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SUSTAINABLE AGRICULTURAL DEVELOPMENT: THE ROLE OF INTERNATIONAL COOPERATION

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Food Security: Issues and Options

**INADEQUATE INCOME AS THE
MAIN PROBLEM OF FOOD INSECURITY**

All countries are concerned with food security in some sense or other. Yet what is meant by the concept is not always clear. Food security should mean that a country is able to provide 'adequate' food to all its citizens under all circumstances that can reasonably be expected. Whether this is accomplished through market mechanisms or through government organizations is not fundamental to the notion of food security. Moreover, the objective should be to provide food security to all as a matter of right, without inflicting any humiliation on the poor or the poor countries. The level of food energy intake at which a person can be considered adequately fed is still a point of unsettled debate among experts (Srinivasan, 1983), yet no matter how one measures hunger and poverty, one finds that large numbers (hundreds of millions) of people in the world, almost all of them in the developing countries, suffer from persistent hunger (FAO, 1986; World Bank, 1986, 1990).

In addition to those who suffer persistent hunger many others, who normally get enough to eat, live precariously on the margin of subsistence. They are vulnerable to all manner of external influences which can easily reduce their food consumption and make them join the ranks of the hungry. A major threat to the already inadequate food consumption of the poor is that of a drop in real income. The poor usually suffer a loss of income when agricultural production is reduced or disrupted owing to unusual weather or wars. Apart from such a sudden decline in real income, a creeping loss may occur if employment opportunities do not keep pace with the growth of the labour force.

The real income of the poor can also fall when food prices rise. If that occurs the poor, who are often net buyers of food, obtain less to eat. Prices can increase for many reasons. This is obvious during drought and may be compounded if the poor also lose employment opportunities. Even when drought, or some other supply difficulty, strikes in a far-off rich country, the price of food for the poor can increase. The rich country will either export less, or import more, foodgrains forcing up prices in world markets. A poor importing country will be unable to import as much as before, or get as much food aid as before, and its domestic price will increase. Food prices can also alter when a major country drastically changes its trade policy and decides to import more

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or export less, as happened in the early 1970s when the Soviet Union suddenly imported nearly 20 million tonnes of grain. Even a booming domestic economy can aggravate the hunger of some poor people if their incomes do not rise as rapidly as increases in food prices because incomes of others in the economy rise even faster.

In an economic, but not a moral sense, the world food system functions efficiently. It provides food at reasonable prices to those who have the money to buy it (Johnson, 1984). Yet the biological needs of those with insufficient purchasing power are not met by the system. The hungry in the world are hungry because they are poor. They are poor because they own too few resources of land, capital or skills. Hunger is primarily a problem of poverty and not of food production. Thus, if all the poor are given additional income, more food will be demanded *and produced*. However, if more food is produced because farmers are given greater price incentives, the poor whose incomes have not changed will remain hungry. Thus food security can be provided to an individual either by increasing money income or by decreasing the price at which 'adequate' food is made available. One has to recognize, therefore, that to deal with hunger is to deal with poverty and under-development.

The same is true for food security for a country. If it has enough income, it need not strive to be self-sufficient. It can import the food it needs. But if it is poor and deficient in food production it becomes more vulnerable to transient influences which reduce domestic production or increase world market prices. Lack of food security is a problem only for poor people and poor nations. While it is conceivable – for example, in some nuclear winter scenarios – that global food production could fall so far below demand that even rich nations would face difficulty, such drastic supply shortages are very unlikely. The technological food production potential of the world, even without invoking exotic technologies, is so large that inability to produce food at any cost cannot be expected to threaten food security of the rich nations (Linnemann *et al.*, 1979; FAO/UNFPA, 1980). We will therefore look at options only for those less fortunate. While famines and other transient food insecurity problems attract much media attention and academic analysis, the major challenge is from persistent food insecurity which affects hundreds of millions. This is considered first.

PERSISTENT FOOD INSECURITY: POLICY OPTIONS

Agricultural development: price policy options

A large proportion of the population, particularly the poor, in most developing countries, depend on agriculture for their income. In the short run it is often far easier to improve their position through agricultural development than to absorb them in sufficient number in alternative productive employment in non-agricultural sectors. Of course, in the long run the bulk of the labour force in most countries has to be employed outside farming. But many developing countries have been unable to increase industrial employment at a sufficiently

fast pace. Moreover, even those not employed in agriculture depend on it to provide food. Thus agricultural development has to be at the centre of any food security strategy in most poor countries.

