QUANTIFYING THE NUTRITION SITUATION IN DEVELOPING COUNTRIES

By

Thomas T. Poleman

September 1979 No. 79-33

NEW YORK STATE COLLEGE OF AGRICULTURE AND LIFE SCIENCES
A STATUTORY COLLEGE OF THE STATE UNIVERSITY
CORNELL UNIVERSITY
ITHACA, NEW YORK 14853

DEPARTMENT OF
AGRICULTURAL ECONOMICS
WARREN HALL

September 1979

This paper was prepared at the request of the International Economics Division of the U.S. Department of Agriculture. Knowing that I had long been interested in the problems of attaching numbers to economic phenomena in developing countries and was particularly skeptical of the various assessments of world hunger, friends there asked that I put down my ideas in a manner more systematic than is my custom. This was an appealing prospect and I have been at it whenever the extra minute offered itself during the past four months.

I am pleased with the results. The work underpinning the first two sections fully confirmed my suspicion that we are still not in a position to quantify the world nutrition situation and that attempts to do so continue to run the risk of contributing more to the existing confusion than to adding to our knowledge. I record with satisfaction, however, that one contributor seems to have profited from its past mistakes. FAO's Fourth World Food Survey is vastly better than its predecessors. The Presidential Commission on Hunger currently has yet another evaluation in hand and one hopes for the best.

The question then arose: had I anything to contribute but skepticism? Happily, I may have. This is to suggest that we eschew the traditional approach of comparing needs against food availabilities and search instead for behavior indicative of perceived dietary adequacy or inadequacy. This would allow us to sidestep the fact that nutritional needs are still not fully understood, and that food availabilities and their distribution among the population remain to be reliably measured in most developing countries.

Our efforts to identify these behavioral thresholds are still in their infancy. At the same time that I worked on the body of the text, three analysts--Steve Tabor, Carol Goodloe, and Linda Weingarten--began evaluating the evidence in five recent household budget surveys. These covered Sudan, Sri Lanka, Indonesia, Bangladesh, and Brazil. Their analyses are in various stages of completion and will eventually be published by the USDA. My tentative conclusions from their work are incorporated into Part IV of the present report in italics. With time this portion of the report can be expanded and finalized. For the present I conclude that the approach has legitimacy, but that if it is not applied astutely and by analysts with a good understanding of the country in question, it could lead to the same sort of misinterpretations as the traditional methodology.

No small part of my pleasure in preparing the report derived from the opportunity it gave me to work again with friends in Washington. These (in the order of their appearance in this particular drama) include: J. W. Willett, William Gasser, Pat O'Brien, Charles Hanrahan, Carmen Nohre, Dave Culver, and Dave Dyer. Their guidance through the bureaucratic labyrinths was unerring.

I also am indebted to Lana Hall for explaining to me the econometric intricacies of the Fourth World Food Survey and the World Bank study. Her evaluation of these papers is available separately.1/

Shlomo Reutlinger, Emmy Simmons, and Abraham Horwitz gave of their time and counsel; and Harry Walters and K. L. Robinson kindly commented on an early draft. As my alter ego throughout, Steve Tabor showed himself to be a young man of uncommon promise.

This paper had its genesis in the congressional requirement that the USDA annually report to it on global food production and needs, and the discomfort felt by some of the analysts with their product. On a number of points they were obliged to pronounce on that which was not known with certainty.

During the course of preparing this paper I have been repeatedly asked what directions I think this activity should take. It has long seemed a shame to me that the USDA and what is now the International Economics Division of the Economics, Statistics, and Cooperatives Service has not played a more forceful role in shaping opinion about the world food situation. The Division fields more analysts than FAO, the World Bank, AID, or IFPRI; and that it is capable of excellence is attested to by The World Food Situation and Prospects to 1985. Yet some of its other product is disappointing.

One problem, of course, is that food policy is no less a political question in the United States than elsewhere and official pronouncements tend to be flavored by the size of carryovers and whether or not our output can be disposed of commercially. That the severity of world hunger as perceived by the USDA has tended to vary in direct proportion to the size of our carryovers is perhaps unavoidable.

Yet it does not follow that a course of research could not be pursued that would lay a foundation for long-term excellence. A good starting point, I think, would be to shy away from "global" statements. I make this suggestion not just because it is likely to be many years before truly reliable assessments of this type can be made, but also because of the minimal extent to which the food and agricultural problems of the West and the LDCs impinge on each other. In the industrialized nations these problems revolve around the perennial questions of managing reserve stocks, price maintenance, and in many capitalist countries, holding down production. In the developing world the need is to expand production and economic participation quickly.

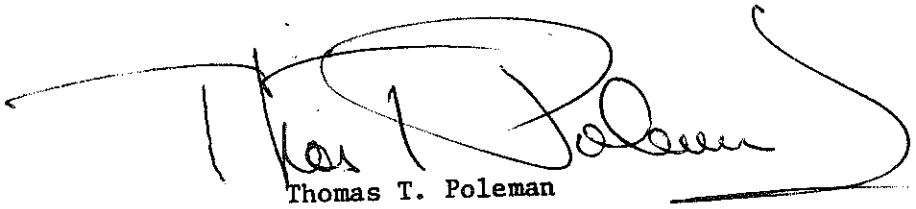
1/ L. N. Hall, "A Critical Evaluation of Recent Attempts at Assessing World Hunger" (Cornell Agricultural Economics Staff Paper No. 79-17, June 1979).

Furthermore, the developing world is anything but homogeneous. Both in resource endowment and the success with which they are grappling with growth and development, the countries of the Third World vary mightily. Still, from the point of view of food, agriculture, population, and employment, a few are crucial and can be taken as bellwethers for lesser states nearby. China, India, Bangladesh, Indonesia, Pakistan, Philippines, Egypt, Nigeria, Mexico and Brazil: if the USDA wishes to speak out on food and agriculture in the Third World, these are the countries on which its analytical resources should be concentrated.

Preparing this paper has been a very personal activity for me in that for a number of years I have been almost alone in suggesting the extent to which world hunger has been misrepresented and in devising means whereby developing food economies might more realistically be quantified. Part of my purpose, therefore, is to show how my thinking evolved. The excessive reference to my writings and the work of my students is intentional.

Lillian Morse is responsible for the excellent typing and also set up the tables and drew several of the charts.

The paper is to be published by the USDA, either as a Special Chapter appended to the forthcoming The World Food Situation and Prospects to 2025 or in some other form. The present draft is being circulated to encourage comments and suggestions. These should be sent either to me or to Dr. David W. Culver at the USDA.



Thomas T. Poleman

CONTENTS

QUANTIFYING THE NUTRITION SITUATION IN DEVELOPING COUNTRIES

By

Thomas T. Poleman

The public has every reason to be confused about the extent of world hunger. Conflicting assessments abound. Depending on the authority consulted, it is possible to be informed that:

- " . . . the world is teetering on the brink of mass starvation" (1, p. 152).
- "A lifetime of malnutrition and actual hunger is the lot of at least two-thirds of mankind" (2, p. 11).
- " . . . 1 billion people suffer from malnutrition. Some 750m of these are near the brink of starvation" (3, p. 72).
- No less than 2,500 million of the 3,782 million persons now living on earth (1972) are critically short of life's necessities, such as food, water, shelter, clothing and fuel . . . In addition, international agencies have established that at least one billion persons suffer from overt hunger or clear-cut starvation . . . Food shortages have become chronic and almost global, and in a world now adding more than 75 million people per year, starvation could easily become seriously acute before the year 2000 (4, p. 53).

Or that:

- There should not be many now who still believe the extraordinary mis-statement . . . that 'a lifetime of malnutrition and actual hunger is the lot of at least two-thirds of mankind.' Why such an obviously erroneous statement should have received such widespread credence is a problem for the social psychologist . . . (5, p. 124).
- A million people starving is better business for the press than a thousand people starving, but a billion people starving is best of all! Here the interests of the instant expert and the press dovetail: the expert . . . gets his name promoted, the press . . . sells news. This is the Catch-22 of food reporting: if you read prognostications, they are probably not worth taking seriously for the very reasons that got them into the papers. (6, p. 32).

Unhappily, so diverse a range of opinion devolves from more than unbridled lust for personal recognition. An element is the disagreement to be found in any subjective evaluation. But above all it mirrors our inability to accurately measure many of the parameters which enter the food equation.

For the developing world especially--and hunger is almost entirely a problem of developing countries--reliable data on such basic components as levels of production and consumption are wanting; and most causal linkages defy more than hesitant affirmation. Serious food evaluations, be they local, regional, or national, are therefore characterized by great caution and circumspection. The trouble begins when the policy maker or editor asks for more. The student, groping in the half-light of imperfect evidence and flashes of perception, is reluctant to add up a series of caveats. Others are not so reticent. The circumstances are ideal for ensnaring the naive and tailor-made for those with a penchant for fitting the data to the thesis.

In such a situation, a Special Chapter on world nutrition becomes not so much one in which numbers are derived and defended, but one in which the state of an imperfect art is delimited. "It is better," said the Ancient, "to be vaguely right than precisely wrong."

CITATIONS

1 Anne and Paul Ehrlich, "Starvation: 1975," Penthouse, July 1975.

2 Lord John Boyd-Orr, "The Food Problem," Scientific American, Aug. 1950, Vol. 183, No. 2.

3 "How to Feed the Third World," The Economist (London), 22 March 1975.

4 Georg Borgstrom, The Food and People Dilemma (North Scituate, Mass., 1973).

5 Colin Clark, Population Growth and Land Use (London, 1968).

6 Nick Eberstadt, "Myths of the Food Crisis," The New York Review of Books, 19 February 1976.

I - HOW COME THE CONFUSION?

Though pronouncements about the world nutrition situation are legion, few have pretended to rest on original analyses. Rather most have had recourse for their underlying data to a small number of more fundamental inquiries carried out by the Food and Agriculture Organization of the United Nations (FAO), the U.S. Department of Agriculture (USDA), and recently, the World Bank. The findings of these studies and the methodologies they employed are summarized in Table 1; their main conclusions are also shown graphically in Chart 1.

One is again struck by the magnitude of disagreement. The conclusion that two-thirds of mankind were afflicted came from FAO's Second World Food Survey. An earlier survey suggested a lower figure. The USDA's two World Food Budgets concluded that almost the entire population of the developing world lived in "diet deficit" countries. FAO's Third World Food Survey put the afflicted in such countries at about 60 percent and identified a shortage of protein as the principal problem. The World Bank saw a problem of roughly the same magnitude--involving some 1.2 billion people--but suggested the prime cause was a shortfall of calories. In its two most recent studies the FAO also identified calories as the culprit, but put the total afflicted at something over 400 million.

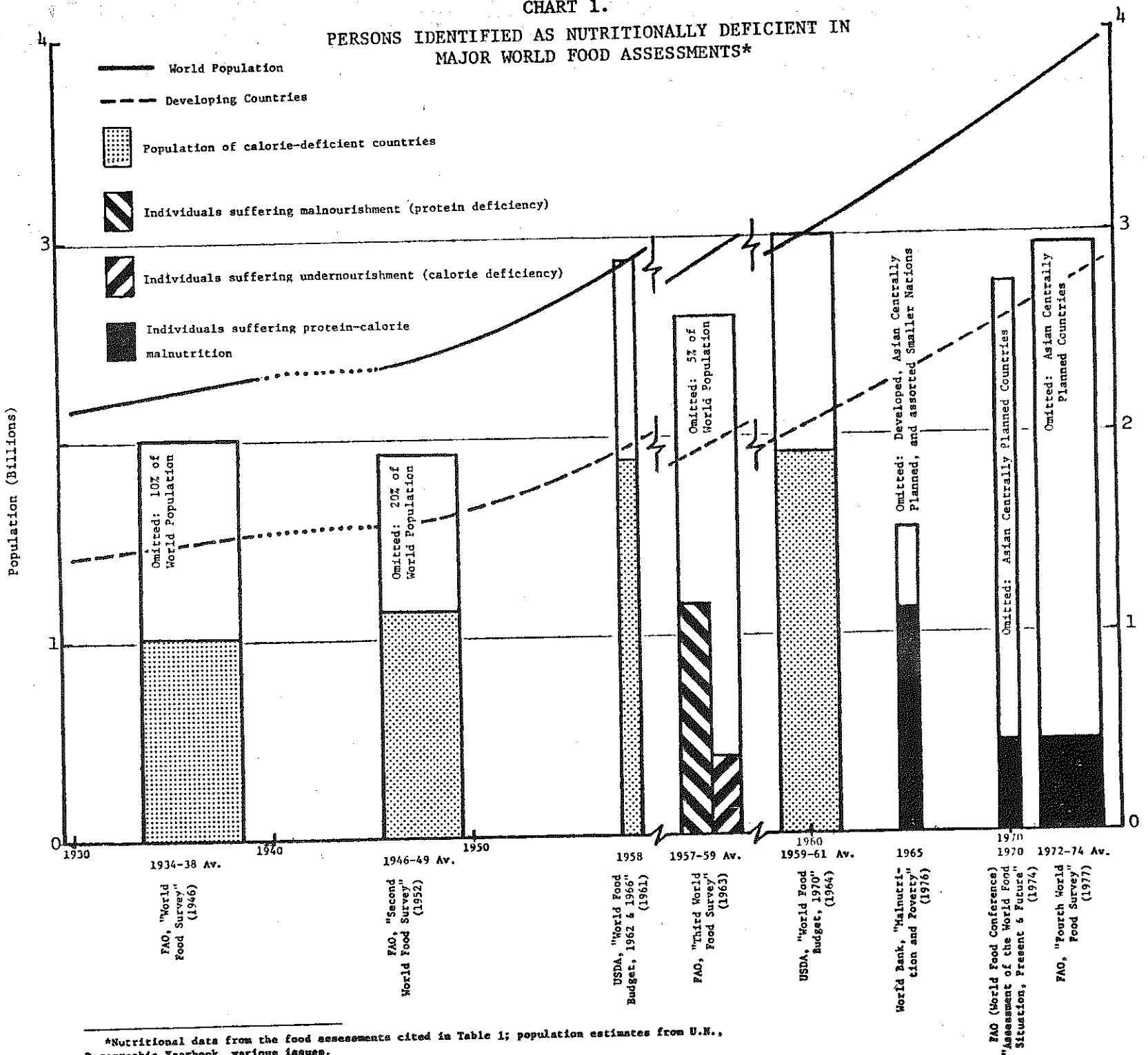
TABLE 1. CONCLUSIONS OF MAJOR EARLY POSTWAR STUDIES OF THE WORLD NUTRITION SITUATION AND SELECTED RECENT PRONOUNCEMENTS

