PN-AAN-371
ISN = 35971

Third World Development: Food, Employment, and Growth Interactions

John W. Mellor

Reprinted from the
American Journal of Agricultural Economics
Vol. 64, No. 2, May 1982

INTERNATIONAL
FOOD
POLICY
RESEARCH
INSTITUTE

1776 Massachusetts Avenue N.W.
Washington, D.C. 20036

Reprinted from
AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS
Vol. 64, No. 2, May 1982

Proceedings

Dynamics of the World Food Situation
(T. Kelley White, IED ERS USDA, Presiding)

Third World Development: Food, Employment, and Growth Interactions

John W. Mellor

Over the next few decades an unprecedented number of people and proportion of the world's population will reside in countries passing through a development phase in which domestic demand for food grows at a high rate relative to domestic production of food. That phase is described by high per capita income growth rates in a context of low base incomes and rapid population growth. In this phase the innate difficulty for food production growth rates to keep pace with demand growth is enhanced by the still immature system for shifting agricultural supply schedules which is characteristic of this relatively early stage of economic growth.

A substantial proportion of the population now experiencing accelerating economic growth falls in countries which derive a major portion of income from exports of oil, but increasingly the source is greater resource productivity hrough economic development and technological change. The latter is the result of the past few decades of concentrated effort to lay the institutional and physical infrastructure of a modern economic system.

Rising real food prices caused by greatly accelerated growth in demand for food will tend to restrain growth in developing countries and increase relative and absolute poverty. The extent of real price increase for food will be substantially determined by the rate of technological change and supply elasticity in developed countries. This is because in the developing countries Says law tends to operate in the market for food, and so accelerated growth in food production tends to create a roughly commensurate, or even greater, increase in demand for food.

In this context, it becomes economic for developing countries to place a greater emphasis on agricultural production in their development strategies than was justified in earlier decades. Success in such an effort will diffuse the benefits of growth more widely than alternative strategies and will even accelerate growth if, as has often been the case, previous emphasis on agriculture was suboptimal for the earlier conditions. Thus, over the next decade the economic pressures on the food front may well have a salutary effect on the pace and pattern of development.

The Extent and Sources of Accelerated Growth in Demand for Food

More than 700 million people live in third world countries which averaged growth rates of nearly 4% or better in per capita income for the period 1970–77.[1] Eight major oil-exporting third world countries (Algeria, Indonesia, Iran, Iraq, Mexico, Nigeria, Saudi Arabia, and Venezuela) had an aggregate population in 1977 of 361 million and an average per capita income growth rate of 5.6% per year. Twelve third world countries which are not major exporters of oil (Brazil, Hong Kong, Democratic People's Republic of Korea, Republic of Korea, Malaysia, Philippines, Singapore, Syria, Taiwan, Thailand, Tunisia, and Turkey) also had an average growth rate of per capita

The papers in the "Proceedings" section were presented at a joint session of the AAEA and the American Economics Association at the annual meetings of the Allied Social Science Association, Washington, D.C., 28–30 December 1981.

John W. Mellor is Director, International Food Policy Research Institute, Washington DC.

He s grateful to Leonardo Paulino for his earlier work and frequent discussions on these matters.

[1] Data cited in this section are adapted from a forthcoming paper by Mellor and Paulino (1982).

Copyright 1982 American Agricultural Economics Association

income of 5.6% for the same period and an aggregate population of 349 million people. In such sets of countries one can expect demand for food to grow at well over 5% per year. Judging from historical records, it is unlikely that food production growth rates will match that pace.

Because of high rates of increase in export prices, the major oil-exporting countries have experienced a large growth rate in national income relative to their stage of development. In the short run this has caused sharp increases in savings rates and growth in foreign exchange balances. This suggests that rapid growth rates in consumption will be maintained even if real oil prices were to increase little over the next several years. In general for these countries, the institutional structure for accelerated growth in agriculture is underdeveloped relative to the growth rates in demand for agricultural commodities. Thus, in the period 1970–77 food imports to these countries grew at a rate of 19% per year in real terms.