The major elements of strategies for promotion of agricultural development consist of price policy, trade policy, investment, infrastructure development, research to foster better varieties, extension to bring new technology to farmers, and institutional reforms. Appropriate policy in each of these areas is not easy to determine, for it involves complex trade-offs and feedbacks. We look at some of these in turn.

Output price policy

Developing countries are often advised to get their prices 'right'. While the importance of 'right' prices cannot be under-estimated, it is not obvious what such prices are. The majority of the world's hungry are net buyers of food. For them, lower food prices mean more food. However, low prices which help the poor also inhibit producers of food. Thus the developing countries appear to face a real dilemma, though perhaps one which is less severe than it may appear at first sight. While farmers do respond with larger output when the price of a specific crop is increased, the output expansion for food in aggregate when all agricultural prices are increased is not as large as it could be for a single crop. This follows because when the price of only one crop is increased resources such as land, labour or water can be diverted from alternative uses. For agriculture as a whole, output expansion has to be realized by general intensification and augmentation of resources, which takes time, particularly in developing countries.

Thus there is some logic in maintaining the relatively low prices for agricultural output characteristic of developing countries. High prices stimulate output only modestly and hurt many of the poor.

High output prices and long-term supply response

It can be argued that high output prices for agricultural products, maintained for some years, would attract more investment into agriculture, thus securing a supply response in the long run much larger than in the short. While this is possible, once again it must be recognized that additional investment in agriculture might well come from reduction in investment in other sectors. Thus, while agricultural GDP would increase, total GDP would barely be affected.

Simulations with a system of linked general equilibrium policy models of a number of countries have shown this in the context of trade policy analysis (Fischer *et al.*, 1988). When agricultural trade is liberalized by all market economies the relative prices affecting agriculture increase in most developing countries. The impact after 15 years of higher prices is demonstrated in Table 1. It can be seen that improved terms of trade for agriculture would indeed stimulate agricultural output in the long run, but the impact on total GDP would be negligible. Moreover, even after 15 years of sustained policy, higher

agricultural GDP would not be adequate to compensate the poor for higher food costs and they would continue to remain worse off in terms of welfare, compared to the corresponding year of the reference scenario.

The estimates in Table 1 should be interpreted with care, as they involve pitfalls of aggregation and index number construction. The lack of impact of agricultural changes on total GDP for developed market economies is to be expected as farming is a small part of the economy. For the developing countries, even keeping index number problems in mind, it is more surprising since, even with large changes in relative agricultural prices and consequent significant changes in agricultural GDP, aggregate GDP changes but little.

To assess the effects on welfare average equivalent income is basically a better measure than per capita GDP since it accounts for consumer preferences

TABLE 1 *Impact of relative agricultural prices on GDP and agricultural GDP (percentage change over the corresponding year of the reference scenario after 15 years of price policy change)*

Country	Pa/Pn	GDP	GDP (ag)	Average equiv. income [†]	Average calorie intake	Persons in hunger
Japan	-39	+0	-6			
EC	-12	+0	-8			
USA	-5	+0	1			
New Zealand	8	1	11			
Canada	13	-0	17			
Australia	9	+0	1			
Austria	6	+0	+0			
Turkey	-10	1	-9	2	+0	-6
Pakistan	-1	3	-1	3	1	-17
Nigeria	-9	-1	-1	+0	1	-57
Egypt	8	-3	5	-2	-0	*
Mexico	-5	-4	1	-4	+0	-3
India	3	+0	-0	1	-0	2
Argentina	48	-0	47	3	-2	31
Brazil	25	-1	7	-1	-2	50
Indonesia	17	1	6	-0	2	*
Thailand	20	+0	6	n.a.	-0	3
Kenya	15	3	10	n.a.	3	-14

Notes: Pa/Pn = price of agriculture/price of non-agriculture weighted by domestic production.
 GDPs are at constant 1970 prices.
 Numbers rounded off: +0 means > 0; < 0.5 and -0 means > -0.5 but < 0.
 * = no hunger in the reference scenario.
[†] = income needed to provide the same utility at base year prices as provided by current consumption.
 n.a. = not available.