Year Published	Conclusions	Methodology
1946	FAO - "World Food Survey"[a/] "In areas containing over half the world's population [prewar] food supplies . . . were sufficient to furnish an average of less than 2250 calories . . . an average of more than 2750 calories . . . were available in areas [with] less than a third of the world's population . . . the remaining areas . . . had food supplies between these . . . levels" (pp. 6-7).	National food balance sheet availabilities minus 15 percent wastage allowance compared with 2,600 Kcal./caput/day allowance (p. 11).
1952	FAO - "Second World Food Survey"[b/] "The average food supply per person over large areas of the world, five years after war was over, was still lower than before the war" (p. 2). "59.5 per cent of population [lives in countries] with under 2200 [Calories]" (p. 11).	National food balance sheet availabilities minus 15 percent wastage allowance compared with regional allowances (p. 22): Far East - 2230-2300 Kcal.; Africa - 2400-2430 Kcal.; Latin America - 2440-2600 Kcal.
1961	USDA - "World Food Budget, 1962 and 1966"[c/] "Diets are . . . adequate in the 30 industrialized nations . . . [where] more than 900 million people live . . . . For most of the 70 less-developed countries . . . diets are nutritionally inadequate, with shortages of proteins, fat, and calories. These countries contain over 1.9 billion people. In most of them, population is growing rapidly, malnutrition is widespread and persistent, and there is no likelihood that the food problem soon will be solved" (p. 5).	Almost identical to "Second World Food Survey."
1963	FAO - "Third World Food Survey"[d/] [As of 1957-59, national food balance sheets and extrapolation of a limited number of budget surveys imply:] "as a very conservative estimate some 20% of the people in the underdeveloped areas are undernourished and 60% are malnourished. Experience shows that the majority of the undernourished are also malnourished. It is believed therefore . . . some 60% of the people in the underdeveloped areas comprising some two thirds of the world's population suffer from undernourishment or malnourishment or both." [Since some people in developed countries don't eat well,] "up to half of the peoples of the world are hungry or malnourished" (p. 51).	National food balance sheet availabilities with distribution around mean inferred from a few surveys in India and elsewhere compared after allowance for wastage with requirements calculated according to the 1957 FAO[e/] system.
1964	USDA - "World Food Budget, 1970"[f/] "Two-thirds of the world's people live in countries with nutritionally inadequate national average diets . . . . The basic problem of the diet-deficit countries is one of productivity. The people cannot produce enough food to feed themselves or produce enough other products to afford to buy the food they require. Food production has barely been able to keep ahead of population growth, much less provide for the expanded demand resulting from some improvement in per capita income" (pp. iii-iv).	Little changed from "World Food Budget, 1962 and 1966"
	In 1971 an FAO/WHO Expert Panel reassessed energy and protein "requirements" and dropped the protein figure for adults by about one third.[g/]	
1973	FAO - "Food Balance Sheets and World Food Supplies"[h/] [As of 1964-66, most national balance sheets] "suggest a surplus of protein availability." [However, other evidence] "suggests a very uneven distribution of protein supplies . . . aggravated by seasonal imbalances . . . . Furthermore, wherever calories are in short supply, proteins are diverted from their primary function of providing for growth and maintenance of tissues to the supply of energy for other vital functions. This explains the widespread incidence of protein/calorie malnutrition in spite of the apparent excess of protein supplies" (p. 19).	
1974	UN World Food Conference - "Assessment of The World Food Situation, Present and Future"[i/] "Taking a conservative view, it would appear that out of 97 developing countries, 61 had a deficit in food energy supplies in 1970 . . . . Altogether in the developing world . . . 460 million people [are affected]; a less conservative definition might give a much higher figure" (p. 5). "The poorer segments of the population, and within these segments, the children in particular, will bear the brunt of an insufficient food supply" (p. 64).	National average energy availabilities with distribution by income inferred from a limited number of surveys compared with energy cost of maintenance (1.5 basal metabolic rate) minus 20 percent. "It is the use of this very conservative level that leads to the estimate of over 400 million individuals . . . " (p. 72).
1976	World Bank (Reutlinger and Selowsky) - "Malnutrition and Poverty"[j/] [As of] "the mid-1960s, it is estimated that 56 percent of the population in developing countries (some 840 million people) had calorie-deficient diets in excess of 250 calories a day. Another 19 percent (some 290 million people) had deficits of less than 250 calories a day" (p. 2).	Regional average energy availabilities with distribution by income derived from country income data and alternative (.15 and .30) calorie-income elasticity estimates for the consumer just meeting his requirements compared with recommended energy allowances calculated according to the 1971 FAO[g/] system.
1977	FAO - "Fourth World Food Survey"[k/] "The evidence . . . indicates that the overall supplies of food . . . could be adequate to meet nutritional needs of the world's population if the distribution . . . were ideal . . . . It is clear that the malnourished are found particularly . . . in the poorest section of urban population and in rural areas where adverse ecological conditions, land tenure systems and other economic factors lead to . . . large landless and unemployed groups . . . . Within these groups, it is the pre-school children, younger women and school-age children who suffer most" (pp. 45-46). "Calculations indicate an order of magnitude of about 400 million as a conservative estimate of the number of persons undernourished in the developing countries, excluding the Asian centrally planned economies" (p. 54).	National average energy availabilities with distribution by income derived from national income distribution estimates and unspecified calorie-income elasticities compared with energy cost of maintenance (1.5 BMR) minus 20 percent.

Sources:
a/ FAO, World Food Survey (Washington, 5 July 1946).
b/ FAO, Second World Food Survey (Rome, November 1952).
c/ USDA, ERS, The World Food Budget, 1962 and 1966 (For. Agr. Econ. Report 4, October 1961).
d/ FAO, Third World Food Survey (Freedom from Hunger Basic Study 11, 1963).
e/ FAO, Calorie Requirements (Nutritional Studies 15, 1957).
f/ USDA, ERS, The World Food Budget, 1970 (For. Agr. Econ. Report 19, October 1964).
g/ FAO, Energy and Protein Requirements (Nutrition Meetings Report Series 52, 1973).
h/ "Food Balance Sheets and World Food Supplies," (FAO) Nutrition Newsletter, April-June 1973.
i/ UN, World Food Conference, Assessment of the World Food Situation, Present and Future (Item 8 of the Provisional Agenda, November 1974).
j/ Shlomo Reutlinger and Marcelo Selowsky, Malnutrition and Poverty (World Bank Staff Occasional Paper 23, 1976).
k/ FAO, The Fourth World Food Survey (Statistics Series 11, 1977).

CHART 1.

PERSONS IDENTIFIED AS NUTRITIONALLY DEFICIENT IN MAJOR WORLD FOOD ASSESSMENTS*



*Nutritional data from the food assessments cited in Table 1; population estimates from U.N., Demographic Yearbook, various issues.

To understand how reasonable minds examining much the same evidence arrived at such varying conclusions, it is appropriate to consider the methodologies employed in the several studies. This is best done chronologically, since perceptions of what should be measured and how have evolved appreciably with time.

The Early Methodology

Within a year of its creation in 1945 the FAO issued the first in its series of World Food Surveys (1). The analytical approach employed in it--and in the Second World Food Survey (2) and the USDA's two World Food Budgets (3; 4) as well--was simple in the extreme and may be summarized by the equation:

$$\frac{\text{Food available for human consumption}}{365 \times \text{population}} - \text{loss allowance} \lessgtr \text{average daily recommended nutrient allowances}$$

To determine whether or not a country was experiencing a food problem, apparent per capita food availabilities, minus an allowance for wastage between the so-called retail level and actual ingestion, were set against estimates of per capita nutrient needs. Where and when availabilities exceeded requirements, all was presumed well; where they did not, the country or region's entire population was considered to be inadequately nourished.

The failings of this approach are several and, when probed, obvious. First of all, it implicitly assumes that societies are sufficiently homogeneous in their food habits for average data to have meaning. This is certainly not the case in developed economies, where differences in income, locality, ethnic background, and place within the household

have long been known to have marked effects on food behavior; and it is now recognized to be no less invalid for the developing world. We will return to this point, since the recent modifications in methodology have been principally devised to take it into account.

A further drawback is that the approach presupposes an ability to specify average food availabilities and needs with a fair degree of precision.

Limitations of the Methodology: Quantifying Food Availabilities

To estimate average food availabilities for a country for a period of time, one must construct what is called a food balance sheet, equating, commodity by commodity, gross supplies and utilization (Table 2). Included on the supply side are measurements of production, trade, and stock changes, and on the utilization side, seed, feed, and industrial nonfood use, waste up to the retail level, processing losses, and that actually available for human consumption. In theory each of the nine components is derived separately; in practice this is possible for only a few industrial countries possessing uncommonly sophisticated reporting procedures and even then imperfectly. In most countries--and all LDCs--the practice is to estimate availabilities for human consumption not independently, but as a residual. It will thus reflect the sum of the failings of the other eight balance sheet components.

The error so introduced will almost invariably be in the direction of understatement. Understatement of production is a characteristic of most newly developed agricultural reporting systems. Wheat production in the United States is now recognized to have been 30 to 40 percent

TABLE 2. FOOD BALANCE SHEET

Population: _____ on _____ _____: FOOD BALANCE SHEET, _____

(_____ metric tons unless otherwise specified)

Commodity	Domestic Production	Change in Stocks	Foreign Trade		Gross Supplies	Utilization						Per Capita Daily Availability		
			Gross Exports	Gross Imports		Seed	Feed	Ind. Non-Food	Waste	Processing Loss	Available for Human Consumption	Grams	Calories	Protein (grams)

above that officially reported during the first decade (1866-1875) of the USDA's statistical efforts (5, p. 260). In Mexico the comparable figure for maize during 1925-34, the Direccion General de Economia Rural's first decade, was over 50 percent (6, pp. 16, 19).

To this very understandable tendency can be added the further complications that:

- The statistical officer in developing countries is frequently (and not irrationally) equated with the tax collector by the farmer, whose response will be to minimize.
- Output which is not seen is not counted and where communications are poor a great deal is not seen.
- Much food production is for on-farm consumption and does not pass through commercial channels where it might be monitored.
- In tropical areas especially, many food crops are not grown in pure stands but mix-planted in fields of bewildering complexity.

There can, of course, be errors in the direction of overstatement. These most commonly trace to the exuberance of field staff who feel under pressure to report outstanding results--the classic case in point occurred in China during the Great Leap Forward of 1957-59; grain output supposedly jumped from 185 to 375 million tons in one incredible year (7, p. 4)--or to governments which for political reasons wish to deny conditions of crisis. But on balance such instances are the exception rather than the rule.

Compared to the problems of estimating production, those relating to the other two components of the balance sheet's supply side are negligible. Stocks--on-farm stocks in particular--are, to be sure, difficult to measure, but the problem of year-to-year changes in carryovers can be minimized by preparing an average balance sheet for

a three- or five-period. The trade figure is usually quite accurate, unless, as in Africa, international boundaries cut rather arbitrarily between traditional trading partners.

On the utilization side the various deductions between gross supplies and availabilities for human consumption tend to reinforce whatever error has found its way into the production estimates. This is because seed, waste, and processing losses are usually calculated as percentages of production. Quantities fed to livestock or given over to industrial nonfood uses will be minimal in most developing countries.

To generalize about the extent to which food availabilities in the LDCs have been and are now understated is not easy. A reasonable assumption is that the accuracy of production estimates has improved with time and that the extent of understatement is now less than it was when FAO published its first World Food Survey. An exception may be sub-Saharan Africa, where independence has frequently been accompanied by a deterioration in the reporting systems established by colonial administrators. When perfection may be anticipated is anybody's guess. It was not until 1902, 36 years after the effort began, that the USDA began reporting wheat output with an acceptable margin of error; and not until the mid-1950s, with 30 years experience in hand, was Mexico able to confidently measure its maize harvest.

Detailed studies a decade ago of the food economies of Malaysia and Ceylon suggested that caloric availabilities in both were officially

understated by from 10 to 15 percent (8; 9). As the staple in both countries is rice grown under irrigated conditions, and thus relatively amenable to quantification, and as both countries have by the standards of the developing world an admirable statistical tradition, this 10-15 percent is probably something of a floor. Elsewhere the amount of food actually available may be undercounted by rather more.

Limitations of the Methodology: Quantifying Food Requirements

If derivation of reliable average food availabilities through the food balance sheet process poses problems, equal or even greater difficulties attend estimation of the nutritional criteria against which these availabilities are judged. Nutrition is still a young science and our ability to establish minimal or desirable levels of intake is not nearly so precise as we would like it to be.

A person's nutritional needs are a function of many things: age, sex, body size, activity patterns, health status, and individual make-up, to mention the more important. Conceptually, knowing these variables, it should be possible to set minimum levels of intake for protein, energy, vitamins, and so forth sufficient to preclude overt deficiency disease in most of a population. As a practical matter it is not, and what were used as surrogates for such minimal criteria in the early food evaluations were the recommended allowances prepared as guidelines for dietitians and other nutritional workers. These allowances consciously err on the side of caution, both to incorporate a comfortable safety margin and to ensure that the substantial variations in food needs among individuals will be covered.

Energy Requirements. The recommended allowances are periodically modified and from the direction and magnitude of change it is possible to infer something of the probable extent by which minimum needs were overstated in the past. With respect of energy allowances, the history of the FAO, the U.S. Food and Nutrition Board, and other responsible organizations has been one of continued downward modification. The energy allowance for the U.S. "reference man"--in his twenties, weighing 70 kilograms, and not very active--now stands at 2,700 calories, 500 calories less than the 1953 recommendation (Table 3).

Apart from undue initial conservatism, the principal cause of this reduction is the increasingly inactive character of life in industrial societies. Physical effort is less and less demanded on the job and the body moves from place to place less on its feet than on its seat. It is not unlikely that the energy allowances suggested for the developed countries are now quite reasonable. Little remains to be understood of how urban man divides his day--it has become after all depressingly routinized--and, thanks to studies carried out in association with wartime rationing programs in the United Kingdom and Germany, the energy costs of most activities are well known (Table 4).

The same is not true for developing countries. Very few energy expenditure/activity studies have been conducted among rural or urban people in these regions and useful common denominators continue to be wanting. A key reason for this shortcoming is the difficulty of obtaining reliable information on energy expenditure. The traditional method for doing this is to record the energy costs of specific tasks

TABLE 3. EVOLUTION OF U.S. RECOMMENDED ENERGY ALLOWANCES FOR MEN AND WOMEN*

Reference Man (70 kg.; in twenties)	Year	Reference Woman (58 kg.; in twenties)
3,200	1953	2,300
3,200	1958	2,300
2,900	1964	2,100
2,800	1968	2,000
2,700	1974	2,000

* Data from D. F. Miller and Leroy Voris, "Chronological Changes in the Recommended Dietary Allowances," J. Am. Dietetic Assn., February 1969, pp. 110-111, and National Research Council, Food and Nutrition Board, Recommended Dietary Allowances (Eighth Ed., Washington, D. C., 1974), facing p. 128.

