strong correlation between the proportion of the world price of crops received by farmers and productivity growth.

Within the populous Asian region, performances have been extraordinary. China increased per person food production by 66.8 per cent in the 1961–91 period. This was due to rapid increases in aggregate food production and population growth of only 1.8 per cent per year. Indonesia experienced an increase of 67.7 per cent in per person food production, even though its population grew at a reasonably rapid 2.3 per cent per year. Brazil, with the largest population in Latin America (147 million in 1990), increased per person food production by 70.4 per cent over the 1961–91 period. The increasing proportion of better-fed people in the world is largely due to the gains made in Asia, however. Approximately 60 per cent of the world's population is Asian. Africa, which had the poorest performance, accounts for only about 12 per cent of the world's population.

While a larger and larger proportion of the world's population has been experiencing improved diets, food prices have been declining in real terms. The World Bank's index of food commodity prices fell by 78 per cent from 1950 to 1993 in constant dollar terms. Moreover, food prices have fallen as the ability of people in developing countries to purchase food has increased. From 1960 to 1990, real per person GDP of developing countries increased by an average of 162 per cent. East Asian developing countries experienced the most rapid increases in per person incomes. This has meant significantly reduced food costs in relative terms.

3. Trends in consumption

While most commentators focus on what has happened or what might happen to food production, they ignore the important changes taking place on the demand side. Further, it is likely that demand-side changes are going to be the most important for the future world food situation. During the 1980s, world cereals consumption growth slowed to 1.7 per cent per year from the 2.7 per cent increase averaged in the 1970s. In part, the slowdown was due to the slower economic growth in many developing countries during this difficult period; however, consumption growth also slowed in many

Asian economies which did not have slower income growth during that period. In China, for example, real GDP grew substantially faster during the 1980s than during the 1970s, yet consumption of cereals grew by an average of 2.3 per cent per year during the 1980s compared to 5.2 per cent per year during the 1970s. This pattern of change holds some very important lessons.

Behind this slowdown are two factors: first, the stage of most rapid increase in total food demand for most of the world's population is past. Per person consumption in total volume terms has risen to levels which are adequate for most consumers. This has been achieved because of the rapid increases in per person incomes in developing countries over the past two decades. The world's average per person cereals consumption has not increased appreciably since 1978, and in developing countries the average has not increased since 1982. Shifts from cereals consumption to other foods such as meats, vegetables and fruits will continue but the decline in the rate of growth of total food demand is expected to continue. This expectation is reinforced by the second factor responsible for the declining consumption growth rate, which is the declining rate of population growth.

The fast rates of population growth that we have seen in recent decades in developing countries are in many cases the result of what is known as the demographic transition. Clean water and better sanitation have reduced the impact of infectious diseases around the world, reducing rates of infant mortality and increasing life expectancy at birth. But it takes some time for the fertility rate of families to adjust to the new situation. So, for a period the population growth rate increases sharply. The faster the income growth of a country, however, the faster the fertility rate adjusts. Those developing countries which have had rapid per person income growth in recent decades have gone through the demographic transition and now have much lower population growth rates. The best solution for the rapid population growth still being experienced in many countries is for them to adopt policies leading to faster economic growth.

As a result of the changes in world food demand, challenges to the world food situation have changed considerably. Now that most consumers have adequate quantities of food, they are demanding greater variety. Consumers who a decade ago consumed most of their cereals as rice or maize now demand wheat products such as bread and noodles as well as more meat, fruits and vegetables. While in developing countries the emphasis is on consumption of more meats and vegetable oils, in industrial countries the dietary emphasis is on less red meats and more fruits and vegetables. The challenge, therefore, is for agricultural policies to adjust to these changes. Whereas, policy may have favoured the basic staple such as rice through price policies, irrigation policies and research and extension, the focus has to

shift to be in line with the changing demand structure. Crop research is a good example. A case can be made that the Green Revolution in rice was a response to the rapid income growth of the Asian rice-dependent economies. The world does not now need rice production to grow nearly as fast as it once did. More research emphasis now needs to be given to yield increases in wheat and grain and oilseeds for livestock feeds, as well as to improving livestock yields.