(at least the preferences implied by the demand system of the 'average consumer'), which per capita GDP ignores. In general, the changes in equivalent income are similar to those in GDP, though for some countries the two do show different signs.

What emerges from these scenarios is that higher domestic food prices in developing countries increase domestic agricultural output, but even when average real income improves the result might, in some important cases, be lower calorie intake and an adverse impact on the chronically hungry. In general, therefore, the case for 'getting prices right' cannot be made with reference to its supposed effects on overall economic growth. We can also extrapolate from the results with reference to effects on nutrition and hunger. As the scenarios show, higher trend prices of food may hurt the poor, even when increasing the average income in a country. It is emphasized that in these scenarios we have assumed normal weather and have accounted for the macro-economic feedbacks and adjustments which might evolve after 15 years of policy change. Thus price increases of similar magnitude which occur suddenly could be expected to be even worse for the poor. This indicates the importance of stabilization of domestic food prices. In the context of variable weather and fluctuating world prices a flexible trade policy and/or a stock policy can be used to stabilize domestic prices.

Trade policy

Trade policy is closely linked to price policy. When a country allows free trade, domestic prices will equal trade prices. If a tariff is imposed on traded goods the domestic price will differ from the border price by the amount of tariff. If no trade is permitted domestic prices will be independent of world prices. Thus using trade policy as an instrument of agricultural development runs into problems similar to the ones encountered by price policy which are described above.

Yet it is often argued that an appropriate trade policy helps promote development in a number of ways. First, under free trade with equality between domestic and world relative prices, investment allocation becomes optimal. Second, free trade provides competition for domestic sectors, provoking greater efficiency. Third, an outward-oriented strategy which promotes exports provides flexibility in importing critical goods, including new technology, and in meeting unforeseen bottlenecks. These arguments for freer trade are not universally accepted. When applied to agriculture their force is quite weak. Many studies have shown that gains from increased allocative efficiency consequent to free trade in general (Whalley, 1985) and trade liberalization in agriculture in particular (Parikh *et al.*, 1988) are marginal. Tables 2 and 3 show the results of agricultural trade liberalization simulations using the IIASA/FAP system of linked models referred to earlier. The changes in GDP and in the number of persons hungry are rather small, compared with the corresponding year in the reference scenario.

The argument that rent-seeking activities in a protected economy lead to production inefficiency, and that freer trade leads to substantial gain as pro-

TABLE 2 *Impact on GDP (at 1970 world prices) of various agricultural trade liberalization scenarios (percentage change after 15 years relative to the reference scenario)*

Scenario*	World	OECD	CMEA**	Developing
F-ALLME	0.28	0.63	-0.30	-0.22
F-OECD	0.22	0.48	-0.40	-0.02
F-LDC	0.05	0.15	-0.11	-0.10

Notes: * = Agricultural free trade by ALLME – all market economies – by OECD countries and by LDC – less developed countries.
 ** = Council of Mutual Economic Assistance formed by the Eastern European countries.

TABLE 3 *Impact on hunger of various agricultural trade liberalization scenarios (percentage change in persons hungry relative to the reference scenario)*

Scenario	Five years after	Fifteen years after
F-ALLME	+0.8	+1.4
F-OECD	+3.3	+3.6
F-LDC	-4.7	-4.6

duction moves to the efficiency frontier, is not likely to be significant for agriculture in developing countries. Activity is in the hands of millions of private producers who act competitively and no further gains in efficiency are likely to accrue from additional competition from abroad.

Thus, while many developing countries singly, and developing countries as a group, would be better off in terms of reducing the number of hungry persons with agricultural trade liberalization than without, we can conclude that agricultural trade policy, like price policy, cannot by itself lead to better food security. In fact, price and trade policy, and other policies which rely on market mechanisms, are not very effective in bringing food to the poor. They will provide food to those who have money to buy it but not to those who lack adequate purchasing power.

PRODUCER AND CONSUMER SUBSIDIES FOR FOOD SECURITY

Adverse impacts on poor consumers of high food prices needed for agricultural growth can be redressed through various subsidy schemes linked to input prices. We examine two such options.