Increased productivity of domestic resources is the primary source of growth in the second set of high growth countries, although some have benefitted from substantial labor exports, e.g., Syria and Turkey. Without large improvement in barter terms of trade, rapid growth in overall income is difficult to achieve in countries with a large agricultural sector without participation of that sector in productivity growth. Thus, countries growing on the basis of increased efficiency have a closer balance between growth in demand for and supply of food. Nevertheless, with a growth rate in demand for food of well over 5% per year, net food imports are bound to grow, if not for every country in the group, then at least for the collectivity of these countries.

It is notable that the sixteen developing countries with the fastest growth rates in the basic food staples production collectively increased imports of basic food staples (Bachman and Paulino). The reference period for the study is 1961–76. Net imports (in tons) of basic food staples more than doubled for this set of food production successes, while the self-sufficiency ratio declined two percentage points. The average growth rate for basic food staples for this set of countries was 3.9%. The lowest was 3.25%. These data also demonstrate that it is remarkable for countries in a high growth rate phase of economic development to achieve growth rates in basic food staple production commensurate with rates of growth in demand for food.

What are the prospects that the 700 million people in the set of fast-income-growth countries will enlarge over the next few decades? Oil prices may not rise as rapidly as in the 1970–77 period, but consumption expenditures may in the future rise faster relative to total income. Some of the countries experiencing fast growth in productivity may falter from economic or political imbalances. On the other hand, other countries could well enter this class in the next decades. It is well to remember that as recently as the mid- to late 1950s both Taiwan and South Korea were widely considered to be poor prospects for growth, particularly given their poor export performance!

India is a massive and relevant case in point. The shift of India, with a population of over 700 million, to high growth status would have a significant effect on global aggregates. Linear projection of 1966–77 growth rates to the year 2000 brings India to the position of a significant net exporter of basic food staples. That is consistent with India's shift from a typical four to six million tons of imports in the 1950s and 1960s to a slight export position in the late 1970s, as well as with the evidence of India having institutionalized a somewhat accelerated food grain production growth rate with good prospects of a modest further acceleration of that growth rate. However, such projections ignore the extent to which India has simply shifted from food grain imports to vegetable oil imports. And more important, it ignores the fact that India's reduction of food grain imports is as much a phenomenon of decline in demand growth rate as of a rise in production growth rate (Mellor 1976). Or, more dramatically, it is a function as much of failure of nonagricultural growth as a success in agricultural growth. Achievement of the 10% growth rates in other sectors consistent with India's institutional structure would be consistent with a close to 4% growth rate in per capita income and, hence, in an over 4% growth rate in agricultural consumption—a demand growth rate well in excess of the current agricultural production growth rate (Mellor 1976).

Phases in Agricultural Demand-Supply Growth

The passing phenomenon of rapidly growing developing country imports of food is captured in table 1 which presents hypothetical

data consistent with successive phases of income growth. The table, depicting five phases, shows accelerating growth in demand to a peak and then diminution. Net imports can be expected to grow as agricultural growth lags in its acceleration behind demand growth. The institutionalization of that growth can be expected to maintain the production growth rate despite decline in the demand growth rate, generating exportable surpluses. This pattern is consistent with the rapid growth in net imports of food by the current fast growth countries, with the finding that the fast-agricultural-growth developing countries increase their net imports of food and with exportable surpluses generated in the mature, high income countries of Europe and North America.

Row one of table 1 depicts an early stage of economic growth in which people are very poor, desperately wish to consume more food but cannot because their incomes are rising little if at all. Poverty causes high death rates and, hence, only modest rates of population growth. The result is a 3% or less growth rate in effective demand for food—a rate that the enlarging labor force, derived from population growth, may roughly provide by more effort on existing and added farmed area.

As development occurs, the population growth rate increases. But, even more important, income begins to grow more rapidly. The low base income carries a relatively high income elasticity of demand, and so rising income strongly augments the effect of population growth to increase the growth rate of demand for food by some 30% over the earlier phase and to exceed all but the most rapid known rates of food production growth. To maintain food production growth rates as high as 4% in general requires large unexploited land areas and institutionalization of continuous substantial improvement in technology.