During the 1960s and 1970s, population growth accounted for one-half of the increase in total cereals consumption in developing countries and two-thirds of the increase in industrial countries. With the declining impact of income growth on total food demand in developing countries, and as more countries move beyond the fast phase of food demand increase due to rapid per person income growth, the impact of population growth will become relatively greater. But this impact will lessen with the declining population growth. World population growth appears to have peaked at 2.1 per cent per year in the 1965–70 period and declined since to 1.7 per cent per year (United Nations 1993). Further decline is expected with further declines in fertility rates and slower declines in death rates so that the world population growth rate could be 1.4 per cent or lower by 2020. This rate assumes a developing countries' population growth of 1.7 per cent per year, with the Sub-Saharan growth rate near 3 per cent per year. But if economic growth rates improve on the African continent and in countries in South Asia still with high population growth rates, the population growth rate for developing countries could well be lower.

4. Global food projections

Food production, consumption, price and trade projections are inherently uncertain. However, there are distinguishable short-term and long-term uncertainties. Short-term fluctuations in prices and production – due mostly to weather fluctuations and disease outbreaks – give rise to most concern among the general public and generate most public policy response. It is the long-term uncertainties about yield growth (or more generally the pay-off to agricultural research), changes in the resource base (soils, water supplies), income growth rates and population growth rates, as well as agricultural policies which are most relevant to the world food situation over the long term. To take all the various factors involved into account, it is necessary to assess the global food outlook within a multi-market framework which prevents inconsistencies in assumptions about the many variables involved. Such a framework also allows a more disciplined approach to tests of differing assumptions about the future course of the important factors.

Sets of projections of the world cereals situation, derived from global

models, have been made available in recent years by major institutions with a long-term background of analysis of primary commodity markets. These are the Food and Agriculture Organisation of the United Nations (FAO), the International Food Policy Research Institute (IFPRI) and the World Bank. Long-term outlooks from the three organisations are presented in Islam (1995), by Mitchell and Ingco (1995) from the World Bank, Alexandratos (1995) from the FAO and Agcaoili and Rosegrant (1995) from IFPRI. IFPRI projections are also presented in Rosegrant *et al.* (1995). Mitchell and Ingco's projections are presented in greater detail in Mitchell, Ingco and Duncan (1997). The results of the three projection exercises are also compared in Islam (1995). These projections incorporate best guesses about future paths for incomes, populations and yields and do sensitivity tests on these variables as well as on other critical variables such as fertiliser prices and investment rates.

Generally, the projections to year 2010 are very much in agreement (see table 1). World cereal production and consumption are projected to grow by

Table 1 Comparison of results of global cereals projections to 2010 (million tons, with rice milled)

Production	World	Former centrally planned economies	Industrial countries	Developing countries		
				South Asia	China[a]	Total
Actual 1989–91	1 726.5	266.0	579.8	202.8	326.8	862.7
Projected to 2010						
Alexandratos	2 334.0 (1.5)[b]	306.0 (0.5)	710.0 (1.1)	292.0 (1.8)	473.0 (2.0)	1 318.0 (2.1)
Agcaoili and Rosegrant	2 405.0 (1.7)	389.0 (1.5)	785.0 (1.3)	297.0 (2.2)	426.0 (1.6)	1 232.0 (1.9)
Mitchell and Ingco	2 311.0 (1.5)	324.0 (0.2)	733.0 (1.0)	282.0 (1.6)	475.0 (1.6)	1 253.0 (1.8)
Net trade						
Actual 1989–91		– 37.2	129.7	– 3.2	– 14.7	– 88.8
Projected to 2010						
Alexandratos		5.0	157.0	– 10.0	– 15.0	– 162.0
Agcaoili and Rosegrant		8.0	151.0	– 10.0	– 14.0	– 161.0
Mitchell and Ingco		15.0	195.0	– 31.0	– 22.0	– 210.0

Source: Islam (1995).