TABLE 4. ENERGY COSTS OF HUMAN ACTIVITIES*

Activity	Average Calories per Minute
Agricultural:	
Feeding mulberry leaves (Japan)	1.4
Milking	
by machine	1.5
by hand	3.5
Cleaning pig sty	4.0
Pushing sheep in dip	5.7
Digging hole for dead sheep	8.0
Service and Industrial:	
Repairing watch	1.6
Typing	
30 words per minute	1.6
40 words per minute	1.7
Stacking beer cases	2.4
Operating a punch press	5.7
Pushing coal tubs	8.0
Athletic:	
Playing poker	1.9
Playing volleyball	3.5
Bowling	4.1
Playing badminton	6.3
Playing tennis	7.1
Scottish country dancing	8.0
Horseback riding	
walking	3.0
trotting	8.0
galloping	10.0

*Data from J. V. G. A. Durnin and R. Passmore, Energy, Work, and Leisure (London, 1967), cited in W. M. Beeghly, "Nutrition, Employment and Working Efficiency: Toward Measuring Human Activity in the Rural Tropics," in T. T. Poleman, et al., The Economic Applications of Vital-Rate Monitoring (Cornell International Agric. Development Mimeo 38, November 1972), p. III-3.

with a respirometer and then multiply the resulting factors by appropriate time spans. The problems are many. The respirometer is a clumsy instrument; it can be kept on a subject for only a few minutes and its presence is hardly conducive to normal behavior (Figure 1). Moreover, time-span recording must be meticulously accurate in order to be useful. To obtain such information under primitive conditions without an impetus similar to wartime rationing is probably asking too much of the research priorities of most LDCs.[1/]

In response to criticism that the energy allowances used in its early World Food Surveys were unrealistic surrogates for minimum needs, the FAO, lacking actual evidence from the LDCs, employed a different approach to establishing floor criteria beginning with its report to the 1974 World Food Conference (12, p. 47):

> In assessing the numbers at risk from energy deficiency the average requirement is not a very suitable base, for much of the population will have true requirements ranging well below the average due to differences not only in body composition but, more important, in activity. The true variation in individual activity is not known neither is the extent of the possible skewness in the requirement distribution.
>
> The Ad Hoc Expert Committee on Energy and Protein Requirements convened by FAO and WHO reported that for practical purposes the energy cost of maintenance can be put at 1.5 x Basal Metabolic Rate where the Basal Metabolic Rate is a measure of the rate at which body substance is oxidized in order to support the continued maintenance of life. The reason why the maintenance cost is put at 1.5 (BMR) is that in non-fasting subjects engaged in a minimum level of activity for dressing, washing, etc., the energy needed to ensure constant body energy is that much greater than BMR.

1/ Recent technological innovations in the field of biomedical engineering show promise of offering alternative methods of measuring energy expenditure which may prove both more simple and more accurate than the respirometer/time-span approach, but to date none has been successfully proven in the field in a large trial. See 10. For an ingenious experiment that did not quite work out, see 11.

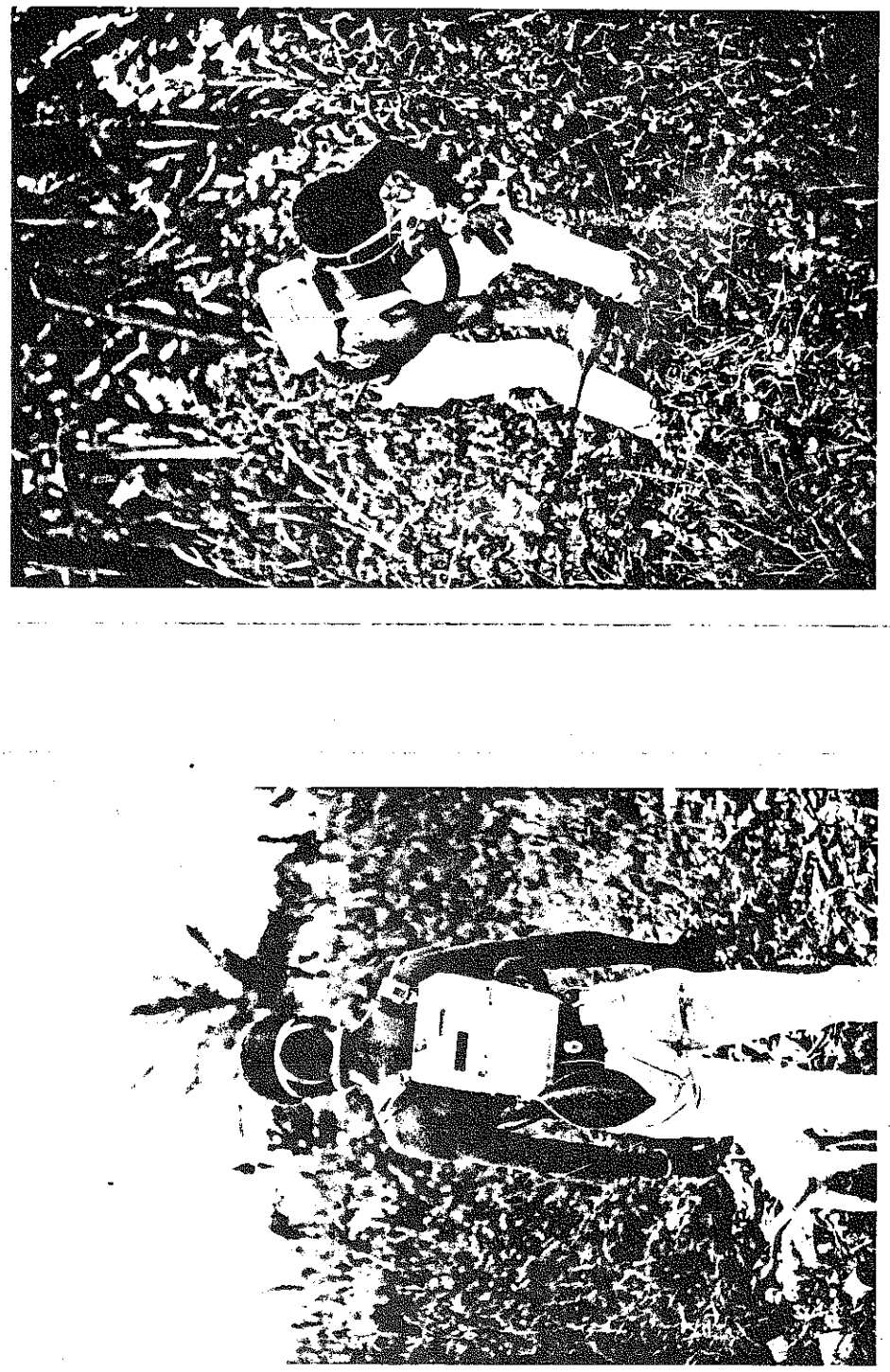


FIGURE 1. INDIRECT CALORIMETRY WITH THE KOFRANYI-MICHAELIS RESPIROMETER

> If the food available to the individual provides energy at a level less than 1.5 BMR it might be said that such an individual is likely to be under-nourished. However, even when the individual variation due to activity has been removed, individual variation in BMR still exists, and it has been estimated that some people may have a BMR as low as 20 percent under the norm. Therefore, if it is wished to make an estimate of the number with energy intakes below maintenance cost of energy with a high probability of not including some who are in fact meeting their rather lower-than-average maintenance cost, it is necessary to fix the limit at 1.5 (BMR) minus 20 percent . . .

It is difficult to fault this modification. Certainly the 1.2 BMR factor which results--.8 x 1.5 (BMR)--yields values which bear a clearer hallmark of reality. If anything, it errs on the side of being too low. Applied to Asia it suggests minimum per capita requirements of the order of 1500 calories, as opposed to the criteria of 2600 and 2230-2300 calories, respectively, used in the first two World Food Surveys.

Protein Requirements. In the early FAO and USDA studies, the terms "undernourishment" ("undernutrition") and "malnourishment" ("malnutrition") were widely used. Undernourishment is generally taken to mean a shortfall in caloric intake such that a person cannot maintain normal bodily activity without losing weight. Malnourishment, on the other hand, describes the lack or deficiency of one or more of the so-called protective nutrients--protein, the vitamins, and minerals.

The first two World Food Surveys defined the nutritional problems of the LDCs largely in terms of energy shortfalls and undernourishment. In the Third World Food Survey insufficient protein availabilities and malnourishment were highlighted. Today most nutritionists concerned with the developing countries speak of protein-energy (or protein-calorie) malnutrition. This sees a shortage of energy again as the prime problem and takes in account that an apparent

adequacy of protein can be converted into a deficit should a portion of it be metabolized to compensate for insufficient energy intake. This major change in problem perception and terminology coincided with a drastic reduction in the recommended minimum allowances for protein.

It is not easy for the layman to follow the technical argument underlying this change. Suffice it that (13, p. 2):

> In 1971, an FAO/WHO Expert Panel of 16 members and consultants reviewed the research . . . of the past decades and concluded that the previous protein recommendations for adults had been largely overstated. According to the new "safe levels of intake," based on lower physiological requirements plus a 30% "safety margin" which--although not necessarily optimal--"shall cover the physiological needs of nearly all healthy persons," . . . the average daily per caput recommendation dropped by one third from previously 61 g of local protein [i.e., adjusted for protein quality differences in national diets as compared to an "ideal" or reference protein] to 40g now.

The effect of this change was dramatic. Prior to the revision, simple comparisons of average availabilities and needs suggested almost all the world's developing countries were deficient in protein; after it, hardly any of them. If the "protein gap" did not disappear overnight, its statistical underpinnings seemed to.

The Legacy of the Early Studies

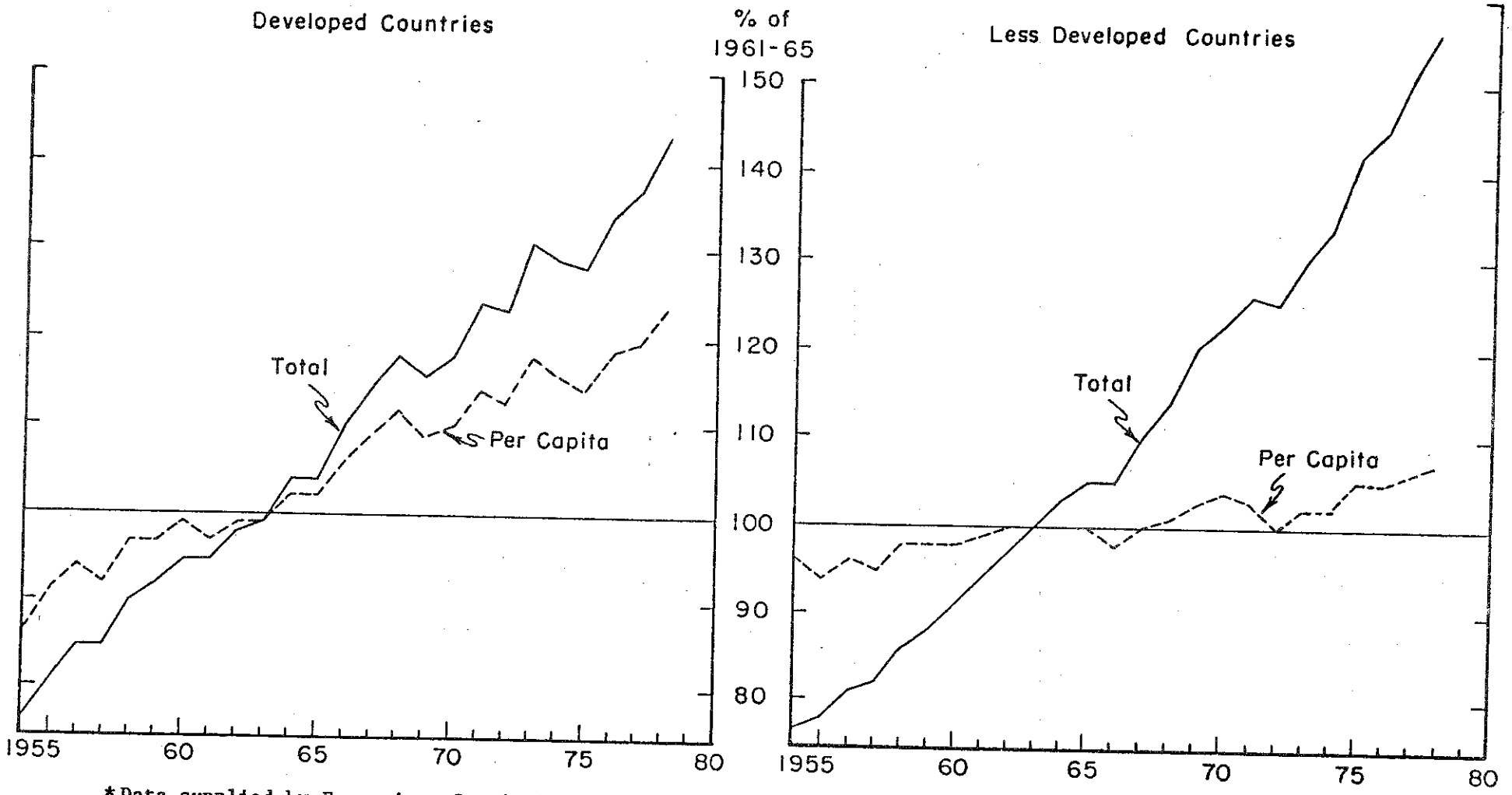
The impression of the world nutrition situation conveyed in the early studies was gloomy indeed. Though the numbers varied, the picture conveyed was one of hungry countries and of a world unable to feed its rapidly growing population. Insufficient production was seen as the problem. As the second of the USDA's World Food Budgets put it (4, pp. iii-iv):

> Two-thirds of the world's people live in countries with nutritionally inadequate national average diets . . . The diet-deficit countries are poor and food deficiencies merely reflect the low level of income in general . . . The basic problem of the diet-deficit countries is one of productivity. The people cannot produce enough food to feed themselves or produce enough other products to buy the food they require. Food production has barely been able to keep ahead of population growth, much less provide for the expanded demand resulting from some improvement in per capita income, most of which goes for food.

We now know that such conclusions seriously distort reality. The record of agricultural productivity in the LDCs has not been all that bad. According to such generally used series of "world" output as that currently issued by the USDA (Chart 2), the LDCs over the past 25 years have expanded production no less rapidly than the developed countries, a remarkable achievement in view of the minimum priority given to agriculture in their development programs. Population growth to be sure, absorbed most of the gains, but modest per capita improvement occurred.

There have, of course, been year-to-year fluctuations in this trend--fluctuations whose import has tended to be magnified by those who would influence public opinion. The first apparent faltering came in the mid-1960s and resulted almost exclusively from two successive droughts in India. Indian production bulks so large in the LDC aggregate that major fluctuations in her harvest influence visibly the index for all developing countries. This fact, however, was lost on many commentators. Conditioned by the early FAO and USDA findings to think of all LDCs as "hungry" and hearing of massive food aid shipments--of the 30 million tons of grain shipped by the United States under Public

CHART 2. WORLD AGRICULTURAL PRODUCTION, 1954-1978*



*Data supplied by Economics, Statistics, and Cooperatives Service, USDA. Developed countries: North America, Europe, USSR, Japan, South Africa, Australia, and New Zealand; less-developed countries: Latin America, Asia (except Japan and Communist countries), and Africa (except South Africa).

Law 480 during the two years ending in June 1967, half went to India--not a few were inclined to predict imminent global starvation.[2/]

A reaction set in almost immediately and again closely mirrored the Indian situation. A sequence of favorable years in terms of weather was accompanied by introduction into the Punjab of high-yielding varieties of Mexican wheat. The result was that the index for all low-income countries rose steeply, as did per capita availabilities. The assessment was as extreme in the opposite direction as it had been in 1965 and 1966. These were the years when the Green Revolution began to be talked of. The situation in Northwest India, together with the introduction of high-yielding, fertilizer-responsive rice in the wetter portions of Asia, led many to believe that a fundamental change had taken place and that feeding the world's rapidly increasing population no longer posed problems. So pervasive was this optimism that the FAO went so far as to suggest, in its State of Food and Agriculture for 1969, that the food problems of the future might well be ones of surplus rather than shortage (14, pp. 1-3).