Continuing progress of development further accelerates income growth. Even though the population growth rate may decline and income elasticity of demand drops significantly, the effect of high income growth is so overwhelming that the rate of growth of demand may well rise by another third. That rate surpasses all but the most extraordinary of past experiences with food production rates. It is this stage that so many countries encompassing large aggregate populations are now entering.

Eventually, of course, population growth rates decline to low levels, and income elasticity of demand for food becomes highly inelastic, and hence growth in income begins to have little effect on food consumption. Meeting demand growth not only becomes much more manageable, but food production growth rates may by then have become institutionalized at close to the high levels needed to meet past demand growth rates. It is in this phase that surpluses accrue. The argument is that in the next few decades a high proportion of the world's population will be in the high demand growth phase, and only a small proportion in the high income, low demand growth phase.

Population Growth

The effect of population growth on demand for food requires clarification because of its interaction with both supply and with other demand factors. Although income growth will be the dynamic force in causing rising food demand in the next decade, population growth will play an indirect role in forcing transfer payments and in interaction with income growth. Population growth will also enlarge the number of people in absolute poverty and deficient in food.

It is not an accident that food production

Table 1. Comparison of Growth of Demand for Agricultural Commodities, Hypothetical Cases

Levels of Development	Percentage of Population in Agriculture	Rate of Population Growth	Rate of Per Capita Income Growth	Income Elasticity of Demand	Rate of Growth in Demand
Very low income	70	2.5	.5	1.0	3.0
Low income	60	3.0	1.0	0.9	3.9
Medium income	40	2.5	4.0	0.7	5.3
High income	30	2.0	4.0	0.5	4.0
Very high income	10	1.0	3.0	0.1	1.3

Source: adapted from Mellor 1966, p. 78.

growth in low income, agriculture-dominated countries keeps rough pace with population growth. Population growth enlarges the rural labor force and hence the capacity to produce food. If mounting pressure on land resources reduces labor productivity, per capita income declines and per capita food consumption decreases comparably. Income-depressing effects may be reduced by longer working hours or by reduced production and consumption of nonfood goods and services.

Decline in rural incomes from population growth may push more rural youth into urban areas, increasing urban unemployment and depressing urban wage rates. The resulting national political pressures may then cause governments to provide transfer payments to lower income urban people through food subsidy and distribution programs. Foreign assistance programs, motivated by concerns for equity or political stability, may relieve the foreign exchange burden of consequent food imports. Such foreign assistance, interacting with rapid population growth, may be an important source of growth in demand for food in the next decade in low income countries not yet experiencing rapid growth in productivity and income. Thus, countries which would not otherwise be expected to become major food importers may become so, adding further to the net food imports of third world countries.

When an economy undergoes sectoral transformation, with capital formation and technological change occurring rapidly in the nonagricultural sector, rapid population growth fuels that process. The supply of labor for growth of the nonagricultural sectors is in effect highly elastic. Under those circumstances of rapid growth in capital stock and labor force, the supply of wage goods—primarily food—will be the operable constraint to growth (Lele and Mellor 1981). Unless rapid technological change in agriculture occurs, the growth momentum can be sustained only by rapid growth in exports or foreign borrowings to pay for rapidly growing food imports. If rapid technological advances occur in agriculture, the extent of upward pressure on food prices is then the product of complex relations between the rate and nature of technological change in agriculture and the rate of growth in nonagricultural employment and income (Lele and Mellor 1981). Rapid application of modern high-yield agricultural technology will tend to restrain the rise in agricultural prices. Large capital transfers, including higher oil revenues, will have the opposite effect. Throughout these processes of rapid economic growth, the higher the population growth rate the greater the growth rate in demand for food.

There should be no misunderstanding about the deleterious economic effects of rapid population growth simply because the effective demand for food keeps roughly in pace with supply in early stages of growth or because in later stages it eventually encourages faster overall economic growth. Rapid population growth tends to decrease labor productivity in agriculture, reduce the pace of transformation of the economy from agricultural to nonagricultural, and hence, discourage growth in per capita income, in food intake, and in nutritional status. Its burden falls on the poor, whose income is derived solely from labor.