Notes: [a] In Mitchell and Ingco's study, Taiwan is separated from China and is included in other East Asia and Pacific countries. In the other two studies Taiwan is included with China. Taiwan's data for 1989–91 was: production 1.9 million tons, total use 8.1 million tons, and imports 6.1 million tons.

[b] Figures in parentheses are rates of growth from 1989–91 to 2010.

1.5 to 1.7 per cent per year in the period to 2010. By comparison, world production of cereals grew by 2.7 per cent on average over the 1970–80 period and by 1.6 per cent in the 1980–91 period. Industrial country production is expected to grow by 1.0 to 1.3 per cent per year over the projection period. By comparison, production in these countries increased by 2.9 per cent in the 1970–80 period and by 0.2 per cent in the 1980–91 period. The main reason for the decline in the 1980s was that in response to the high level of world grain stocks, the 1985 US Farm Bill sharply reduced support prices to agriculture and reduced US cropland planted to grains by 19 per cent in the 1985–87 period. Lester Brown (1991) misinterpreted the impact of the US policy to argue that world production of grain was no longer increasing.

In the developing countries, cereals production rose by 3.1 per cent per year in the 1970–80 period and by 2.7 per cent per year in the 1980–91 period. The forecasters project a rate of growth in the period to 2010 of between 1.8 and 2.1 per cent. Remember that population growth in developing countries is projected at 1.7 per cent or even less by this time. As table 1 shows, the industrial countries (such as Australia, Canada, France, and the United States) have provided the exports needed by the former centrally planned economies and the developing countries. Their role as exporters is expected to grow in importance to supply projected developing country imports of 160–210 million tons by 2010. At the same time, the forecasters expect the former centrally planned economies to shift from being major importers to being significant exporters. What happens in the former centrally planned economies will be one of the most important factors affecting the long-term world food situation and one of the most uncertain. Two factors strongly support such projections, however. First, cereal consumption in the former Soviet Union and the Eastern and Central European economies was heavily subsidised, to the extent that total per person calorie consumption was higher than in the richest industrial countries. With the movement towards world market prices in these countries, per person consumption of cereals has declined and wastage in consumption will be reduced. Second, while several of these economies have resource endowments favouring agricultural production, their agricultural production, harvesting and storage practices under central planning were highly inefficient. With the shift to market pricing, efficiency should improve. Yields, including livestock feeding ratios, should increase more quickly (see Tyers 1994 for a comprehensive discussion). How fast these improvements will take place will depend greatly on how quickly secure property rights to land and profit can be established. The beneficial impact of giving more secure property rights to land to farmers in China and Vietnam should carry a strong message to countries such as the Russian Federation.

The higher world production figure projected for 2010 by Agcaoili and Rosegrant (1995) is basically due to their more optimistic projection for the former centrally planned economies – 1.5 per cent growth compared to 0.5 per cent growth projected by Alexandratos (1995) and 0.2 per cent projected by Mitchell and Ingco (1995). But all analysts would acknowledge the high degree of uncertainty attached to this projection, which flows over into the net trade projection.

There is substantial agreement between the projections on the outlook for China. None of the projections give any support to the very pessimistic forecasts made by Brown (1995). Mitchell and Ingco project net imports of 22 million tons by 2010, while Alexandratos and Agcaoili and Rosegrant see no increase in cereals imports over the 1989–91 level. Brown's arguments supporting his projection of China's cereals imports of up to 370 million tons by 2030 have been effectively discredited by various writers recently (e.g., Alexandratos 1996; Johnson 1997). I therefore give them no credence in discussing the likely sources of risk in food markets.

5. Uncertainty and instability in world food markets

I discuss the world food outlook in terms of the main areas of uncertainty which will have an important bearing on how much continued improvement in the world food situation we will see and, separately, the issue of instability in world food markets and what courses of action to adopt with respect to such instability.

As I have argued above, developing countries have been experiencing rapid population growth. But these growth rates have slowed as countries have moved through the demographic transition, particularly those countries experiencing sustained, rapid economic growth. Global population growth is moving to a much reduced level; the reduction will be even greater if sustained economic growth can be achieved in South Asia and Africa. Therefore, the yield increases needed to maintain increases in per person food consumption will not be as large as in recent decades.

