

THE "NEW" FOOD-FEED COMPETITION

by

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Hunger and undernutrition is a world problem that is both wide-spread and stubborn to solve. According to FAO estimates for the mid-1970's, the seriously undernourished exceeded 15 percent of total population in 55 countries of the world and amounted to 435 million (FAO 1981). This number will have grown to 510 million by 1990 and to 590 million by the year 2000 if present trends persist.

The classical ingredients of food crises have certainly contributed to the current state of hunger and undernutrition around the world. Rapid population growth did take place following World War II. More recently, the average annual rate of population growth for the 1960's and 1970's, respectively, was 2.4 and 2.2 for the developing countries and 1.0 and 0.8 percent for the developed ones. Shortfalls in food supplies occurred. In the early 1970's a 3 percent shortfall in grain production led to the 1972-74 food crisis - and to a 250 percent price increase for grains! More recently, three major droughts for East Africa have created regional supply shortfalls and food crises. Finally, an "entitlement failure" (or poverty) has precipitated hunger in certain areas, as the work of Sen (1981) has demonstrated. An increase in relative poverty in many developing countries, even in absolute poverty in some, could be the prelude to increasing numbers of undernourished.

On the other hand, it has not been sufficiently emphasized that the classical ingredients of food crises - rapid population growth, shortfalls in supply and poverty - occurred and malnutrition increased during a period of historically unprecedented agricultural growth and incomes growth for developing countries. The average annual rate of growth in agricultural production for developing countries was 3 percent for the period 1966-81. This is higher than the rate of growth in population. Yet diets in many developing countries barely improved. The income gains in the last two decades also outdistanced the population increases. While population grew by about a half (46 percent) per capita incomes roughly doubled between 1960 and 1980 (World Bank 1981).

The irony of the situation is that in some basic sense the world as a whole, most nations in general and sizeable proportions of the population in particular, are richer today than they have ever been before in the entire span of human history. Yet the world food problem may be as grave today as it ever was, at least in terms of the absolute number of persons affected. This, obviously, would have never been the case if population alone and/or poverty were the principal causes of hunger. No satisfactory explanation of this conundrum has ever been offered, aside from the generic statement that hunger is a question of "distribution".

This article concentrates on certain characteristics of the world food situation which make malnutrition an especially stubborn problem to solve. At the heart of the problem lies a change in the structure of demand for agricultural commodities, specifically grains, which has intensified the traditional "food-feed competition" (Yotopoulos 1985). The novel conclusion of this paper is that undernutrition and hunger can also be the result of "entitlement successes", or affluence - not only of poverty.

1. Cereals for food or for feed?

Food crises are usually manifested by shortages in cereals (wheat, rice and coarse grains). Shortages can occur because of shortfalls in supply and/or because of increases in demand, whether those are due to population growth or to "other causes". Some characteristics of cereals make the "other causes" of increases in demand, particularly incomes growth, a crucial component of food crises. These characteristics are:

- (i) Cereals constitute the staple commodity for two economically distinct groups of population, for the "poor" and the "non-poor" (hereinafter "middle-income classes"). In most countries, cereals are the major source of calorie intake of low-income households. In these countries, at a relatively low level of subsistence, cereals consumption is a good proxy for nutritional adequacy. At higher levels of income, among the middle-income class, cereals also feature prominently in the human diet. The only difference is that cereals (mostly coarse, but also some wheat) are consumed indirectly, having first been converted to animal protein.

- (ii) Cereals are shifted from the direct consumption (of the poor) to the indirect consumption (of the middle-income classes) by feeding them to a rather inefficient protein converter, the animal stomach. A "shrinkage" of cereals occurs in the process. The relevant calorie-equivalent grain-meat conversion ratios vary from 2:1 for poultry to 7:1 for feedlot-fed beef.
- (iii) As a result of (ii) it is possible to have a shortfall in supply of cereals for the (direct) consumption of the poor without the actual quantities of cereals produced having decreased. This could happen if the population in the middle-income classes has increased; and/or if the conversion ratio has increased because, say, people shift from poultry to beef. In this case, the shortfall in supply is the result of the indirect demand of the middle-income classes "crowding out" the direct demand of the poor.
- (iv) Should (iii) occur, it is not clear that pure market interventions can prevent the "crowding out" of the poor. Since cereals for direct and those for indirect use are most often one and the same commodity, the two uses are market-linked. As a result, an increase in the price of the cereals fed to animals which would decrease indirect consumption would at the same time increase the prices of cereals used for the direct consumption of the poor. This could lead to hunger - not via "crowding out" but through the classical cause of "entitlement failure", or poverty.
- (v) Finally, to what extent the competition between middle-income classes and the poor for indirect versus direct consumption of cereals will lead to "crowding out" and thus to hunger, will depend on several factors: the size of the middle-income class and its rate of growth; the grain-meat conversion ratio and the way it changes in the process of development (usually increased); - the income-class-specific elasticities of demand with respect to income and prices.