Income Growth

Accelerated growth in income is the basic source of divergence in growth in demand and supply of food. The extent to which income growth accelerates food demand growth beyond food supply growth depends, on the demand side, upon the level of income, the employment content of growth, and the rate of income growth itself. The first two factors affect the aggregate income elasticity of demand. Demand will be driven rapidly when income is initially low, when growth has a high employment content, and when the income growth rate is rapid. Large net capital inflows and enhanced terms of international trade favor the latter. Because of strong multiplier effects of agricultural growth, heavy investment in agriculture may not shift supply of food more rapidly than demand.

It should be noted that inelasticities of agricultural supply with respect to increased demand traces to the fixity of land resources and hence are phenomena of the basic food staples such as cereals, which use the bulk of land. As demand for agricultural commodities rises in response to income, the relative composition of demand changes. It is fruits, vegetables, and livestock products for which demand is more elastic and it is the livestock commodities which are most important in aggregate. They represent a potentially large, derived demand for basic food staples or the production resources for basic food staples, particularly at the margin. And, it is the rising importance of livestock products that plays a major

role in restraining the decline in the overall income elasticities for basic food staples. Income elasticity of demand for livestock products remains relatively stable at well over one, up to income levels still achieved by only a handful of countries.

A peculiarity of the derived demand for feed for livestock should be noted. At low incomes, livestock comprise a small budget share, and hence the derived demand for basic food staples is small. As incomes rise, the income elasticity of demand for basic food staples for direct human consumption declines; the income elasticity of demand for basic food staples derived from livestock consumption is much higher than that for direct consumption and declines less rapidly. The base level of the derived demand is very small relative to the direct demand, but, with sharply different elasticities the weights change rapidly, and the weighted average elasticity changes—at first declining, then rising, and eventually declining again. It is the period of rising weighted income elasticity of demand when demand growth for basic food staples increases explosively, tending to throw countries onto the international market for substantial aggregate imports of food.

Some Empirical Evidence

Table 2 provides data consistent with the foregoing analysis. The slow growth countries with less than 1.0% per capita income reflect rapid increase in imports because of large foreign assistance. They are largely concentrated in Africa, which receives per capita levels of foreign assistance which are large by historical standards of Asia. The somewhat faster growth countries (3.0% to 4.9%) evidence rapid growth in net imports as expected. The very fast growth countries (over 5%) show explosive growth in net imports for all the reasons indicated plus the loading of those countries in the oil-exporting categories for which incomes grow rapidly relative to institutional development and, hence, capacity to accelerate growth in agriculture.

Table 3 shows growth rates for basic food staples for each per capita income class. As expected, the basic food staple production growth rate is successively greater for each successively higher income growth rate, except for the fastest, which is, as stated, heavily influenced by the oil exporters. The relative importance of yield increase relative to area expansion also increases with per capita in-

Table 2. Exports, Imports and Net Trade of Major Food Crops in the Developing Countries, 1961/65 and 1973/77 Averages

Country group	Exports			Imports			Net Trade[a]			Annual Growth Rate 1961/65–1973/77[b]	
	1961/65	1973/77	Change[c]	1961/65	1973/77	Change[c]	1961/65	1973/77	2000[d]	Exports	Imports
	(million tons)		(%)	(million tons)		(%)	(million tons)			(%)	
Total	21.9	28.3	+29	27.2	51.3	+88	−5.3	−23.0	−125	2.1	5.4
By GNP capita growth rate											
Less than 1.0%	2.2	1.2	−47	3.8	9.2	+143	−1.6	−8.0	−46	−5.1	7.7
1.0%–2.9%	13.2	16.4	+24	10.4	15.3	+47	+2.9	+11.1	+18	1.8	3.3
3.0%–4.9%	4.1	7.2	+76	5.8	11.2	+93	−1.7	−4.0	−34	4.8	5.6
5.0% and over	2.5	3.5	+41	7.2	15.6	+116	−4.7	−12.1	−63	2.9	6.6
By region											
Asia	7.6	10.2	+34	13.9	21.2	+52	−6.3	10.9	−2	2.5	3.5
North Africa Middle East	1.4	1.1	−21	5.0	11.6	+133	−3.6	−10.6	−63	−2.0	7.3
Sub-Saharan Africa	2.9	1.7	−43	2.0	4.5	+127	0.9	−2.9	−29	−4.6	7.1
Latin America	10.0	15.3	+53	6.3	13.9	+122	+3.7	+1.4	2	3.6	6.9

Source: Developed by Leonardo Paulino from FAO.