The factors underlying the second pause--the "food crisis" of the early 1970s--were more complex and primarily involved the developed rather than the developing countries. In brief, it resulted from an unhappy coincidence of four main influences: an intentional running down of stocks and a holding down of production in the United States; unprecedented prosperity and rising demand in Europe and Japan; a general

2/ Popular writings on world food problems are most voluminous at times of perceived crisis. Thus the Indian difficulties of the mid-1960s caused a spate of them and we are currently experiencing a deluge engendered by the problems of the early 1970s. This timing has not contributed to thoughtful analysis.

relaxation of attention to agriculture in the LDCs; and unfavorable weather in India, the African Sahel, and the Soviet Union. The role of the Soviet Union was particularly destabilizing. The failure of its 1972 harvest triggered the run on world supplies and the short crop of 1975 prolonged it. Nonetheless the crisis was truly global in that the price rises were general and in that it exposed the weaknesses of the international agricultural order. "International" is the operative word: most affected were the countries trading in the world market. Least involved were the largely self-reliant LDC economies.

Today the pendulum of assessment has once again swung. Harvests almost everywhere have been favorable for three years running. India entered the 1977/78 crop year with an unprecedented 18 million tons of grain on hand, and the carryover is now thought to approach 25 million tons. To the extent that there is talk of crisis, it is usually in the context of avoiding declining prices and holding down mounting surpluses.

But if this story of modest progress does not tally with the pessimism of the early FAO and USDA studies, it does not follow that the postwar years have witnessed a reduction in the actual number of people nutritionally distressed. For the suggestion that increased production alone could eliminate hunger was only one of the misconceptions conveyed by the early studies.

A second unfortunate legacy was the notion that countries could be classified as hungry or well fed. It is now clear that, to the extent that this notion has validity, the early studies misrepresented

reality. With food availability estimates that understated set against requirement figures that overstated, the cards were so stacked that almost all LDCs could be classed as "diet deficit." Redone with truly accurate information, it is probable that few countries would be so classified. Much as the protein gap proved a statistical illusion, the list of diet-deficit countries would be whittled away.

But such a computation would perpetuate the most important failing of the early methodology: that individuals, not countries, experience nutritional deprivation, and that average country data tell us little about the individual. It is now a commonplace among serious pronouncements on the food situation that, equitably distributed, global supplies are sufficient to feed all. The problem is that all within a country do not have equal access to existing supplies, and it is to consideration of how this inequality may be quantified that we now turn.

CITATIONS

1 FAO, World Food Survey (Washington, 5 July 1946).

2 FAO, Second World Food Survey (Rome, November 1952).

3 USDA, ERS, The World Food Budget, 1962 and 1966 (For. Agr. Econ. Report 4, October 1961).

4 USDA, ERS, The World Food Budget, 1970 (For. Agr. Econ. Report 19, October 1964).

5 Holbrook Working, "Wheat Acreage and Production in the United States Since 1866: A Revision of Official Estimates," Wheat Studies of the Food Research Institute, Vol. II, No. 7, June 1926.

6 T. T. Poleman, "Mexican Agricultural Production, 1896-1953: An Appraisal of Official Statistics" (Cornell Agricultural Economics Staff Paper No. 77-30, August 1977).

7 P. P. Jones and T. T. Poleman, "Communes and the Agricultural Crisis in Communist China," Food Research Institute Studies, Vol. III, No. 1, February 1962.

8 M. J. Purvis, "Evaluation and Use of Underdeveloped Agricultural Statistics: The Food Economy of Malaysia" (unpublished dissertation, Cornell Univ., 1966).

9 T. Jogaratnam and T. T. Poleman, Food in the Economy of Ceylon (Cornell Univ. Internat'l. Agr. Dev. Bulletin 11, October 1969).

10 T. T. Poleman, "A New Research Tool and Its Uses," in T. T. Poleman, et al., The Economic Applications of Vital-Rate Monitoring (Cornell Internatl. Agr. Dev. Mimeo. 38, November 1972).

11 W. M. Beeghly, "Nutrition, Employment, and Working Efficiency: Toward Measuring Human Activity in the Rural Tropics," in T. T. Poleman, et al., The Economic Applications of Vital-Rate Monitoring (Cornell Internatl. Agr. Dev. Mimeo. 38, November 1972).

12 U.N. World Food Conference, Preliminary Assessment of the World Food Situation, Present and Future (Rome, April 1974).

13 The FAO Food Policy and Nutrition Division, "Food and Nutrition: A New View of an Old Problem," Nutrition Newsletter, Vol. II, No. 4, Oct.-Dec. 1973.

14 FAO, The State of Food and Agriculture, 1969 (Rome, 1970).

II - THE EMPHASIS ON INCOME AND THE RECENT STUDIES

Attempts to disaggregate food availabilities below the national level have thus far focused on the effect of income and the improvement the recent studies have wrought in problem identification has been appreciable. Estimates of the number of nutritionally deprived persons have dropped and no longer are developing countries quantified as if in the grips of an all-encompassing hunger. Still it would be idle to pretend that the studies do not leave much to be desired. Given the paucity of evidence on LDC income distribution and the exact effects income change have on behavior toward food, it could hardly be otherwise.

The Findings: How Many and Where

Third World Food Survey (1963). The first study which attempted to take account of the income effect was FAO's Third World Food Survey (1). Largely the work of the emminent Indian statistician, P. V. Sukhatme, then Director of FAO's Statistics Division, the study is spotty in its description of methodology. This is understandable. Our insights into the effect of income rest largely on household budget surveys, and if there are few of these today of acceptable quality, there were even fewer a decade and a half ago.

Nonetheless, on the basis of evidence from Maharashtra State in India and elsewhere, Dr. Sukhatme concluded (1, p. 51):

> . . . as a very conservative estimate some 20% of the people in the underdeveloped areas are undernourished and 60% are malnourished. Experience shows that the

> majority of the undernourished are also malnourished. It is believed therefore . . . some 60% of the people in the underdeveloped areas comprising some two thirds of the world's population suffer from undernutrition or malnutrition or both.

This, of course, was before the recommended allowances for protein were lowered; with revision, the 60 percent malnourished presumably disappeared. On the other hand, Dr. Sukhatme's 20 percent undernourished is not too much different from FAO's current estimate of persons suffering protein-energy deprivation.

FAO World Food Conference Presentation (1974). In its documentation prepared for discussion at the (November 1974) World Food Conference (2), FAO took due account of the 1971 reduction in protein allowances and also employed the 1.2 BMR criterion for minimum energy needs for the first time. Though this yielded floor values well below the energy requirement figures used by Dr. Sukhatme--1500 as opposed to 2300 calories for the Far East--the proportion of LDC population whose estimated intake fell below it actually increased: from 20 percent to 25 percent (2, p. 66).

It is difficult to reconcile this increase with so large a reduction in minimum energy needs, but if there is an explanation it presumably lies in the methodology used to take into account the effect of income. However, it is not clear what this methodology was. The linkage between income and caloric availabilities as reported in six budget surveys was summarized (2, pp. 60-61), but no relationship between these surveys and the regional estimates of those at risk--shown here in Table 5--was offered. In fact, one suspects the methodology involved a certain

TABLE 5. WORLD FOOD CONFERENCE: NUMBER OF PEOPLE ESTIMATED TO HAVE HAD AN INSUFFICIENT PROTEIN-ENERGY SUPPLY IN 1970, BY REGION*

Region	Population	Percentage Below 1.2 BMR		Number Below 1.2 BMR	
		Preliminary Estimate	Final Estimate	Preliminary Estimate	Final Estimate
	(millions)			(millions)	
Developed	1,074	3	3	28	28
Developing[a/]	1,751	*20*	*25*	*360*	*434*
Far East[a/]	1,020	*22*	*30*	*221*	*301*
Latin America	283	13	13	37	36
Africa	273	25	25	68	67
Near East	171	20	18	34	30
World[a/]	2,825	*14*	*16*	*388*	*462*

*Preliminary estimates from U.N., World Food Conference, Preliminary Assessment of the World Food Situation, Present and Future (Rome, April 1974), p. 39; final estimates from U.N., World Food Conference, Assessment of the World Food Situation, Present and Future (Item 8 of the Provisional Agenda, November 1974), p. 66.

a/ Excluding Asian Centrally Planned Economies.

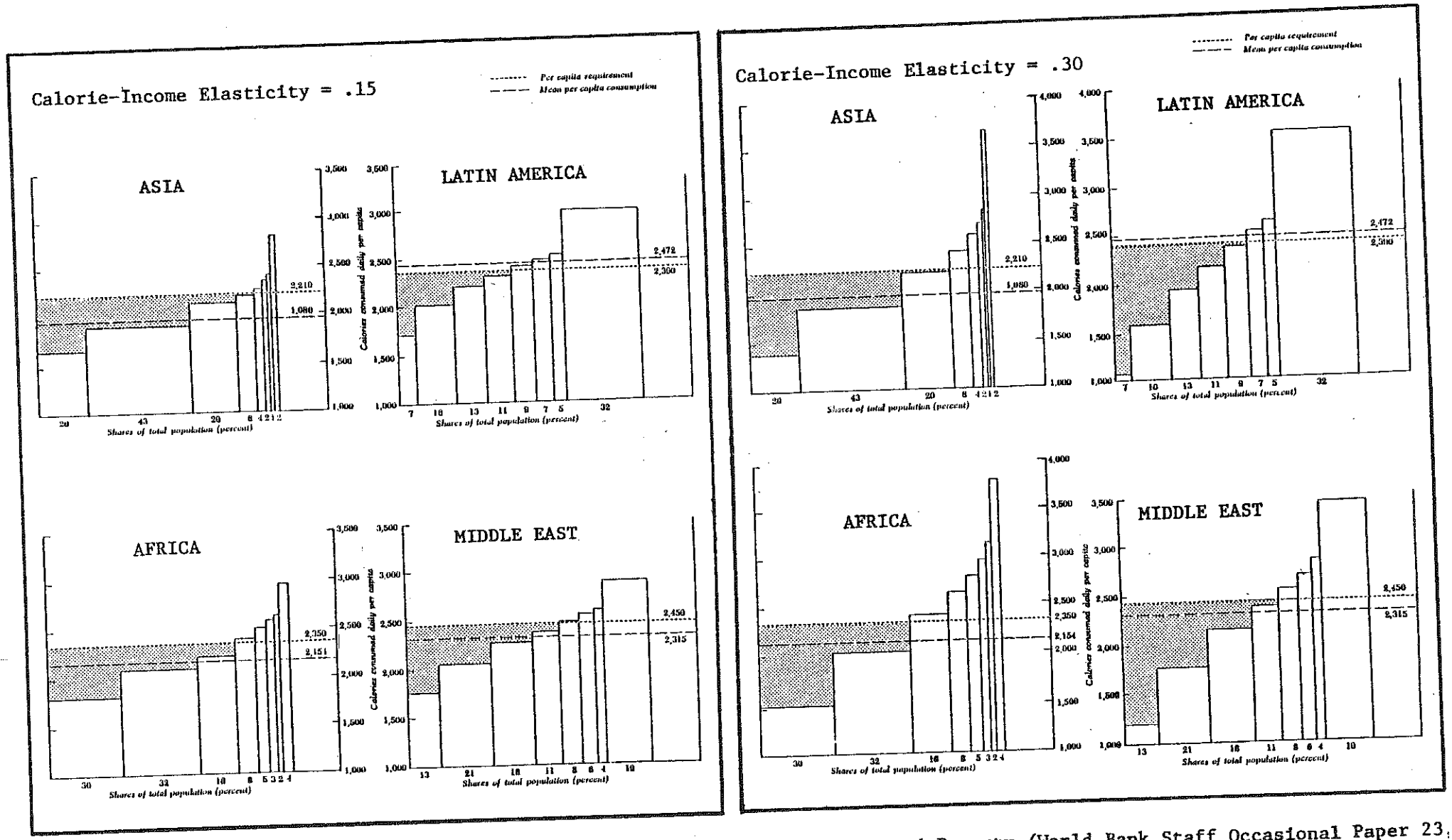
Principal modifications shown in italics.

measure of arbitrariness. Between April 1974, when the preliminary documentation was released, and the conference itself in November, the estimate of the LDC population with intakes falling below 1.2 BMR was raised from 360 million to 434 million--or from exactly 20 percent to exactly 25 percent (Table 5).

The World Bank Study (1976). With Malnutrition and Poverty (3), prepared by Drs. Reutlinger and Selowsky for the World Bank, we come at last to a study whose methodological footsteps can for the most part be traced. The approach involved allocation among eight income classes of the total supply of food energy believed to be available in 1965 to the developing world's four major regions--Asia, Latin America, Africa, and the Middle East. The distribution of population among these classes was based on estimates for 30 LDCs prepared by the Income Distribution Division of the Bank's Development Research Center.

Allocation of food energy to each income class was somewhat arbitrary. It was not based on actual evidence for each region, but was derived from the distribution suggested by elasticity coefficients relating increments in caloric "intake" to increments in income. A range of calorie-income elasticities for people just meeting their needs of from .10 to .30 was postulated; in the authors' words, "several analyses of data obtained through household food consumption surveys have confirmed that calorie income elasticities [in this range] . . . are consistent with observed behavior" (3, p. 18). As Chart 3 illustrates, the elasticity chosen dictated the results: the lower the coefficient the greater the equality in caloric distribution, the higher the coefficient the greater the inequality.

CHART 3. THE WORLD BANK METHODOLOGY IN OPERATION: CALORIC "CONSUMPTION" BY INCOME GROUP COMPARED WITH AVERAGE AVAILABILITIES AND "REQUIREMENTS," 1965, BY REGION*



*Adapted from Shlomo Reutlinger and Marcelo Selowsky, Malnutrition and Poverty (World Bank Staff Occasional Paper 23, 1976), pp. 20-23.

The energy "consumption" estimates derived in this manner were then compared with recommended allowances calculated in accordance with the 1971 FAO system (4).

Although the reasons for its selection were not specified, a calorie-income elasticity of .15 was deemed most appropriate by the authors. On the basis of it, they concluded (3, p. 2):

> Based on average calorie consumption data in the mid-1960s, it is estimated that 56 percent of the population in developing countries (some 840 million people) had calorie-deficient diets in excess of 250 calories a day. Another 19 percent (some 290 million people) had deficits of less than 250 calories a day.

The regional distribution of these 1,130 million people is shown in Table 6.

The World Bank study has attracted considerable attention. It has been praised for having introduced long overdue rigor to the quantification of world nutrition problems. Others have suggested that much of the rigor is spurious; that by taking food balance sheet averages as a starting point, the question of underreporting food availabilities is ignored; that the FAO 1971 recommended allowances employed as target criteria grossly overstate minimum energy needs; and that the calorie-income elasticity coefficient so central to the analysis will in reality vary from one country to another and that it unduly simplifies the sort of changes in food behavior which take place as one moves from poverty to affluence.

With none of these objections is it possible to disagree. Nonetheless, the World Bank study should not be dismissed out of hand. It had the honesty to detail its methodology and state its assumptions. And it drove home the importance of income. For this it deserves to be recognized as an important watershed in the measurement of world hunger.