The empirical sections that follow propose to illustrate how these factors have changed in a world-scale in the recent years.

2. The extent of the problem

Most references to total demand for cereals become meaningless unless they distinguish its two components, the demand of the poor and that of the middle-income classes. The reason is that the direct demand of the former is bounded while the indirect component of the demand of the latter is not. There is only so much cereal that can be consumed directly to provide an adequate nutritional intake - something less than 200 kg per capita per year. The variance is much higher when indirect cereal consumption is also considered, with the average per capita rising to 500 kg per year in W. Europe and 800 kg per year in the U.S. The situation is illustrated in Figure 1. The curve representing the demand for food asymptotically tapers off while the one representing feed has a sigmoid shape. The former represents a "necessity" consumed directly by the poor and to a certain extent by the middle-income classes. Feed, on the other hand, represents a "luxury" consumed indirectly, mostly by the middle-income classes. By ignoring the distinction between the poor and the rich and aggregating the food and feed demand curves, one gets the total demand curve that represents a polynomial of higher order. Such curves, unless broken down to their basic components, are difficult to use for predictions since their turning points cannot be determined with accuracy.

Table 1 breaks down demand into the two components, the direct consumption (food) and the indirect consumption (feed) and presents the aggregates for 1980 and the annual rates of growth, 1966-80, for groups of countries. A number of interesting observations emanate from the data.

First, at the aggregate level the importance of cereal use for feed is striking. Of the total world utilization of cereals 39 percent is accounted for by feed, 47 percent by food and 14 percent by other uses, such as industrial, seed, etc. The developed countries, both market and socialist economies, are responsible for the preponderant use of feed, 83 percent of the total. In fact, the 467 million tons of feed consumed by the 26 percent of the world's population that lives in the developed countries is almost equal to the total cereals consumed directly (food) by the remaining 74 percent of the world's consumers. Next in importance in consumption of feed are the middle-income developing countries, with a total of 54 million metric tons, followed by China with 38 million tons, and last the forty low-income developing countries with a mere 5 million tons in feed consumption. The table

reveals that by 1980 animals were playing a very considerable role in the global picture of cereal consumption.

Second, and in the context of a general improvement in per capita incomes, the rates of increase in feed-use are always greater than the rates of increase in direct consumption in all groups of countries. Moreover, the divergence between the two rates of growth tells the story of an eventual saturation of demand for food and an improvement in diets reflected in the increase in feed-use. The low rates of growth of direct consumption of cereals in the developed countries (below one percent per year) and the correspondingly high rates of growth of feed-use (2.7 percent per year for all developed countries, and 5.5 percent for centrally planned ones) are evidence of that trend. Even the developing countries show substantial rates of increase in feed-use, especially since they started from low levels of consumption of animal protein. (For example, the rate of increase in feed-use is greater in middle-income developing countries than it is in the centrally planned economies.) On the other hand, the rate of increase in food consumption in developing countries is moderate, little higher than the rate of increase in population.

3. The role of the middle-income class in demand for food and for feed

The conclusion from Table 1 is that by 1980 animals were playing a very considerable role in the global picture of cereal consumption. This was the result of the combination of two factors. First, the calorie-equivalent grain-meat conversion ratio is highly variable, usually greater than one - and commonly between 2:1 to 7:1 in commercial feeding systems. As a consequence, the weight that feed-use assumes in total cereal demand increases rapidly. Second, and in conjunction with the first, the numbers of people consuming animal protein have grown dramatically. For the first time in history large numbers of consumers, in almost all countries, have graduated to income levels that permit the consumption of "chicken-twice-a-week". In fact, "chicken-twice-a-week" may be an appropriately operational definition of the middle-income class. This is the class which grew most rapidly since World War II, having become the main beneficiary of economic development.

In more technical terms, the preceding discussion requires that the existence of different socio-economic groups is specifically₃ considered in analysing the demand for cereals. It can be shown that changes in demand for cereals are related to changes in population and to changes in income through the respective elasticities of demand

appropriately weighted, with weights of relevant shares of each socio-economic class into per caput consumption.