Even allowing for increases in incomes in developing and transition economies, the best estimates of the yield growth needed for the next one to two decades are in the range 1.5 to 1.7 per cent per year – allowing for no increase in farmed area. Cereal yields have averaged 2.25 per cent annually since 1950. A pessimistic view is that this rate of yield growth, due in large part to the introduction of semidwarfing genes into rice and wheat, was fortuitous and may well not be repeated. In that case, we would have to manage with traditional rates of breeding progress in the range of 0.5 to 1.0 per cent per year (Fischer 1996). This is an extremely pessimistic view, given the performance of science in the twentieth century. Moreover, closure of

the gap between on-farm and experimental yields in many developing and transition countries should be greatly enhanced by better agricultural institutions and policies – particularly more secure property rights to land, lower taxation of agriculture, and freeing up of markets, particularly for fertiliser.

Institutions and policies also have a large role to play in improving the agricultural resource base. Concerns about degradation of water, soil and germplasm resources are legitimate. In most cases, the most appropriate management of these resources will be achieved by institutional developments which internalise the external costs associated with their use. This may well mean that marginal lands will no longer be farmed or not farmed as intensively, or that water will be priced appropriately and its agricultural use reduced. Farmers should not be encouraged into extra-marginal land uses by policies as, for example, in Australia where drought areas are declared with great frequency and incomes are subsidised as a result. Such action pretends that the Australian environment is something other than what it actually is. While these desirable developments in institutions and policies may well reduce the physical agricultural resource base in some cases, overall resource allocation and social welfare will be improved. But I believe that the impact of any such reductions on farming output will be more than offset by the improved efficiency coming from institutional developments which give farmers more secure access to land and water.

The issues discussed above have dealt with their impact on the long-term world food outlook. But some of these issues also affect the stability of food markets. For example, reducing government subsidies of marginal land use in Australia would reduce the instability of farm production. In a global context, such policy action would have a beneficial impact on price stability. More secure access to land leads to greater investment in land, including investment promoting soil and water conservation, which leads to less instability in production.

Production instability may also be reduced by the liberalisation of agricultural markets, though there has been little reduction of protection of agriculture to date through multilateral processes (see e.g., Hathaway and Ingco 1995). This result is particularly disappointing with respect to the United States and the European Union whose farm policies have had the most destabilising impacts on world agricultural markets, as happened in the 1960s, 1970s and 1980s. While most world market instability arises from weather shocks in large producing countries, on occasion the instability has been attenuated by policy measures in large producing countries such as the United States. But other countries are becoming large in international terms such that the actions they take to affect production and/or stock levels can have a significant impact on world prices through changes in their net trade.

For example, China is already a large participant in the cotton, sugar and wool markets. It may become a major player in the grains and oilseeds markets. Indonesia is now a large participant in the rice market.

Unfortunately, periods of rapid growth of imports which accompany sustained fast income growth in developing countries trigger pressures for poor policy choices. As per person incomes are increasing from very low levels, food consumption increases rapidly. Domestic food production is unable to keep up with the rapid consumption growth, which may be as high as 6–8 per cent per year, and imports have to increase. However, there is often political pressure to restrict imports. It is not realistic to expect domestic agricultural production to achieve such growth rates. But this period of rapid consumption growth and high import demand growth passes as per person incomes continue to increase. Adopting policies which attempt to maintain self-sufficiency during this phase of economic development would be economically very costly. China is one of the more recent examples of countries going through this process. Because of its continuing high income growth and sharp reduction in population growth rate, it should pass through this phase relatively quickly. But there are considerable pressures from within the country, fostered by the kinds of uninformed projections made by Brown (1995), for policies to maintain self-sufficiency in grains. Not only would adopting self-sufficiency policies have an adverse impact on economic development within China, it would rob grain-exporting countries such as Australia of major export opportunities.