Input subsidy and low output price

Some developing countries maintain relatively low agricultural prices but subsidize inputs such as fertilizer, water or electricity to stimulate higher production. A subsidy on farm inputs when output prices are low is really a subsidy to consumers. Also an input subsidy accrues to all farmers, big or small, who use the inputs. It also stimulates input use by poorer farmers because their credit needs and risks are reduced. On the other hand, low output prices impose a tax on farmers in proportion to their marketable surplus, and larger farmers have more available for sale. While this may seem a way out of the dilemma of requiring high output prices to stimulate production and low output prices needed to protect poor consumers, problems remain.

The consumer subsidy implied by low output prices benefits all consumers, rich or poor. Thus, if the subsidy rate is high, as it has to be to help poor consumers, the total cost of the subsidy becomes large. Thus a successful programme, effective in stimulating farmers to use more of the input, leads to an increasing strain on the government budget. If it is impossible to finance the cost with increased taxes, other expenditure has to be cut. In many cases this is likely to affect public investment, which will slow down the growth of the economy. Furthermore, if lower public investment impinges on irrigation, electrification, power, transport and, possibly, agricultural research, agricultural output could suffer, and the net effect after some years could be lower production than would have been obtained without any input subsidy. Of course, the outcome depends on the magnitude of the various effects and feedbacks involved.

Input subsidy costs can grow rapidly. In India, fertilizer support, amounting to some 30 per cent of its cost, has grown from Rs 5 billion in 1980–1 to more than Rs 40 billion in 1990–1 and is now 5 per cent of the central government budget. Simulations with an empirical applied general equilibrium model of India have been made to explore alternatives to the fertilizer subsidy (Narayana, Parikh and Srinivasan, 1991). In one such scenario fertilizer subsidy was assumed to be withdrawn in 1989. At the same time, rural works programmes were substituted with the aim of distributing 20 kg per capita of wheat, annually, among the two poorest rural classes as wages. An irrigation subsidy was also assumed to be introduced to enhance the irrigated area annually by one million hectares. Prices and tax rates were kept fixed at reference run levels. The results (as described more fully in Parikh and Suryanarayana, 1989) shown in Table 4, when compared with the reference run, show higher GDP and higher welfare for the poorest rural class from 1990 onwards. Agricultural GDP, at constant as well as current prices, is also higher, though, of course, farm income, including fertilizer subsidy, is lower. Owing to the 30 per cent increase in fertilizer prices, foodgrain output falls by 3.3 per cent in 1990. In year 2000, however, as a result of the additional irrigation capacity created, foodgrain output is simulated to be 4.5 per cent higher, even though fertilizer use is some 3.5 per cent lower.

Thus, in designing a subsidy programme for food security, one should think of the opportunity cost of the funds involved to see if greater security could be provided through alternative policies.

TABLE 4 *Alternative to fertilizer subsidy*

	Year	Reference run (fert. subsidy (30%) continued)	No subsidy from 1989, rural works programme, additional irrigation
GDP 70 (10 ⁹ 1970 Rs.)	1990	746.01	747.28
	2000	1262.93	1337.20
GDP Agr. 70 (1970 Rs.)	1990	247.47	248.74
	2000	315.55	332.01
Fertilizer subsidy (current price)	1990	41.26	—
	2000	52.83	—
Fertilizer use (10 ³ N)	1990	10007	8736
	2000	12874	12407
Total Irrigated area (10 ⁶ hectares)	1990	56.19	57.19
	2000	77.85	91.71
GDP Agr. (10 ⁹ current Rs)	1990	535.04	547.51
	2000	718.57	759.55
Food grains (10 ⁶ tonnes)	1990	161.03	155.74
	2000	209.47	218.86
Rural poorest class (equiv. income)	1990	120.20	124.50
	2000	124.70	129.40

Dual pricing to direct subsidies and taxes

Whereas a subsidy through output price goes to all consumers and an input price subsidy accrues to all producers, one might want to subsidize only the poor consumers or the smaller farmers to limit subsidy costs. To reach only poor consumers selectively, the prices of those foods which are consumed mainly by them, such as millet, sorghum and other similar coarse grains, might be kept low. Yet this is not easy to accomplish. If prices of coarse grains alone were reduced farmers would shift resources out of their production. Moreover, when coarse grains are cheap, more of them may be fed to animals to produce meat for richer consumers. However, farm prices can be maintained if distribution is handled through ration shops selling coarse grains at subsidized prices. In this case, to reach the poor effectively, public food distribution has to cover urban as well as rural areas.