Time series data that are necessary to implement this formulation are not commonly available. More specifically, it is difficult to find information on both changes in income and changes in the density of each class size over time. Still, by simplifying we could use information about the incomes of different population groups along with the corresponding demands. The appropriate weights in this formulation would be the population share of each group into total population. The data available for this calculation are from the Tunisian national income and expenditure survey of 1975 (Kamoun 1975). Table 2 presents the income and population information along with the consumption of food and feed for each of the three socio-economic classes.

The average direct consumption of cereals (food) appears constant around 150 kg per caput per year for the three socio-economic classes. Direct consumption of the middle class and of the rich levels off at the satiation point as shown in Figure 1. One might have expected lower per caput consumption of food for the poor group. The observation, however, is consistent with the fact that Tunisia, a middle-income developing country (per caput GNP of \$1 120 in 1979) with a relatively equitable income distribution, has a very low incidence of under-nutrition. Even at the lowest income groups, therefore, basic nutritional needs are probably met through direct consumption.

The data on the indirect consumption of cereals (feed) are consistent with the sigmoid shape suggested in Figure 1. There is clearly an inflection point somewhere in the middle-class income. A 56 percent increase in average per caput income from the income levels of the poor results in a 135 percent increase in feed-use, from 24.8 to 58.4 kg per caput per year. In the next income class of the rich the increase is only 81 percent, up to 105.8 kg per caput per year. The variance in indirect consumption of cereals across the three socioeconomic classes of Tunisia is striking. Cereal consumption for animal feed goes from 25 to 106 kg per caput per year from the poor to the rich class, respectively. This variance becomes important as incomes rise within an economic class and as people graduate between socio-economic classes. The feed-use of cereals should grow dramatically. Moreover, most of the impact should be coming from the middle class for two reasons. First, the middle-income class is the main beneficiary of development: the "graduation" income represents a

50 percent increase over the average incomes of the poor. Second, the elasticity of feed-use with respect to middle-class income is high - the value implicit in Table 2 is 2.4!

4. The role of prices in linked markets

Cereals are one more example of a commodity that is a "necessity" for one economic class - food consumption for the poor - and a "luxury" for another - indirect feed demand for the middle-income classes. Other such commodities exist, as indicated by the historical admonition "Let them eat cake!" Nevertheless, cereals have two characteristics that set them apart from other such commodities. First, in the experience of recent economic development, feed-use has become a very popular luxury, a result of the huge increase in the numbers of the middle-income classes. Second, both the luxury and the necessity commodity are the same physical product: the same coarse grains, and to a certain extent soft grains too, go to feed either animals or the poor. In other words the markets of cereals for food and for feed are linked and this poses special problems with respect to pricing.

The increased competition for cereals between the middle-income classes and the poor has rendered more crucial the role that prices play in a linked-market setting. Pricing of food has always posed a traditional dilemma in political economy. Food is the largest item of expenditure of the urban and rural poor, and therefore the price of food affects income distribution where it counts most, at the bottom of the scale. As a result, low food prices often become a political desideratum. Food prices, on the other hand, not only determine the incomes of the farmers, but more importantly high prices provide them with incentives to invest more, to use more modern inputs and thus to produce more food. In this classical dilemma the modern variant of the food-feed competition has provided an additional wrinkle.

The competition for cereals between the poor and the middle-income classes has two aspects. In the short-run, and in case of shortfalls in supply, livestock can be slaughtered thus "stretching" the grains available by directing them to use as food by the poor. Animal feed then serves as a cushion for the poor that softens the blow of market shocks and price increases. In the long-run the outcome of the competition for direct versus indirect consumption of cereals will be decided by the respective price and income elasticities of the two socio-economic classes. The more inelastic with respect to income is the demand of the middle-income classes for indirect consumption, the

greater the price increase that will be required to limit their use of cereals for animal feed. In a world where the food and feed grain markets are linked, a price increase in the latter would effectively ration the quantity of meat consumed by the middle class. In the meantime it would have two other effects. The price increase of feed grains would be reflected in the food grain market by diverting cereals to animal feed and by driving prices of cereals up. The price increase causes a decline in the real incomes of the poor and an attendant decrease in the quantities of food grains demanded. In the extreme case, and as a result of the combination of the respective price and income elasticities of demand, the animals for the consumption of the middle classes may crowd out the direct demand for the subsistence of the poor.