The opportunities for bad policy choices, therefore, remain large, and this together with production shocks stemming from natural causes should ensure continuing commodity market instability. Whether production- or policy-related price shocks will be as frequent or of the same magnitude as in the past, it is impossible to say. Primary commodities differ greatly in the degree of price instability, which appears to be related more to the price formation processes of the individual markets than to characteristics such as the share of total production traded or the inelasticity of demand or supply. It may be argued that production shocks could become more frequent or of greater intensity as farming presses harder against the margins of soil quality, water availability or the germplasm resource. I believe, however, that adoption of good policies and institutions can lead to an even more robust farming system.

6. Management of commodity risks

Production and price instability will persist as will no doubt the debate over the nature of government involvement in its management. As Timmer (1996) summarised the current status of the debate: 'The mainstream

academic literature has judged schemes to stabilise food prices as extremely difficult to implement, not worth the costs, and highly likely to be captured by special interests' (p.46). The lack of academic support for price stabilisation is reflected in the lack of support for international commodity agreements (see e.g., Gilbert 1995) and for domestic price stabilisation schemes. However, there remain those such as Timmer who are in favour of domestic commodity price stabilisation schemes, particularly where the commodity is significant in terms of GDP; which is more likely to be true for developing than high-income countries. His arguments largely rest on a postulated link between commodity price instability, macroeconomic instability and lower economic growth. There are numerous studies which find evidence to support both sides of this argument. I believe that there is such a link – though not for the oft-claimed reason of poor price signalling of investment, but rather because of the difficulties which governments have in managing expenditure smoothing and the political economy problems of the struggles over the distribution of resource rents. Sachs and Warner (1995) find a strong negative association between natural resource dependence and growth. Reasons suggested for this adverse relationship include the Dutch-Disease effects of price booms in the export commodity. But the good economic performances of initially resource-dependent economies such as Botswana, Chile, Indonesia and Malaysia (and earlier the United States) suggest that policies can modify or offset this impact.

If there is some social benefit to reducing the price uncertainty or price variability[1] of commodities of significance within an economy, a number of questions arise. Does this only apply to commodities that are significant exports? Is it only relevant to commodities where the government is highly dependent on the commodity for revenues (as with mineral or petroleum exports, or such soft commodities as cocoa and coffee)? Or is it of significance, as Timmer (1996) argues, when it is an important food commodity such as rice in a low-income developing country? Is it the reduction of price uncertainty or the reduction of price variability which is important? One view is that reducing price uncertainty over defined periods by use of financial instruments (such as futures, options, swaps, etc.) has benefits in terms of increased productive efficiency, increased collateral value of commodity stocks and superior budgetary control (Duncan and Gilbert 1995). Timmer (1996) argues that price variability in significant food crops, such as rice in Indonesia, causes increased variability in other prices

[1] These are not the same. For example, use of futures contracts will reduce price uncertainty over a limited period (say, one year) but, because commodity futures prices are only slightly less variable than cash prices, does not reduce price variability much over longer periods.

throughout the economy and that the effectiveness of price signalling in allocating consumption and investment is thereby adversely affected.

If expenditure smoothing, rather than reduction of price variability *per se*, is the main concern (which also takes account of quantity variability), in principle the adverse impact of commodity price and quantity fluctuations on private and public expenditure can be managed through various mechanisms – e.g., access to credit and deposit markets, to storage facilities, or forms of insurance. While these instruments are generally available in high-income countries (though not necessarily accessed because of government crowding out of private-sector operations), in most developing countries they have not been available, or available only on unfavourable terms or in informal markets. There are two issues involved. One is the unavailability of the facility because it has not been able to develop, or not allowed to develop because of government restrictions. The other is the inability of the individual agent or government to access the facility, often because of lack of creditworthiness but also because of government restrictions such as controls over capital movements which inhibit access to international financial markets.