To be able to improve consumption of coarse grains among the poor, output needs to be increased. The difficulty in this case is that new production

technology using high-yielding varieties is mainly available for wheat and rice. As yet there has not been a major research breakthrough specific to coarse grains. Whether this is due to neglect by researchers because of their urban or 'class' bias, or because of the inherent difficulties and uncertainty of success in scientific research is not clear. Whatever the explanation of this situation, a major increase in coarse grain output appears to require marked price incentives to farmers and ultimate strain on government budgets.

One way to subsidize consumers, without nationalizing the food trade and without injuring farm incomes, is to provide a limited quantity of food at a subsidized price to all consumers through ration shops. Additional purchases of food would be permitted in the open market, where prices would be higher than they would be in the absence of partial rationing. Farm incomes would thus be protected. Such dual pricing policies are adopted in a number of developing countries and do indeed provide some relief to poor consumers. The problem remains that of coverage; there are difficulties in directing the subsidy only to the poor. Usually the benefits of such rationing are limited to residents of urban areas or larger towns. The rural poor, who constitute the bulk of the problem in many countries, are frequently ignored. Covering the entire population with such schemes involves a high subsidy cost and consequent financial burdens.

Even though partial rationing and dual pricing do not provide fully satisfactory solutions, it is worth noting that, given limited financial resources for subsidizing food, it is better to provide smaller quantities with larger concessions on the ration price than to distribute more food per person at a smaller subsidy per food unit. The subsidy is then more likely to reach the poor, who would be able to buy from the ration shop all the food to which they are entitled. An extension of this argument is indeed that it is best to give direct income subsidies to poor consumers (if they can be identified) rather than using price policy as an instrument for providing them with food security.

INFRASTRUCTURE DEVELOPMENT, RESEARCH, EXTENSION AND FOOD FOR WORK

Agricultural growth that achieves low food prices is needed to improve food security. Experience in many developing countries has shown that development of land through levelling, irrigation or drainage, and provision of facilities such as roads, markets and electricity, are critical in stimulating agricultural growth without raising food prices.

Once the potential for agricultural growth through infrastructure development is realized, further improvement requires technological progress in the form of newer higher-yield varieties. This requires research, which cannot be centralized as varieties need to be adapted to local agro-climatic conditions. Moreover, sustained efforts in extension are needed to persuade farmers that any new variety is indeed better. The natural scepticism of farmers, so poor that they cannot afford to take any risk, takes time to overcome. Other support in the form of credit and assured supply of inputs such as seeds, water, fertilizers and pesticides are also vital. A comparison of agricultural develop-

ment in different districts of India has confirmed the importance of infrastructure and extension (Parikh, Mahendra, and Shantanu, 1991).

For many African countries, land development efforts which expand cultivable area have a large potential in stimulating agricultural output. For land-scarce countries of Asia, irrigation and drainage works improve land productivity by raising yields as well as by increasing multiple cropping. For many Asian countries, rural work programmes (or food for work) may be the most attractive way to stimulate agricultural growth, since they generate additional income for the poor which is needed not only to alleviate hunger but also to absorb the output of agriculture.

The level of agricultural growth that can be sustained is linked with both the growth rate of the national economy and the incomes policy. Even a poor developing country can run into the paradox of hunger amidst abundance, if the growth and distribution of income are such that adequate effective demand for food is not generated. This was seen in India where, during the year May 1990 to May 1991, food prices increased by 16.5 per cent even though government stocks of foodgrains stood at 21 million tonnes in May 1991. Note that more than 200 million persons suffer from persistent hunger in India. Simulation with a general equilibrium model of Bangladesh has also shown that it can also run into the problem of surplus rice and yet have hungry people if agriculture grows rapidly. This further underlines the need to make agricultural development policy a part of the overall growth strategy.