The undesirable effect of market linkage can be prevented if a tax on meat consumption, rather than a price increase of animal feed, is used as a rationing mechanism. The problem with taxes is that they are of limited usefulness as instruments for international redistribution. A government would have only small incentive to tax the consumption of its middle-income classes in order to release grains for the survival of the poor in a third country. At the level of within-country income distribution a tax would in principle be more effective, although in practice it may be difficult to impose because of the political power of the middle classes and the wealthy. For the same reasons indirect rationing devices such as the proclamation of meatless days, could be equally ineffective.

The market link can be broken by targeted programmes which increase food-use versus feed-use. Group-targeting directs the grains to the poor through issuing rations and coupons or by disposing of them at fair-price shops or in soup kitchens. The government often bears the entire cost of such programmes or else it can partly offset it by an increase in the price of all grains for the non-poor. Commodity-targeting, on the other hand, favours the prices of the grains mainly consumed by the poor. In Bangladesh, as an example, sorghum was sold in 1969 at ration shops at half the price of wheat and rice. The rural poor bought sorghum, while the urban poor in Dakha paid double the price and bought rice or wheat. The question that arises is whether cheap sorghum also went to feed the animals for the consumption of the middle classes. In other words, successful targeting is often complicated.

5. Conclusions: Is the food-feed competition really new?

The controversy about food versus feed is in fact quite old. "Sheep eat men" was the slogan of the English peasants dispossessed by enclosures to create fields for pastures. Besides, before the advent of the internal combustion engine, when man depended on animals for power and transportation, the competition between food and feed must surely have been more intense.

This is only partly correct. In the past, when animals were important in the economy, the competition between food and feed was only indirect and it was localized. Indirect, in the sense that it was competition for the land to grow food or to grow feed. Today, it is competition for the land, but it is also direct for the final disposition of a quantity of grain produced between feed and food. In fact, the quantity of soft grains fed to animals increased during the period 1966-1980 from 10 percent to 13 percent of total world output. Similarly in the past the competition was localized because transportation was expensive and the consumption of bulky commodities, such as meat or animal feed, was more efficient at the source of supply. This is no more the case after the transportation revolution. For the first time, whether wheat produced in Australia will go to feed people in Bangladesh, pigs in the USSR, or sheep to be exported to the EEC becomes a question for the world market to determine.

In the traditional food-feed controversy it was animals that competed with people for feed versus food. Its modern variant has retained this aspect through competition for land. But it has also added another dimension: people who compete with people for the indirect versus direct consumption of cereals. In the competition between the rich and the poor, relative affluence, for the first time, has become a great claimant on world food supplies. It is true that competition for food has always been based at least partly on the demand for luxuries versus that of necessities. This competition, however, has much intensified in recent years since meat has become a very popular luxury among the members of the ballooning middle-income classes.

Sen (1981) who has studied a number of famines occurring in the last forty years concludes that "Starvation is the characteristic of some people not having enough food to eat. It is not the characteristic of there not being enough food to eat. While the latter can be a cause

of the former, it is but one of many possible causes" (Sen, 1981, p.1). This article has focused, instead, on "there not being enough food to eat" - both for the animals of the middle-income class (indirectly) and for the poor (directly) - which often results in the poor not having enough to eat. This new "food-feed competition" is the characteristic of a post-Malthusian world where hunger and food crises are as likely to be triggered by the rapid growth of middle-income classes, as by the classical cause of population growth.

The proper lesson from the food-feed competition is substitution and correct pricing, rather than abstention. The problem per se is not the consumption of meat or of animal products, which will always constitute an important component of the human diet. The issue is rather what animals eat. Animals raised on grain substitutes do not compete for the staple commodity of the poor. Substitution of grains in animal feeding systems goes a long way in resolving the food-feed competition. Likewise, the higher the price of grains fed to animals, the less meat will be consumed and the more grains will be substituted by non-grain feeds. Improper pricing occurs when grain prices are low, irrespective of the use to which grains are put. Subsidization of the daily bread of the poor may make good sense, both for reasons of welfare maximization and of political survival. But unless cheap bread is specifically targeted to the poor it will end up feeding chickens. Appropriate pricing becomes ever more difficult in linked markets.

Footnotes

1/ An IFPRI study suggests similar numbers for the undernourished. The nutritional deficit for 1990 is estimated around 45 million tons of cereal-equivalent even with high growth rates of income (IFPRI 1977). The World Bank (1981) estimates that one billion of the world's population was undernourished in 1980. This latter figure includes an estimated 150 million undernourished in China, which the FAO estimate excludes.