TABLE 6. WORLD BANK: NUMBER OF PEOPLE ESTIMATED TO HAVE HAD AN INSUFFICIENT PROTEIN-ENERGY SUPPLY IN 1965, BY REGION*

(millions)

Region	Population	Population With Daily Calorie Deficits		
		Total	250 Calories	250 Calories
		CALORIE-INCOME ELASTICITY = .15		
Asia	869	736	563	173
Latin America	244	113	55	58
Africa	247	190	151	39
Middle East	144	91	75	16
TOTAL[a/]	1,504	1,130	844	286
		CALORIE-INCOME ELASTICITY = .30		
Asia	869	563	563	0
Latin America	244	113	87	26
Africa	247	151	151	0
Middle East	144	73	48	25
TOTAL[a/]	1,504	900	849	51

* Data from Shlomo Reutlinger and Marcelo Selowsky, Malnutrition and Poverty (World Bank Staff Occasional Paper 23, 1976), pp. 24, 53-55.

a/ Excluding developed, Asian centrally planned, and assorted smaller nations.

Fourth World Food Survey (1977). Criticisms of the World Bank study were considered and to an extent overcome by FAO in its most recent statement, The Fourth World Food Survey (5). It made use of a methodology not unlike that devised by Reutlinger and Selowsky, except that the calculations were made at the national, not regional, level and that 1.2 BMR was used as the floor criterion. Unhappily, the quantification is less easy to follow. The calorie-income elasticities used for individual countries were not specified, nor were the patterns of income distribution.

The Fourth World Food Survey put the number of people with an insufficient protein-energy supply as of 1972-74 at 455 million--or, once again, 25 percent of the LDC population (Table 7). If this number and percentage are considerably less than half those estimated by Reutlinger and Selowsky, the two studies are at least in agreement as to where the bulk of the people at risk reside:

	Percentage of Those at Risk	
	World Bank	Fourth Survey
Far East	65	65
Africa	17	18
Latin America	10	10
Near East	8	6

Although it has become customary to speak of world, or developing country, nutrition problems, the difficulties are very much concentrated in South and Southeast Asia.

TABLE 7. FOURTH WORLD FOOD SURVEY: NUMBER OF PEOPLE ESTIMATED TO HAVE HAD AN INSUFFICIENT PROTEIN-ENERGY SUPPLY IN 1972-74, BY REGION*

Region	Population (millions)	Percentage Below 1.2 BMR	Number Below 1.2 BMR (millions)
Far East	1,042	29	297
Latin America	302	15	46
Africa	301	28	83
Near East	182	16	29[b/]
TOTAL Developing Countries[a/]	1,827	25	455

* Data from FAO, The Fourth World Food Survey (Statistics Series 11, 1977), p. 53.

a/ Excluding Asian centrally planned countries

b/ Shown as 20, an apparent misprint.

How Valid The Conclusions?: Some Empirical Difficulties

In emphasizing the importance of income the recent studies have done important service. Obviously it is the poor that suffer and obviously it is to them that remedial measures should be directed. But in highlighting the income effect the studies also draw attention to how little we know about the distribution of income in developing countries and about the differences in dietary behavior between one income class and another.

Income and Its Distribution. If estimating food production in LDCs poses difficulties, they pale in comparison to those of attaching numbers to income and its distribution. It is not just that the old problem reappears of the statistician being mistaken for the tax collector. In some countries the distribution of income is a matter which government intentionally wishes to obscure. To reveal the truth about extreme inequality is to invite revolution. But perhaps the most basic problem is that national income accounting involves applying modern Western concepts to situations for which they were not intended.

National income may be defined as the "total earnings of labor and property from the production of goods and services" (6, p. 486). An individual's income will thus be the flow of value added which accrues to his labor or property. All very tidy--provided that production flows through the marketplace, where it can be valued, and that consumption is divorced from production.

This is clearly not the case in the developing world. Most food production is for home consumption, not the market, and much of what is sold travels through diffuse, informal channels. Nonetheless it

must be counted and valued, as must such other nonmarket production activities as firewood gathering, food processing, water carrying, and the like. In economies characterized by seasonality of activity and chronic underemployment, the valuation estimates are no less tenuous than the counting, and the result can be regarded as little more than guesswork.

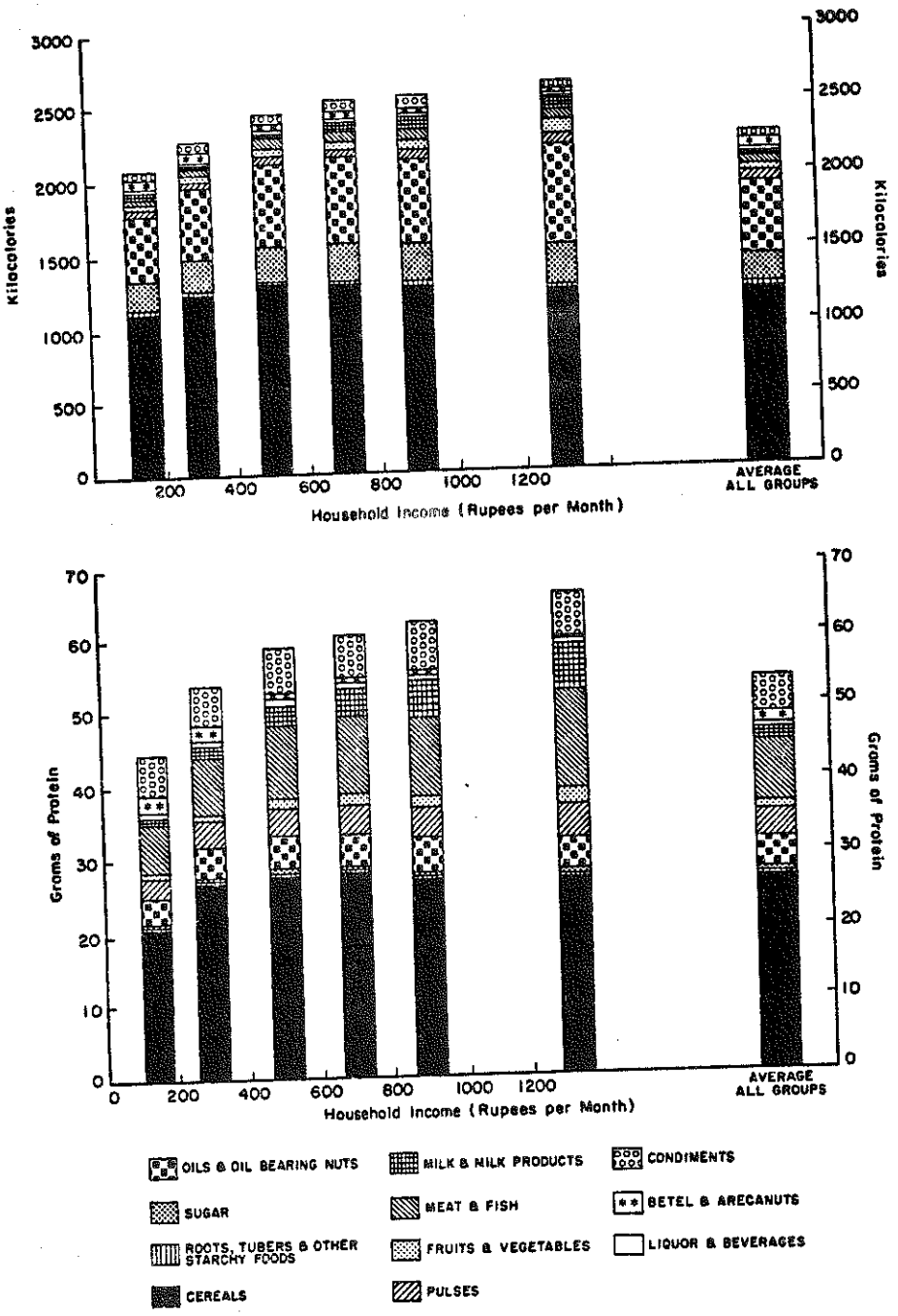
There are also a variety of services which compound the issue. These include many of the religious, police, and medical functions which are provided on the basis of customary obligation or barter. Involved also are many of the village-level education and entertainment activities whose value to the local inhabitants is very real. Uncertainties additionally exist with respect to the valuation and distribution of public goods and services provided by the central authorities.

As to the impact these and other "uncertainties" will have on estimates of income levels and distribution, it is safe to conclude that they would act in the direction of understatement for the poor. This is because so many of their activities take place outside of the market and tend to be overlooked. In emphasizing this, one does not wish to imply that the poor of the developing world are secretly hoarding great wealth and only pretending to be inadequately fed. Rather it is to caution against accepting income levels reported to be below (say) the equivalent of $200 per year or so, or giving credence to precisely expressed income-diet linkages.

Income and Diet. Central to the analysis in both the World Bank study and The Fourth World Food Survey was the concept of calorie-income elasticity. While the concept itself is valid, it misleads by suggesting that the relationship between income changes and changes in energy intake may be reduced to one tidy figure. Not the least of the limitations of such a notion is the implication that the richer one gets the more calories one ingests. Visions are conjured up, not just of skeleton-thin poor, but of 400-pound millionaires.

The reader also comes away from the studies with the impression that the income-hunger relationship is a simple one, amenable to clear-cut evaluation. This is not the case. Chart 4, prepared five years ago to summarize the effect income has on nutrient intake in Sri Lanka, is suggestive of the real world. The household budget survey on which it is based was then almost unique. It covered almost 10,000 households representative of the entire country and was conducted and analyzed with uncommon integrity. Yet, even with this survey, one can infer precious little about the extent of protein-calorie malnutrition. The most important dietary adjustment historically associated with rising income is a decline in the importance of the starchy staple foods--read rice in southern Asia--as sources of energy and a shift to the more expensive, flavorous foods such as meat, fish and vegetables. In Sri Lanka this tendency is observable among only the four uppermost income classes (20 percent of the population), and then, because of egalitarian measures imposed by the government, only weakly so. Between the lowest class (43 percent of the people) and the next lowest (37 percent), the sole change is quantitative. There is a difference in

CHART 4. APPARENT PER CAPITA DAILY ENERGY AND PROTEIN AVAILABILITIES IN SRI LANKA, 1969-70, BY INCOME CLASS*



*Reproduced from T. T. Poleman, Income and Food Consumption: Report to the Government of Sri Lanka (FAO/UNDP, No. TA 3198, Rome, 1973), pp. 18-19. Based on data from Sri Lanka, Dept. of Census and Statistics, Socio-Economic Survey of Sri Lanka, 1969/70, Special Report on Food and Nutrition Levels in Sri Lanka (1972).

apparent per capita daily availabilities of 200 calories and 10 grams of protein, but none in diet composition.

What are we to infer from this? Because increased quantity not quality was purchased with increased income, the 200-calorie jump could be interpreted as implying behavior consistent with enforced reduced activity among the very poor (or actual physical deterioration) and that the 1.2 BMR energy floor of 1500 caloires is an unrealistically low figure for minimum needs in Sri Lanka. But just as reasonably, one might postulate caloric adequacy among that element of society which is too poor to waste anything and which, given the very high rate of unemployment in Sri Lanka, leads a less active life and therefore has lower energy needs. Thus it is possible to have it either way: depending on your assumptions, you can prove beyond a statistical doubt that 43 percent of Ceylonese suffer protein-calorie malnutrition or none do.

Income, then, is clearly crucial, but hasty evaluations of its impact are out of place. If its effect is to be properly understood (and taken into account in devising remedial measures), the evidence at hand must be subjected to painstaking scrutiny. As background for doing this, an appreciation of those income-diet linkages which manifested themselves over time in the now-developed countries is helpful.

CITATIONS

1 FAO, Third World Food Survey (Freedom from Hunger Basic Study 11, 1963).

2 U.N., World Food Conference, Assessment of the World Food Situation, Present and Future (Item 8 of the Provisional Agenda, November 1974).

3 Shlomo Reutlinger and Marcelo Selowsky, Malnutrition and Poverty (World Bank Staff Occasional Paper 23, 1976).

4 FAO, Energy and Protein Requirements (Nutrition Meetings Report Series 52, 1973).

5 FAO, The Fourth World Food Survey (Statistical Series 11, 1977).

6 Paul Wonnacott, Macroeconomics (Homewood, Ill., 1974).

III - THE EFFECT OF INCOME ON DIETS: THE EXPERIENCE OF THE DEVELOPED COUNTRIES

Students of food economics have customarily evaluated the income-diet linkage in terms of three principal relationships: the percentage of income allocated to food; the proportion of food energy derived from the various commodity groupings; and the shifts in the relative importance of specific commodities within these groupings. While these relationships are particularly useful in helping predict changes in demand, they also are helpful in understanding where a particular household or country stands along the expected course of dietary evolution.

Expenditure for Food and Engel's Law

That the smaller the family income, the greater will be the proportion of it spent on food was first observed over a century ago. The observer, analysing the household budgets of Belgian and French workers, was Christian Lorenz Ernst Engel (not, as so many suppose, Friedrich Engels) and hence its canonization as Engel's Law. The basis for the empirical validity of Engel's Law is obvious. Food is the most essential of life's necessities--much more so than clothing and shelter--and circumstances can exist under which 90 percent or more of a family's income must go for it.

On the other hand, there is an upper limit to ingestion of food energy--in the sense that the capacity of the human stomach is limited--that does not apply to nonfood goods and services. The quality of the

diet, and thus its cost, may improve as one grows richer, but the scope for improvement is far vaster for items whose intake is not physiologically constrained. Hence, with one important exception, observation has consistently shown that the percentage of family income spent on food will decline as income rises, although absolute food expenditures may rise.

The operation of Engel's Law may be observed between countries at different levels of economic development, in a country over time, and among income classes at a particular time. Some inter-country comparisons (as of 1965) follow (1, p. 78):

	Food Expenditures as Percent of Private Consumption Expenditures
Ghana	60.6
Korea	55.4
Ceylon	48.3
Taiwan	47.7
Greece	39.1
Italy	38.8
Sweden	26.1
Switzerland	24.5

That roughly two-thirds of disposable income will be spent on food in the poorer LDCs is a reasonable rule of thumb. Among the more prosperous developing countries the figure drops to 40-50 percent. At high levels of development it will level off somewhere below 20 percent.

The latter figure is suggested by the experience of the United States (Table 8). Between 1929, when estimates of national income were first made, and 1975, real per capita income more than doubled. Real outlays for food, however, increased by only half again and declined from 23 percent of disposable income to a low of 16.3 percent. The percentage would now be somewhat higher, since the recent inflation has been paced by rising food prices. Across the income range, the latest (1973-74)

TABLE 8. UNITED STATES: FOOD EXPENDITURES IN RELATION TO DISPOSABLE INCOME, SELECTED YEARS 1929-75*

Year	Disposable Personal Income Per Capita	Expenditures For Food Per Capita	Percent Spent on Food	Consumer Price Index (1957-59 = 100)
	(current dollars)			
1929	684	160	23.4	59.7
1934	414	97	23.3	46.6
1939	537	120	22.3	48.4
1944	1,056	216	20.4	61.3
1949	1,264	300	23.8	83.0
1954	1,585	348	22.0	93.6
1959	1,905	386	20.3	101.5
1964	2,278	418	18.3	108.1
1969	3,111	540	17.3	127.4
1970	3,348	579	17.3	134.9
1971	3,588	589	16.4	140.7
1972	3,837	625	16.3	145.4
1973	4,286	698	16.3	154.4
1974	4,639	788	17.0	171.3
1975	5,060	866	17.1	187.0

*Data from USDA, ERS, Food Consumption, Prices, and Expenditures (AER 138, July 1968), pp. 165, 181 and ibid., Supplement for 1975 (Supplement to AER 138, January 1977), pp. 67, 77.