Notes: Trade data include bran and cakes for feed use; to minimize double counting, partial adjustments were made for wheat flour based on available figures for this commodity as reported in the 1978 FAO *Trade Yearbook*; the People's Republic of China is not included in this table because of difficulties of developing significant trend coefficients in the face of large politically related fluctuations.

[a] Exports minus imports.

[b] During the period 1966–77.

[c] Calculated between the mid-years of the indicated periods.

[d] Projections derived from production and income data for 1961–77 and UN population projections.

Table 3. Average Annual Growth Rates of Production, Area Harvested, and Output per Hectare of Major Food Crops in the Developing Countries, 1961–77

Country Group	Average Annual Growth Rate, 1961–77			Relative Contribution to Production Growth	
	Production	Area Harvested	Output per Hectare	Area Harvested	Output per Hectare
	(%)			(%)	
Total	2.65	1.00	1.64	38	62
By GNP Capita Growth Rate[a]					
Less than 1.0%	1.30	0.64	0.66	49	51
1.0%–2.9%	2.91	0.79	2.10	28	72
3.0%–4.9%	3.03	0.95	2.05	32	68
5.0% and over	2.75	1.89	0.85	69	31
By region					
Asia	2.78	0.66	2.10	24	76
North Africa and Middle East	2.53	1.12	1.40	44	56
Sub-Sahara Africa	1.59	1.28	0.31	80	20
Latin America	3.22	1.78	1.41	56	44

Source: Developed by Paulino from FAO.
Note: Excluding China.
[a] During the 1966–77 period

come increase, again, with the expected exception of the highest income growth rate group and its oil exporter influence.

Global Effects of Accelerated Income Growth

The problem for world agriculture in the 1950s and 1960s was large populations in the very high income phase generating surpluses and a huge population in the very low income phase with slow growth in effective demand, despite the poor nutritional status of people in those countries. The high income countries attempted to restrain agricultural production and to develop systems to subsidize exports to low income countries with highly elastic demand. The low income countries showed a major interest in expanding industrial production.

The food problem for the world in the 1980s and 1990s is one of vast populations moving into the high growth, medium income stage, sorely taxing the export capabilities of the more mature economies. During this period of rapid growth in demand for food, problems of instability in food production will be particularly onerous.

Thus, the closing of the twentieth century will see a period of great pressure for developing countries to increase food production so as to minimize their need for imports of food, and for the developed countries to increase production to meet the inevitable increase in import needs of the developing countries.

Prices

The extent to which real food prices increase over the next few decades will be substantially determined by the relative size of the third world population which moves into the fast economic growth phase and the effective supply elasticities for food of the mature economies.

For the developing countries, their growth rates in agriculture will be more important in affecting their overall growth rates than in affecting the food supply-demand balances. That is because of the multiplier effects of agricultural growth in other sectors and the reinforcing effect of exogenous capital inflows that add further to demand stimulating growth (Mellor 1976; Mellor and Lele 1978, Lele and Mellor 1981).

The major exception to this generalization is the lowest income countries, for which failure in agriculture may be covered by politically or humanely motivated foreign assistance to maintain consumption growth rates ahead of population growth. Thus, growth in food imports is likely to be significantly restrained by production success only in the case of noncommercial imports.

For the developed countries, the critical issues are the extent to which rapidly expanding export markets will sustain or accelerate de-

velopment and application of new production technology and the elasticity of area under cultivation with respect to real food price. High rates of technological advance and high supply elasticity of area will result in only small price increases in the face of large growth in third world imports.