2/ For a sampling of evidence relating to increases in absolute and/or relative inequality in developing countries see Kuznets (1975), Adelman and Morris (1973), Ahluwalia, Carter and Chenery (1978), Griffin and Khan (1977)

3/ See Yotopoulos (1985), pp. 471-72.

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Table 1: Demand for cereals, aggregate 1980 and rates of growth 1966-1980
(Million metric tons and percent)

	Number of Countries ¹	Aggregate 1980			Rates of growth 1966-80		
		Total ² Demand	Food	Feed	Total ² Demand	Food	Feed
Less developed	90	439.6	328.1	58.1	3.3	3.1	5.3
Low LDCs	40	238.1	207.6	4.7	2.8	2.9	3.8
Middle LDCs	50	201.4	120.5	54.0	3.9	3.5	5.4
Africa	37	54.8	44.3	3.1	2.6	2.9	6.2
L. America	24	87.1	45.6	33.1	3.9	3.3	5.2
N. East	14	68.0	40.8	14.6	4.0	3.6	4.5
Asia and Far East	15	229.6	197.5	7.9	3.0	3.0	6.6
Developed	34	749.6	174.2	466.7	2.0	0.6	2.7
Market DCs	26	437.6	104.0	287.5	1.4	1.0	1.3
Centrally planned DCs	8	312.0	70.2	179.1	3.0	0.1	5.5
China	1	243.2	177.9	38.2	3.3	3.2	4.3
Total	125	1 432.4	680.2	562.9			

1. China is excluded from the groupings of both DCs and LDCs. Low LDCs are those with per capita income in 1975 less than \$370. The others are defined as middle income LDCs.

2. Total demand besides food and feed includes also residual uses such as industrial, seed, waste, etc.

Source: Food and Agriculture Organization, "Supply Utilization Accounts" (files).

Table 2: Population, average per capita income and demand for direct and indirect cereal consumption by socioeconomic class, Tunisia, 1975

	Population		Per capita income (dinars)	Annual per capita consumption (kg)	
	(thousand)	(% of total)		Direct (food)	Indirect (feed)
"Poor"	2 537	42.4	62.4	151 110	24 820
"Middle-income class"	2 961	49.5	97.3	153 300	58 400
"Rich"	488	8.1	382.6	142 350	105 850
Total	5 986	100.0	143.7	150 745	48 910

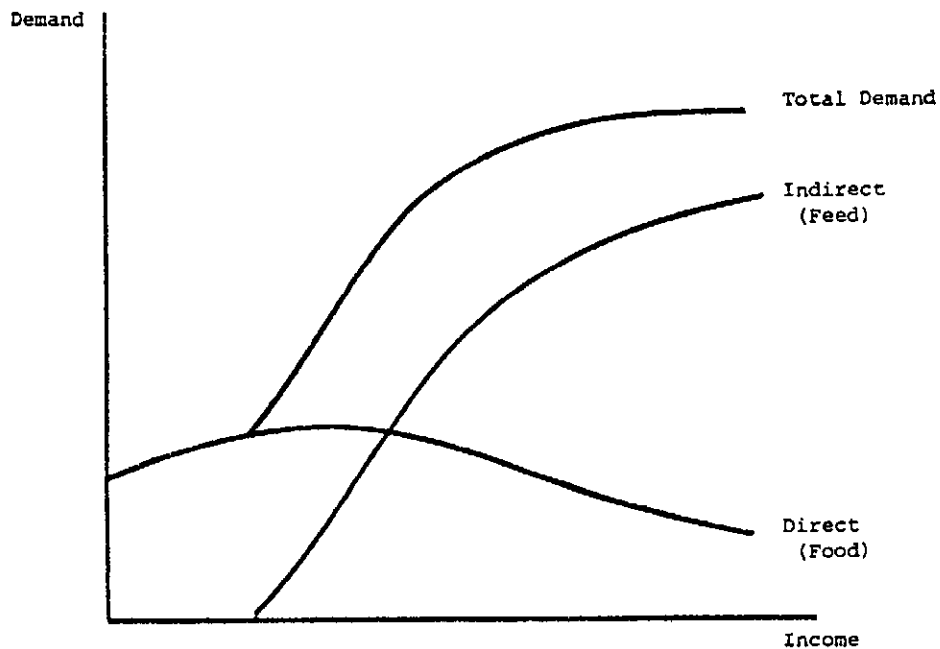


Figure 1

Demand for Cereals, Total, Direct and Indirect,
According to Income.