Consumer Expenditure Survey, carried out by the Bureau of Labor Statistics, reported the following breakdown (2, p. 21):

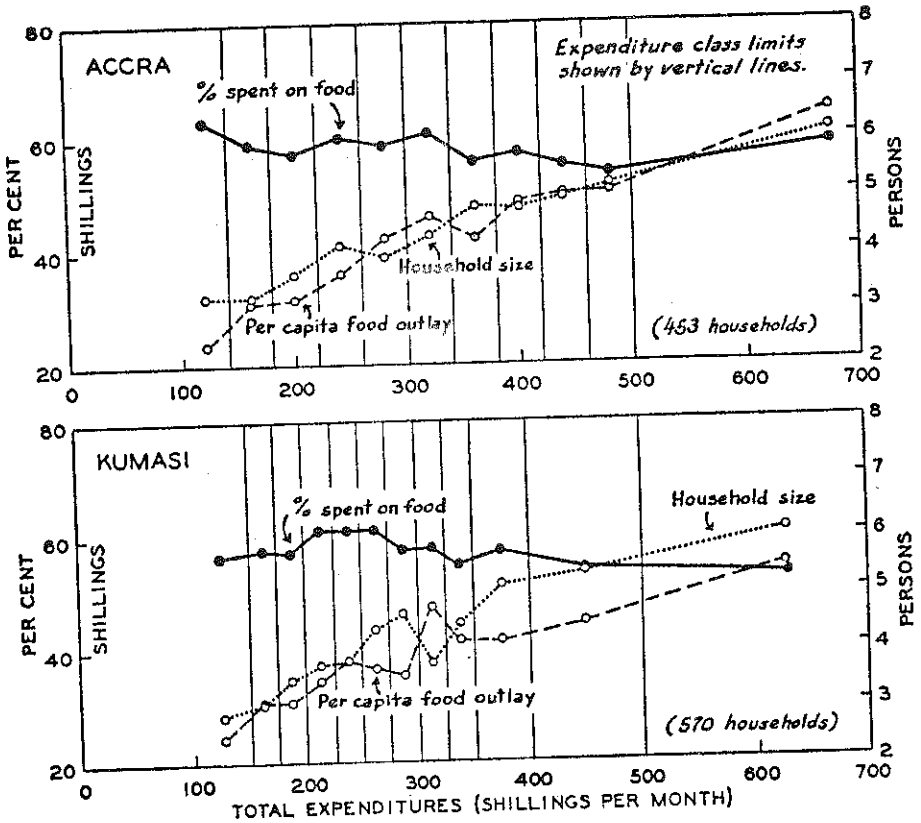
Income Class (dollars)	Percent Spent on Food
< 5,000	38.9
5,000-8,000	23.0
8,000-12,000	18.7
12,000-15,000	15.8
15,000-20,000	14.2
> 20,000	10.2

The operation of Engel's Law is frequently less evident in data for the developing countries. Thus surveys of household budgets conducted in Ghana's two largest cities, Accra and Kumasi, in 1953 and 1955, respectively, showed little change in the percent spent on food (Chart 5). The extreme observations are worth noting. In the lowest expenditure class[1/] observed in Accra, food absorbed 63 percent of all outlays, whereas in the highest class it accounted for 58 percent; in Kumasi the percentages were 56 and 53, respectively--all this among samples which embraced over a fivefold difference in total expenditures between the extreme classes.

Several factors account for this comparative constancy. One is that the survey samples usually do not cover the full income range; were the very rich included, the operation of Engel's Law would certainly be more evident. A second is that household income in developing countries tends to be positively related to family size. In Africa, especially, the concept of the household is such a broad one that it

1/ Since income is so difficult to estimate in LDCs, expenditure is commonly used as a surrogate and data analyzed by expenditure class rather than income class.

CHART 5. ACCRA (1953) AND KUMASI (1955): PERCENTAGE OF TOTAL HOUSEHOLD EXPENDITURES SPENT ON FOOD, PER CAPITA MONTHLY FOOD OUTLAYS, AND HOUSEHOLD SIZE, BY EXPENDITURE CLASS*

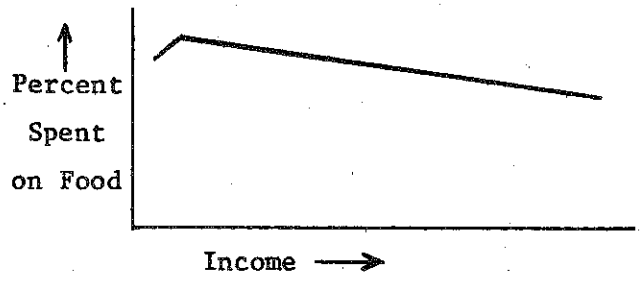


*Reproduced from T. T. Poleman, "The Food Economies of Urban Middle Africa: The Case of Ghana," Food Research Institute Studies, Vol. II, No. 2, May 1961, p. 145.

may encompass many adults, all of whom contribute to total receipts. As income rises, then, so often does the number of persons who must be housed, clothed, and fed. In the developed countries, of course, the case is just the opposite: there income is correlated inversely with family size.

A final factor underlying the frequent failure of Engel's Law to strongly manifest itself in developing countries is that per capita food outlays, particularly at the lower end of the income spectrum, can be quite responsive to increases in income. Again the data for Ghana in Chart 5 show this. This at-first-glance anomalous behavior becomes more reasonable when the perceptions of those who give over about two-thirds of their income to food are considered. If one's level of living is largely a reflection of the food one eats, what better way to indicate an improvement--to one's self and one's peers--than by increasing the quantity and quality of the diet?

Behavior of this sort can among the very poor provide the one exception to the universality of Engel's Law. A number of surveys have suggested that the abjectly poor--people near starvation--will use an increase in income first to enlarge food intake and that the full Engelian relationship in fact looks something like this:



The income level associated with the point of inflection is clearly an important threshold. Below it a family behaves as if it perceives itself to be inadequately nourished; beyond it as if food no longer posed the most pressing demand on income. Indeed this point on the income range was the original definition of the "poverty line." As an indicator of dietary adequacy, however, it is not without limitations. In urban areas particularly, such items of consumption as shelter and bus fares can, during the short term, take precedence over food as a claimant on income, and choices made by the family decision maker will not necessarily reflect the hierarchy of needs of all members. The latter point--that some in a household can be adequately nourished while others are not--is important and we will return to it.

Changes in Diet Composition and Bennett's Law

Although in physical appearance they may differ markedly, the diets of poor people the world over have a number of things in common. One is that a high proportion of the calories and a fair share of the protein will come from foods composed principally of starch. These "starchy staples" are the cereals and the starchy fruits, roots, and tubers. Depending on the staple, this dietary cornerstone will either be served steamed or boiled (as with rice and potatoes), as leavened (wheat) or unleavened (maize) bread, or as a doughy paste or stiff porridge (cassava, yams, and plantains). It will normally be accompanied by side dishes or sauces, which, in addition to adding flavor to an otherwise bland meal, will contribute considerable protein and the bulk of the fat, vitamins, and mineral content. A second characteristic of poor peoples' diets

is that the protein in these sauces and side dishes will tend to be more vegetable than animal in origin.

The diets of the poor are dominated by the starchy staples for a very simple reason--their cheapness, whether expressed in terms of market price or production cost. Far less land and less labor expense are typically needed to produce a thousand calories of energy value in the form of the starchy staples than in the form of any other foodstuff. Meat and vegetables by comparison are inefficient converters: vegetables because their caloric content is low; meat because an animal must be fed between three and ten pounds of grain for it to produce a pound of meat. But most people enjoy animal products and vegetables, and they turn away from the starchy staples as they become wealthier.

A simple way to rank diets is according to the percentage of total calories supplied by the starchy staples and a convenient way to record change is to monitor shifts in this starchy staple ratio. This is Bennett's Law--observed in the 1930s by M. K. Bennett, the pioneering student of world food economics: that the richer one becomes, the smaller becomes one's dependence on energy supplied by the cheap starchy staples.

Some national average starchy staple ratios suggested by FAO data for 1964-66 follow (3, pp. 85-125):

	Percent of Total Calories from Starchy Staples
China	78
Philippines	69
Haiti	65
Uganda	65
Sri Lanka	63
Singapore	52
Colombia	48
Argentina	41
Germany (West)	31
Switzerland	30
Canada	27

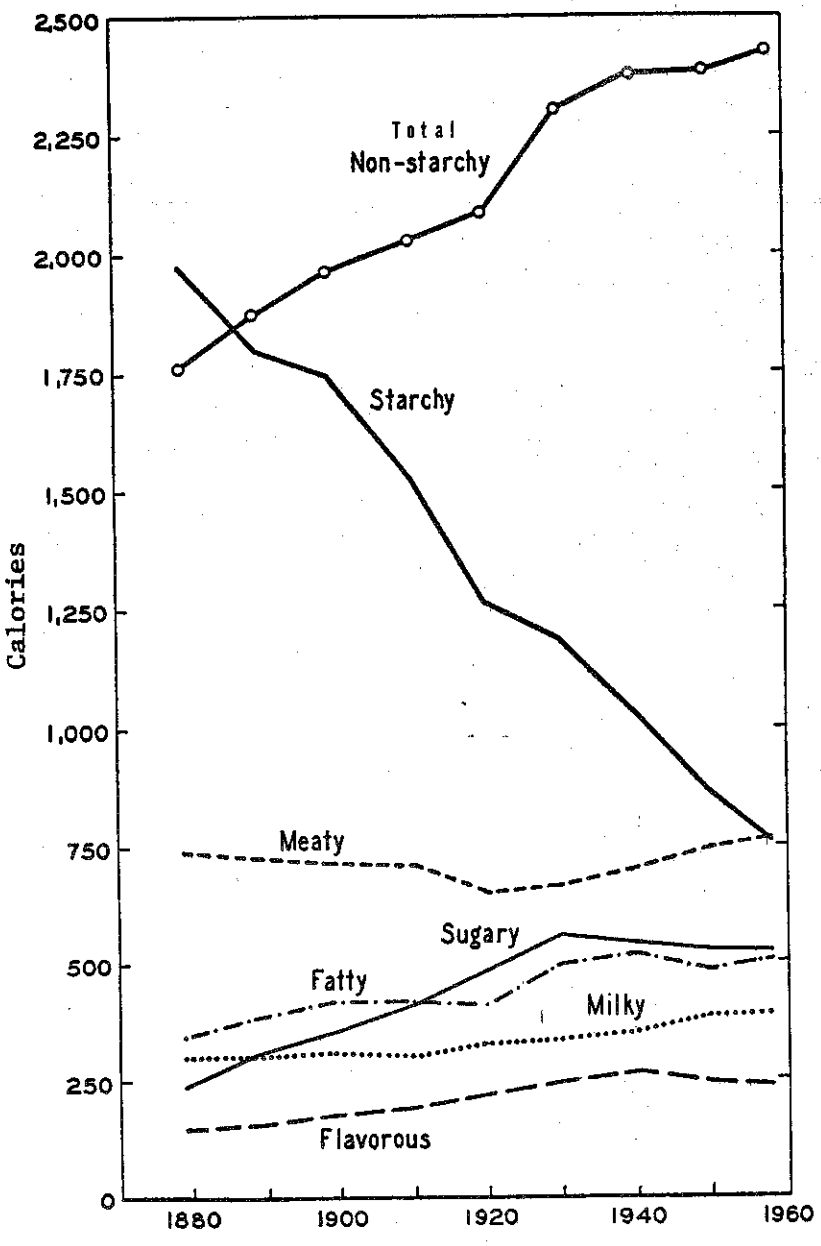
In the poorest countries the ratio can approach 80 percent, and 60-70 percent seems typical of most Asian and African LDCs. It is appreciably lower in most of Latin America. In Western Europe and North America the contribution of the starchy staples falls to between a quarter and a third of total energy availabilities.

The historical course of the starchy staple ratio in the United States is shown in Chart 6. It stood at 53 percent a hundred years ago, when our great-grandparents consumed large amounts of wheat flour, maize meal, and potatoes. Today our diets are dominated by meat, fats and oils, sugar, vegetables, and dairy products; and the starchy staple ratio has dropped to 24 percent. Total per capita caloric availabilities, incidentally, also dropped--from 3,750 calories per day in 1879 to under 3,200 in 1959--a reflection of the increasingly inactive character of our national life.

This dietary transformation took place gradually, but with very rapid economic growth the changes within a decade or so can be appreciable. Thus between the mid-1950s and the early 1970s real per capita income in Japan grew from the equivalent of less than $300 to over $1200 (Chart 7). This was attended by a rise in per capita energy availabilities of from 2100 to 2500 calories daily, and of protein from 60 to

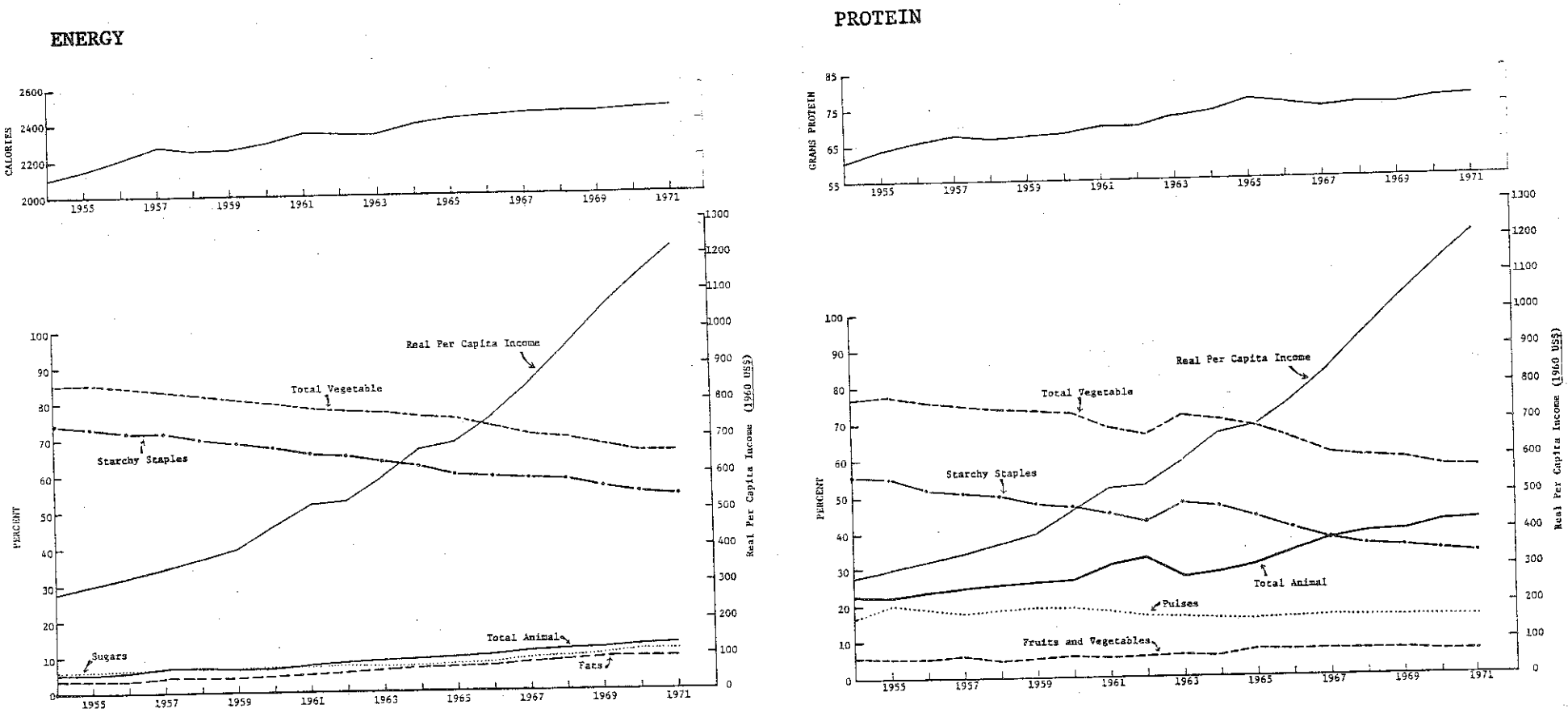
CHART 6. UNITED STATES: PER CAPITA DAILY ENERGY AVAILABILITIES DERIVED FROM BENNETT'S SIX MAJOR FOOD GROUPS, 1879-1959*

(Calories)



*Reproduced from M. K. Bennett and R. H. Peirce, "Change in the American Diet, 1879-1959," Food Research Institute Studies, Vol. II, No. 2, May 1961, p. 101.