Experience of highly motivated and skilled engineers and scientists who have worked in rural areas has shown the tremendous potential and economic profitability of labour-intensive land development schemes in different parts of the world. Such schemes can also be a vehicle for generating off-peak season employment for the rural poor and be an anti-poverty measure. However, to be effective such schemes must be well-engineered, economically attractive, relevant to the needs of the people and efficiently executed.

Of course, while such a strategy of labour-intensive land development, properly organized and implemented, can help in reducing hunger, one must recognize that it also requires the resources necessary to reach all the poor. The developing countries do not have these resources. Aid on a substantial scale, tied to such programmes, can effectively provide food security to all in a reasonable time if it is forthcoming.

TRANSIENT FOOD INSECURITY

Famines, as examples of extreme food insecurity, affect relatively very few people, but pose immediate danger of death. However, since relief efforts are needed for a short period, international action is easily mobilized against famines. We examine here some policy options to deal with transient food insecurity.

Domestic buffer stocks versus reliance on trade

To provide security against transient disturbances, a country may either operate domestic buffer stocks or rely on foreign trade (that is maintain a buffer stock of foreign exchange). It may be noted that reliance on foreign trade does not imply free trade. That is a separate issue.

As already emphasized, the world market cannot be relied upon to provide food at stable prices. This is not to under-estimate the importance and the substantial amount of food aid given as famine relief, but to emphasize that, as a course of normal strategy of development and for food security, developing countries must take account of the extra expenses involved in relying primarily on the world market for food in dealing with emergencies short of famines.

Though the International Monetary Fund (IMF) cereal facility is very helpful in providing access to foreign exchange to meet unexpected import costs, the IMF has eventually to be repaid. The facility does make it possible for a country to rely more on trade and to aim for slightly lower food self-sufficiency than would otherwise be the case. Yet there are some issues which should be noted. It is often not easy to be an intermittent exporter of small quantities of food. If a country is larger and its domestic production fluctuates in a way that makes it a major exporter in some years and a major importer in others, its exports will depress world prices and imports will increase them. It will, therefore, on balance, need to export a larger quantity to pay for the import of a given quantity. This extra cost will have to be balanced against the costs of domestic storage. The relative costs depend on the variability of domestic production, the variability of prices on the world market, the costs of domestic storage and the size of the country's needs compared to the world market. If the terms of IMF cereal facility were further softened, trade could be made more attractive than domestic buffer stocking. However, a country which is small, or badly located geographically, may not be able to export small quantities of intermittent surplus. In such cases operation of domestic buffer stocks becomes unavoidable.

A common buffer stock for food security: would it work?

It is often suggested that developing countries should maintain a common buffer stock of food grains to enhance food security. One could conceive of an agency holding stocks in a number of countries, which could be released to countries in need on the basis of specific criteria, for example, the shortfall below an accepted calorie availability norm.

The basic idea of such a scheme would be that individual nations could maintain a smaller domestic buffer stock than otherwise for given levels of confidence and food availability. Also their dependence on an international grain market dominated by a few large private traders could be reduced. However, by and large, there are very few grain surplus developing countries. For them grain exports constitute a major source of foreign exchange earnings. They would have a strong incentive to operate on the free market,

particularly when international prices are high. A common buffer stock scheme could, therefore, run into difficulties precisely in those years when it was most needed.

AN INSURANCE SCHEME

The IMF cereal facility provides access to foreign exchange to import cereals. However, it does not protect a country against price increases on the world market resulting from actions of other bigger, and richer, players. If insurance cover was provided against price increases then greater reliance could be placed on international markets. Countries would be encouraged to participate if the premium for cover was less than the cost of maintaining a domestic buffer stock. To ensure the availability of food when required the insurance agency might want to operate a buffer stock itself.

CONCLUSIONS

Food security is a problem of poverty and under-development. Though economic development can eventually be expected to absorb the bulk of the active population, in the medium term agricultural growth must itself play an important role in alleviating poverty and hunger. An integrated approach to agricultural growth and poverty alleviation is needed. More aid, a softer IMF cereal facility, along with an insurance scheme against higher import prices, and a better trading environment, can provide developing countries with the necessary resources, but they must themselves follow policies to provide food security for all.