Growth

If the real price of food rises substantially, it will slow third world growth through two important effects. It may reduce savings rates if governments feel pressure to maintain food consumption growth in the face of higher real prices of imported food. It will push up the real price of labor in terms of industrial goods and foster substituting capital for labor. The consequent capital deepening will raise incremental capital output ratios and slow growth (Lele and Mellor 1981).

This latter argument can be turned around to emphasize the role of accelerated growth in agriculture in facilitating mobilization of labor in a situation of rising real price of imported food. Thus, a rational response to the regime of the 1980s and 1990s is increased emphasis on agriculture's role in growth as compared to the 1950s and 1960s.

Poverty

It is the poor who will bear the burden of rising real prices of food (Mellor 1978). They will do so either in the form of reduced purchasing power from higher real prices of food or from lower employment due to food price induced increase in wage rates expressed in terms of labor product and consequent capital deepening.

Under these circumstances, concern for poverty alleviation focuses on means of expanding the supply of food. That may occur by facilitating the processes of technological change in the agriculture of developing countries, which facilitates growth in employment and food consumption even though it may not lead to greater food self-sufficiency. Growth in agricultural output in the mature economies can also facilitate increased welfare of the poor by relieving the upward pressure on real food prices and providing a basis for subsidized food for low income groups. The latter facilitates direct increase in welfare as well as increased employment through the effective wage subsidy.

Conclusion

The next few decades will be extraordinarily dynamic in food production, consumption, and trade. Increased food production in both developing and mature economies will become more central to both growth and equity strategies.

In this dynamic context new relationships will occur among various food-related factors, presenting new challenges and additional responsibilities on the research community. It is already clear that research is needed to trace the course of derived demand for basic food staples from the complex changes in consumption patterns that accompany rapid income growth. The relationship between employment growth and food supply needs to be explored in all its ramifications, including the marginal propensities to spend wage income on food, the elasticities of substitution between food and other goods and services, the respective supply elasticities of those commodities, and the elasticities of substitution of capital and labor in various production processes. These are all of direct and interacting relevance to the demand for food and the extent to which food supply may restrain economic growth. The nature of the labor market more generally needs exploration, particularly as it affects the balance between food production and income generation in other sectors—a relationship particularly important and poorly understood in African countries (Lele 1975). Finally, the optimal allocation of capital between the food and nonfood sectors is important, an exploration that needs to commence with the work of Sen and be pursued in the context of the now well-known potentials for technological change in agriculture. From these analyses can spring the understanding of food processes and relationships of the next few decades which are essential to policies for more efficient pursuit of people's objectives in this extraordinarily dynamic period.

References

Bachman, Kenneth L., and Leonardo A. Paulino. *Rapid Food Production Growth in Selected Developing Countries*. Washington DC: International Food Policy Research Institute Res. Rep. No. 11, Oct. 1979.

FAO. "Production Yearbook Expos. 1975 and 1979." Rome, 1976 and 1979.

Lele, Uma. *The Design of Rural Development: Lessons*

from Africa. Baltimore MD: Johns Hopkins University Press, Nov. 1975.

Lele, Uma, and John W. Mellor. "Technological Change, Distributive Bias and Labor Transfer in a Two-Sector Economy." *Oxford Econ. Pap.* 33(1981).

Mellor, John W. "Food Price Policy and Income Distribution in Low-Income Countries." *Econ. Develop. and Cultur. Change* 27(1978):1–26.

———. *The Economics of Agricultural Development*. Ithaca NY: Cornell University Press, 1966.

———. *The New Economics of Growth. A Strategy for India and the Developing World*. Ithaca NY: Cornell University Press, 1976.

Mellor, John W., and Uma Lele. "Growth Linkages of the New Foodgrain Technologies." *Indian J. Agr. Econ.* 28(1978):35–55.

Mellor, John W., and Paulino, Leonardo A. "Food Production Needs in a Consumption Perspective." *Global Aspects of Food Production*, ed. M.S. Swaminathan, forthcoming.

Sen, A. K. *Choice of Techniques*. New York: Augustus Kelley, 1968.