CHART 7. JAPAN: PER CAPITA ENERGY AND PROTEIN AVAILABILITIES AND PROPORTION OF DIETARY ENERGY AND PROTEIN SUPPLIED BY SELECTED FOOD GROUPS, 1954-1972*



*Nutrient availabilities calculated from food balance sheets published in Japan, Min. of Agr. and Forestry, Abstract of Statistics on Agriculture, Forestry and Fisheries (various issues); income data are in terms of 1960 real value and are calculated from Japan, Bur. of Stat., Japan Statistical Yearbook 1967 and 1972, pp. 507 and 491 respectively.

almost 80 grams. But even more significant were the shifts in the contributions of the several food groups. The starchy staple ratio dropped from 75 to 55 percent, and proteins of animal origin rose from less than 25 percent of the total to almost half.

The course of dietary evolution which may be expected to accompany income is shown schematically in Chart 8. In addition to the decline in the caloric contribution of the starchy staples, the principal modifications are (4, pp. 1-3):

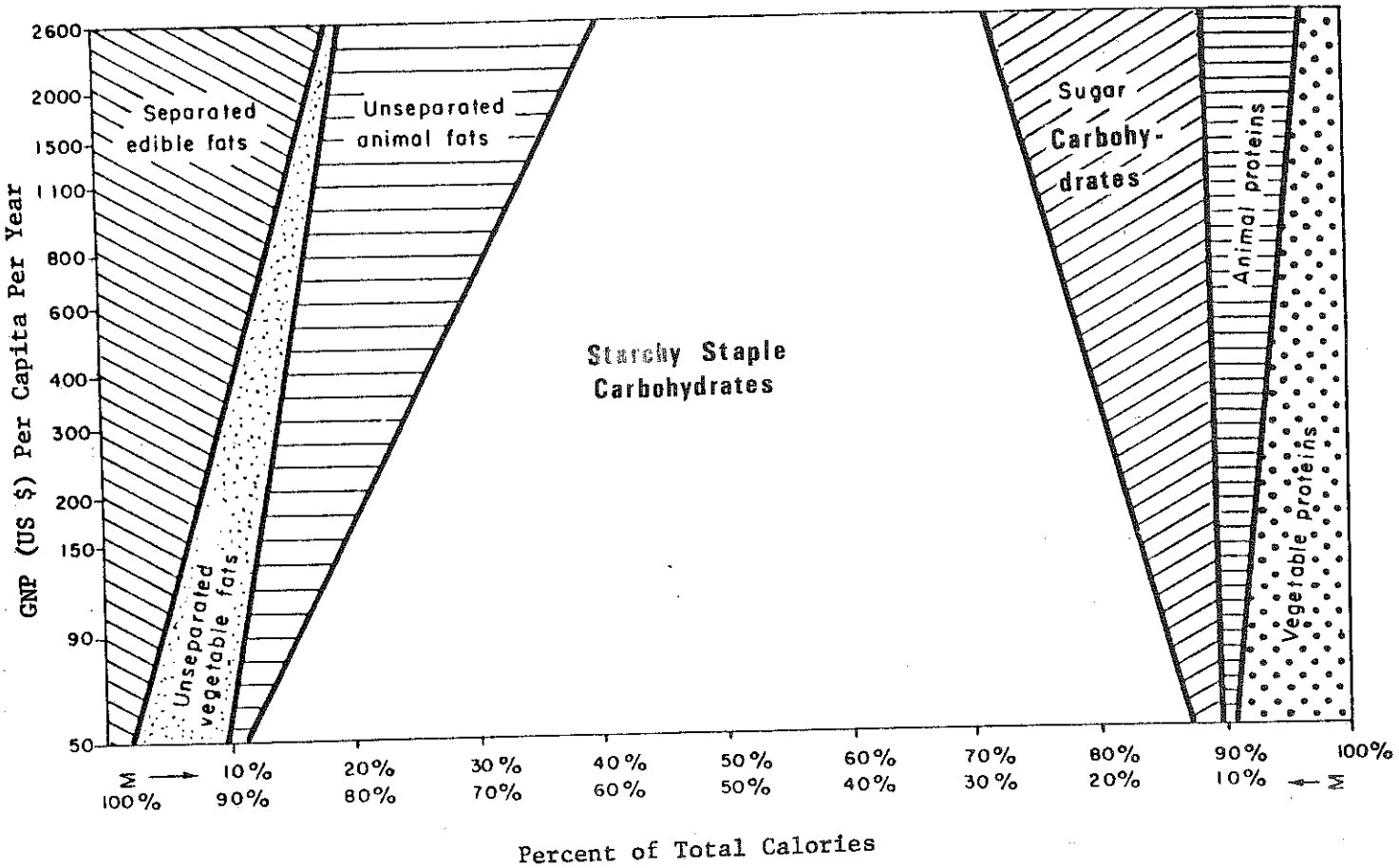
- The replacement of proteins of vegetable origin by those derived from animal products.
- A steep rise in the intake of separated fats (oils, butter, margarine, and the like) and of unseparated animal fats through increased consumption of meat, fish, and dairy products; and a reduction in the unseparated vegetable fats contained in the starchy staples.
- Increased consumption of sugar and sugar-sweetened foods.

The nutritional implications of this transformation are not always apparent. Generalizing from the experience of the United States, Bennett concluded that the effect on balance was minimal (5, p. 225):

> If all nations have a general sufficiency of food calories, the tendency for sugar to contribute an increasing fraction of total calories cannot be regarded as a positive improvement of nutritional status, for the sugar (if refined) contains nothing but food energy. The same may be said of that portion of the fats and oils which consist of purified items like lard, unfortified margarine, and most refined vegetable oils, and there can be little question that this fraction of total fats and oils increases in consumption as income rises. Again, the tendency for grains to decline in consumption with rise of income may not be favorable, especially if, as seems certain, there occurs simultaneously a drift away from lightly milled grains toward the highly milled; these tendencies would reduce availability of several water-soluble vitamins and of vegetable protein, although the important--and unanswerable--question would be be whether the reduction was from superabundance to abundance or from sufficiency to shortage. Against these presumptively unfavorable tendencies are to be set

CHART 8. THE EFFECT OF INCOME ON DIET SCHEMATIZED: PERCENT OF TOTAL CALORIES DERIVED FROM FATS, CARBOHYDRATES, AND PROTEINS, BY ANNUAL PER CAPITA GNP*

(Semi-logarithmic scale)



*Adapted from J. Périssé, F. Sizaret, and P. François, "The Effect of Income on the Structure of the Diet," (FAO) Nutrition Newsletter, Vol. 7, No. 3, July-Sept. 1969, p. 2.

> presumptively favorable ones: increase with income in consumption of animal protein with its associated mineral and vitamin content, and of those particular fats which, like butter, are carriers of fat-soluble vitamins.

The increased incidence of cardiovascular disease in developed countries has since Bennett wrote been linked to higher intakes of fat and sugar, and many now decry the lack of dietary bulk which is a direct consequence of a low starchy staple ratio. But the applicability to the developing world of his rather tempered conclusions as to the positive dietary effects of income is open to question. Both energy and protein availabilities were quite high in the United States a hundred years ago--much higher than in most of today's developing countries. For them the postwar Japanese case would seem more relevant. There, in addition to the expected changes in diet composition, a sharp increase in total protein availabilities occurred. That this change, coupled with higher intakes of fruits and vegetables (minimized in Chart 7 because of their low energy content), represented a net nutritional gain is strongly implied by the weights and heights attained by teenagers after the war. As Table 9 shows, they are markedly taller and heavier than their parents.

It would be gratifying if one could identify some threshold in the continuum of adjustment in the dietary contribution of the various food groups--say, a particular starchy staple ratio--as being indicative of behavior reflecting the absence of perceived nutritional deprivation. However, the Sri Lankan findings (Chart 4) are probably suggestive of what obtains in most developing countries: that only in the higher income classes will changes in the relative importance of

TABLE 9. HEIGHT AND WEIGHT OF JAPANESE TEENAGERS BORN BEFORE AND AFTER THE SECOND WORLD WAR*

		15-year-olds		
		Born 1933	Born 1948	Change
Male:	Weight	43.38 kg.	50.65 kg.	7.27 kg.
	Height	150.2 cm.	161.1 cm.	10.9 cm.
Female:	Weight	43.57 kg.	47.83 kg.	4.26 kg.
	Height	147.2 cm.	152.8 cm.	5.6 cm.

*Data from Japan, Ministry of Health and Welfare, Nutrition in Japan (1964), pp. 20, 22, 32.

the various food groups begin to manifest themselves strongly. At lower levels of income the principal dietary adjustments are more reasonably to be expected to take place within specific food groups.

Quality Adjustments Within the Food Groups

The sorts of quality adjustments that take place within the food groups as incomes rise are obvious. Less favored foodstuffs are replaced by those ranking higher in the preference hierarchy, and fancier cuts or grades replace the ordinary.

In the developed countries these adjustments are most apparent among the meats. Thus the following estimates of annual per capita consumption in the United States (6, p. 59; 7, p. 11):

	Pounds of retail cut equivalent		
	Beef	Pork	Lamb and Mutton
1930	39	62	6
1940	43	68	6
1950	50	64	4
1960	64	60	4
1970	84	62	3

Lamb and mutton are clearly perceived as inferior foods by Americans, whereas beef is preferred. The tender steak, of course, is savored by the wealthy, while the less fortunate make do with hamburger.

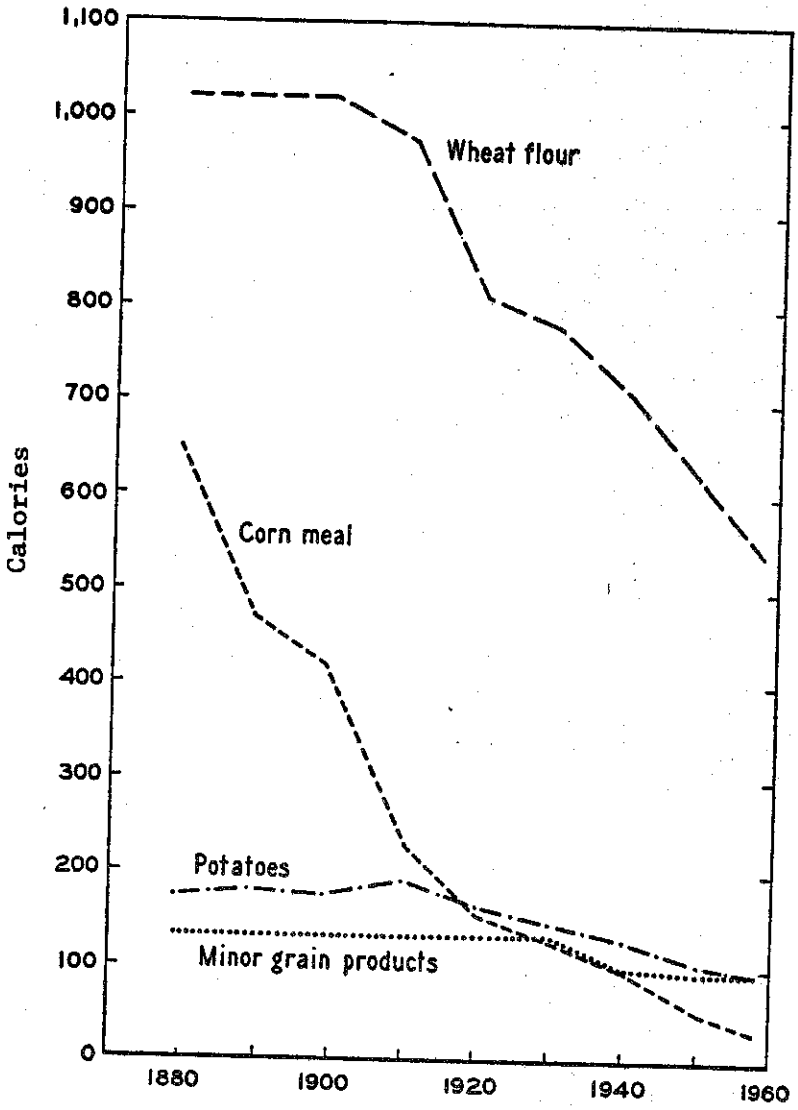
Over most of the income range in developing countries, on the other hand, the most important quality adjustments occur among the starchy staples and, to a lesser extent, among the pulses which are the principal suppliers of vegetable protein. Most LDC consumers are still too poor to demand more than the cheapest commodities in the other food groups. This behavior is consistent with what we know of

the evolution of Western diets. One of the first changes evident in 19th century Europe was the replacement of rye bread and potatoes by wheat products (8), and a shift away from maize meal (Chart 9) marked the onset of the transformation of the American diet.

If one were to seek a behavioral threshold suggestive of perceived nutritional adequacy, then, a prima facie case can best be made for the income level at which this type of substitution sets in.

CHART 9. UNITED STATES: PER CAPITA DAILY ENERGY AVAILABILITIES DERIVED FROM THE STARCHY STAPLES, 1879-1959*

(Calories)



*Reproduced from M. K. Bennett and R. H. Peirce, "Change in the American Diet, 1879-1959," Food Research Institute Studies, Vol. II, No. 2, May 1961, p. 103. Potatoes are both white and sweet, Minor grain products are milled rice, wheat cereal, corn cereal, cornstarch, hominy and grits, rye flour, buckwheat flour, oatmeal, and barley products.

CITATIONS

1 USDA, ERS, Food Consumption, Prices, and Expenditures: Supplement for 1971 (Supplement to AER 138, August 1972).

2 A. E. Gallo and W. T. Boehm, "Food Expenditures by Income Group," National Food Review (USDA, ESCS), June 1978.

3 FAO, Agricultural Commodity Projections, 1970-1980 (Rome, 1971, Vol. II).

4 J. Périssé, F. Sizaret, and P. François, "The Effect of Income on the Structure of the Diet," (FAO) Nutrition Newsletter, Vol. 7, No. 3, July-Sept. 1969.