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DISCUSSION OPENING – TRUMAN R. PHILLIPS*

Dr Parikh focuses his analysis on options touted to benefit the poor. They are of particular concern because lack of food security is stated to be a problem only for poor people and poor nations. Within that context the central theme is persistent food insecurity which affects hundreds of millions of individuals; he does recognize that the problems caused by famine and other transient episodes have their own obvious importance, but it is persistence which he sees as the major challenge.

The main effort is devoted to appraisal of three policy response options (price policies for agricultural output, trade policies and farm input subsidies) where effectiveness is assessed using the IIASA/FAP system of linked general equilibrium models. Analysis of three further alternatives (dual pricing, infrastructure development plus research and extension, and holding of food reserves) is conducted in more general terms.

A key finding is that price and trade policies which rely on market mechanisms are not particularly effective in bringing food to the poor. Specifically, the number of hungry persons would not be greatly reduced according to the simulations after 15 years of either higher prices for agricultural output or trade liberalization. Referring to Indian fertilizer subsidies it is shown that their cost could become a substantial burden on the national budget, and it is suggested that there are alternative programmes which are more cost-effective. Dr Parikh then suggests that rationing and dual pricing could be cheaper options than general price policies or input subsidies, but despite that it would remain difficult to reach the poor, and especially those in rural areas. Under the heading of infrastructure development, research and extension, plus food for work programmes, he highlights the option of promoting labour-intensive land development, allied to keeping food prices low. It is noted, however, that a number of poor countries would need aid on a substantial scale to undertake such programmes successfully. Less is said about overcoming transient food insecurity by maintaining domestic buffer stocks or using the IMF cereal facility.

The general conclusions of the paper appear to me to be defensible, though there are several specific results which appear worthy of note and discussion. Firstly, while it may be generally true that price and trade policies are ineffective in reducing food insecurity, the simulation results do produce some startling

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differences. Contrast the projected decline in the number of hungry in Pakistan and Nigeria (17 and 57 per cent respectively) with the increases of 31 and 50 per cent in Argentina and Brazil. Given this range of estimates it would be safer to conclude that the option of high agricultural prices as a means of influencing food security needs to be carefully examined for each country.

Secondly, the impact of the simulation of free trade by all market economies, or by OECD countries, suggests that there could be 1.4 or 3.6 per cent more hunger after a 15-year period. By contrast, when LDC liberalization is considered, the result quoted involves a 4.6 per cent reduction in the numbers affected by hunger. It is not clear from the paper if this result refers to trade liberalization by LDC countries alone, or if it is an overall effect which also includes simultaneous developed country action. If it is the latter it suggests that LDC liberalization would more than compensate for the unfavourable effect stemming from the developed world. Though all of these changes do not represent major deviations from the base projection, it is worth pointing out that LDC liberalization has some beneficial impact.

My third comment is more general; it relates to breadth in analytical approach and, in particular, to the options which Dr Parikh has considered. Specifically, one might attempt to identify key strategies which could be adopted to reduce food insecurity, and then consider the instruments or interventions to be used to realize them. Five strategies are listed in Figure 1; increase food supply, increase stability of supply, increase access to food, increase food quality and increase food intake. These goals could be reached by making investments of various types (in agriculture, human resource development (HRD), health, infrastructure or research); or through interventions in economic policy or by aid transfers. Space does not allow a full discussion of the detailed issues involved; all that can be done is to suggest that the shaded areas represent those investments or interventions which could be used to fulfil each goal. The boxes which are marked 'X' indicate the strategies and investment and intervention choices implicit in Dr Parikh's paper. Given the nature of this meeting, it is perhaps not surprising that he tended to focus on the strategy of increasing food supply, and the use of economic policy. He must be congratulated for what he has been able to accomplish, but clearly his coverage has not been comprehensive. Those of us interested in the major problem of persistent food insecurity should not, however, lose sight of all of the options which are available.

	STABILITY				
	Increase food supply	Increase stability of supply	Increase access to food	Increase food quality	Increase food intake
INVESTMENT					
Agriculture	X				
HRD					
Health					
Infrastructure					
Research	X				
INTERVENTIONS					
Economic policy	X	X	X		
Transfers (aid)					

FIGURE 1 *Food security strategies, investments and interventions*