Liberalisation of commodity markets in developing and transition countries has increasingly meant that price risks are borne by the private sector rather than the government. This has created much greater interest in the use of commodity price risk management and financing instruments in developing countries. Because individual farmers do not generally have direct access to these instruments, intermediaries must be developed and there have been quite significant innovations in this area in recent years. For example, in Africa a private bank, in Poland a private grain-processing company, and in Mexico a government agency are offering what are effectively put options to individual farmers, which allows them to lock in a price for their output for the coming season. Farmer financing is also being enhanced by the development of these facilities which provide security for bank loans for working capital, as do warehouse-receipt facilities being developed in several countries.

It has been argued (e.g., Dawe 1996) that expecting farmers to participate in such activities following removal of public price stabilisation schemes is unrealistic because of the high transaction costs. So far, the results are promising, but time will tell. Other concerns arising from the prospect of agricultural liberalisation, particularly Uruguay Round-agreed reductions of price support programs in the European Union and the United States, are that public grain stocks in these countries will be reduced, leading to lessened cushioning of international price volatility and food shortages, and reduced availability of food aid (see, for example, Islam and Thomas 1996). Several points can be made in response to these concerns. First, public stocks crowd

out private stocks, so there is no reason to believe other than that private stocks will take the place of public stocks. Moreover, private stocks should be more efficient than public stocking policies in terms of stabilising markets. Further, given advances in transportation facilities and inventory-holding practices, the optimal stock level may well be lower than in the past, just as in other areas where inventories are held.

Second, more openness to trade by food-importing developing countries should decrease their quantity risk exposure. Third, most low-income, food-importing countries have policies which directly (taxes) or indirectly (over-valued exchange rates) inhibit agricultural development. Better policies would increase agricultural productivity and dampen production risks. Finally, while the delivery of food aid has improved, in recognition of the adverse impacts it can have on domestic food production and on consumption patterns, the availability of food aid has been determined by production behaviour under price supports in the donor countries, not by demand in the recipient countries.

7. Conclusions

As far as the world food outlook is concerned, the recent upsurge in concern seems poorly based. With population growth continuing to slow and the most rapid phase of growth in food consumption now past for most of the world's population, the rate of growth needed to meet the expected effective growth in demand is much lower than it has been for the past 40 years. Those people concerned about recent declines in growth of grain yields should remember that the world does not need yields to grow as fast as they have done in the past, particularly for rice. It is therefore highly likely that world prices of grains will continue to fall in real terms, though we have to expect the occasional sharp increase as seen in the past year. But these will not signal any long-term crisis in the world food situation. A challenge for agricultural policies and for agricultural research is to adapt to the changing dietary patterns resulting from the rapidly increasing incomes over much of the developing world.

Other challenges are for developing and transition countries to set up institutions and policies which will reduce the gap between experimental and on-farm yields. Of most importance in this respect is the development of property rights which provide farmers with more secure access to land and profits. All countries face the challenge of putting in place institutions and policies which will protect the agricultural resource base. In most cases, the most appropriate management of soil, water and germplasm resources will be achieved by internalisation of the external costs associated with their use.

More secure access to land, leading to greater investment in promoting soil and water conservation, should lead to less unstable but higher production.

Production and price instability will continue, though whether the degree of instability will be greater or less is impossible to say. Less interventionist policies in major producers such as the European Union and the United States may mean a lessened frequency of shocks, and even a modification of their magnitude as the importance of private stockholding grows. However, the growing importance in world markets of countries such as China, still with a preoccupation with self-sufficiency policies, is a potential source of destabilisation of world food markets.

The management of commodity risks has entered a new era with the global liberalisation of agricultural markets. This liberalisation has strong support within economic research which judges international and domestic efforts to stabilise prime commodity prices to be difficult, if not impossible, to implement without subsidies, highly likely to be captured by special interests, and of unproven net social benefit. Research is needed on the question of the social value of reducing price uncertainty and/or price variability and under what circumstances or for which commodities it is likely to be of benefit.

These issues are likely to be of much greater significance to highly commodity-dependent developing countries than to high-income countries where the main pressure for price stabilisation stems from narrow producer interests. With the private sector in developing countries facing substantially greater commodity risk exposure following liberalisation, interest there is focusing on the development of spot, forward and futures markets and increasing accessibility of the sector to these markets, both domestically and internationally.

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