5 M. K. Bennett, The World's Food (New York, 1954).

6 USDA, ERS, Food Consumption, Prices, and Expenditures (Agr. Econ. Report 138, July 1968).

7 USDA, ERS, Food Consumption, Prices, and Expenditures: Supplement for 1975 (Supplement to AER 138, July 1977).

8 M. K. Bennett, "Wheat in National Diets," Wheat Studies of the Food Research Institute, Vol. XVIII, No. 2, October 1941.

IV - INCOME AND DIET IN THE LDCs: ARE THERE MEANINGFUL THRESHOLDS?

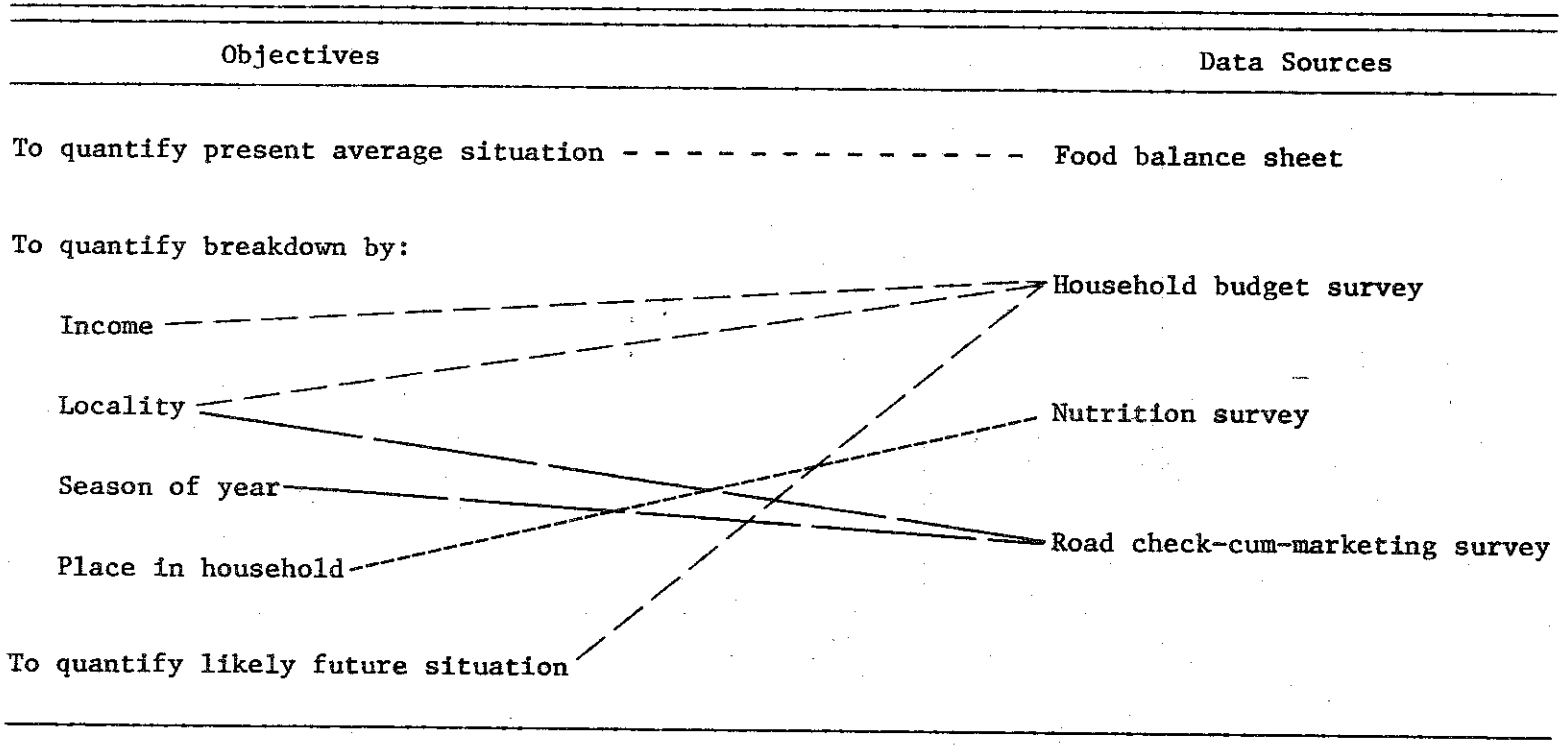
To search for behavioral thresholds to act as indicators of nutritional adequacy or deficiency has considerable appeal. If successful, it would enable us to skirt the question of requirements and the (arbitrary) designation of minimal needs. And it would permit us to dodge somewhat the consequences of our inability to accurately measure actual food intakes. Yet such thresholds, if identifiable, would clearly have their limitations. It is idle to pretend that people consciously seek to maximize nutritional well-being when they sit down to eat--although in fact they may do a fair job of it--and, to repeat, it would be an error to suppose that all members of a household share equally in budgetary decisions.

Nonetheless, the search would seem worth the effort--if only because other approaches have thus far led to so little.

National Food Accounting

Attempts to quantify food problems in developing countries have given rise to the singularly inexact art of national food accounting. Its aims and the data sources on which it draws are shown in Chart 10. We seek to attach numbers to the present average situation; to specify how this breaks down across the income range, from one locality to another, between seasons of the year, and among individual members of the household; and to anticipate the likely direction of these circumstances in the future. To this end we draw on four principal tools or

CHART 10. NATIONAL FOOD ACCOUNTING: OBJECTIVES AND DATA SOURCES



data sources: the food balance sheet, the household budget survey, the nutrition survey, and the road check-cum-marketing survey.

Food Balance Sheet. The food balance sheet is the chief tool for quantifying averages. We have seen that the figures it yields, average availabilities for human consumption, will reflect the sum of the errors of its components and that, because of the difficulties of measuring food production under conditions of economic underdevelopment, these errors are likely to be in the direction of understatement. The food balance sheet process, thrown into reverse, is also a convenient vehicle for relating the findings of sample surveys to the national scene.

Nutrition Survey. Ideally the nutrition survey would be the perfect instrument for measuring world nutritional problems. It seeks to record not only the foods actually consumed by the individual but to note the effect on physical well-being. But precisely because of the wealth of detail it collects, the findings of most nutritional surveys are of limited value to food accounting. The samples are typically tiny--skilled paramedical personnel are required as enumerators and each can monitor only a small number of subjects--and unrepresentative. If what they have told us of food behavior among soldiers, prisoners, and boarding school students could be extrapolated beyond these elements of society, the nutrition survey could provide much valuable evidence. As it is, the one vehicle we have for monitoring the individual has thus far not been particularly instructive.

Road Check-cum-Marketing Survey. Another type of survey whose potential has been but partially realized is the road check-cum-marketing survey. It focuses on the road or market and monitors quantities of food either passing a particular point or arriving at a particular

destination. Unlike the nutrition survey, it is quite efficient in its use of enumerators and can have either an entire country or region or city as its focus (Chart 11). Because it is usually carried out over an extended period, typically at least 12 months, it is especially useful for ascertaining the effect of season of the year on food availabilities.

Despite its many attractions and the fact that check points--for security as well as revenue purposes--are common in developing countries, the road check survey has been little used as a statistical tool. One reason, presumably, is that the truck one would like to stop is increasingly likely to be carrying contraband and the driver increasingly unwilling to cooperate.

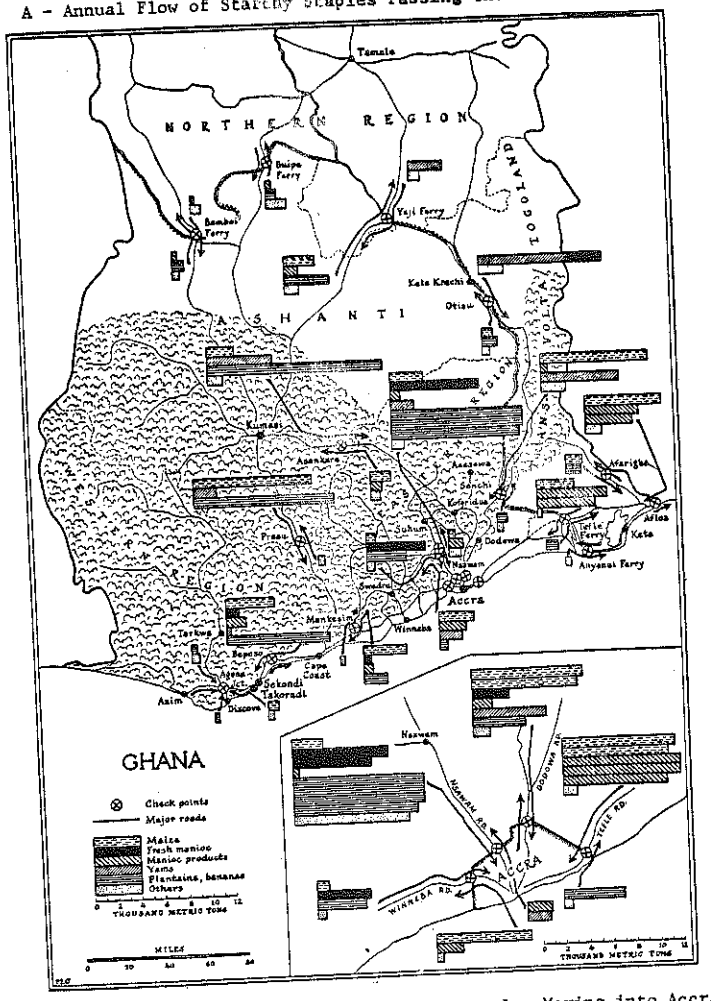
Household Budget Survey. Comparatively giant strides, on the other hand, have been made with the household budget survey. Once carried out chiefly to provide a system of weights for the components of cost-of-living indices for capital cities, the budget survey has come to be accepted in a number of countries as a prime tool for quantifying socioeconomic parameters. With recognition of its usefulness has also come expanded attention to the surveys' food component, so that they are now our principal source for insights not just into the effect of income and locality on food behavior but for the elasticity relationships needed to anticipate the future.

Testing and Interpreting the Household Budget Survey

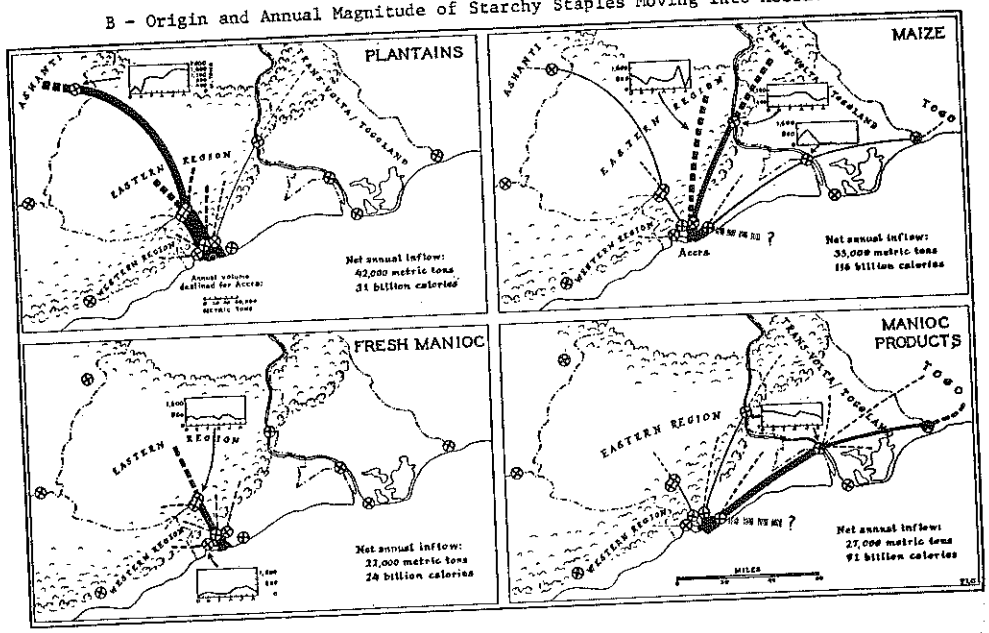
Because the budget survey covers only a small sample of a population, care must be taken in extrapolating its findings to the whole.

CHART 11. FINDINGS OF A ROAD CHECK SURVEY: GHANA, 1957/58*

A - Annual Flow of Starchy Staples Passing the Check Points:



B - Origin and Annual Magnitude of Starchy Staples Moving into Accra:



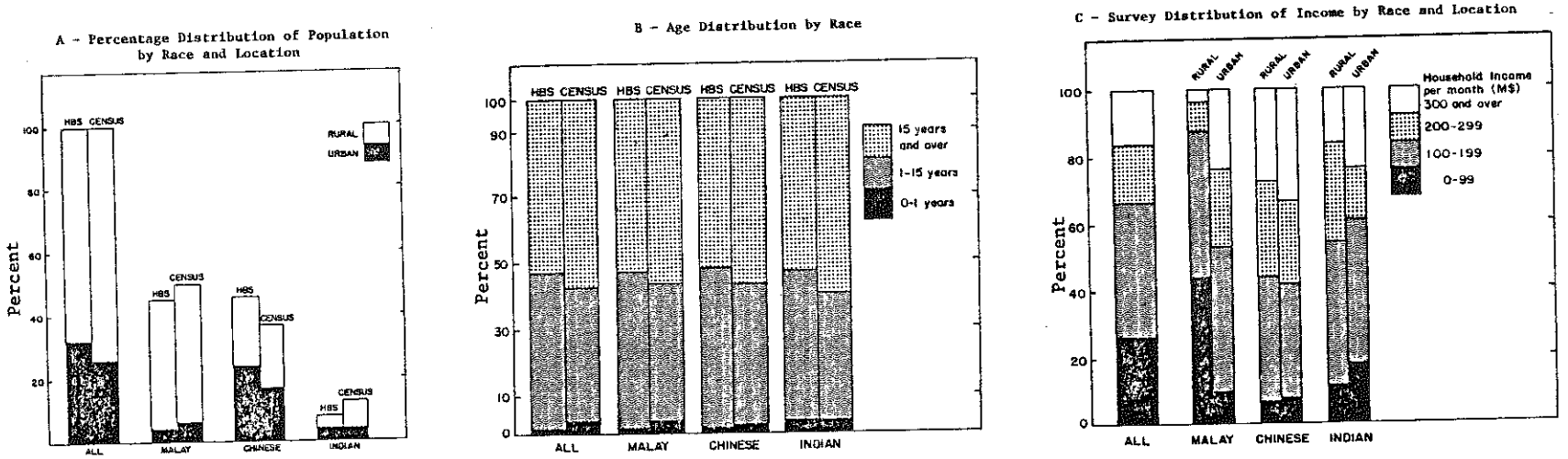
*Reproduced from T. T. Poleman, "The Food Economies of Urban Middle Africa: The Case of Ghana," Food Research Institute Studies, Vol. II, No. 2, May 1961, pp. 165, 168. Based on unpublished returns from the 1957/58 Ghana Produce Movement Census.

The first step in the analytical process must be a thorough examination of the manner in which the sample was drawn, how the data were collected, a comparision of the characteristics of the sample with those of the population it was designed to represent, and a preliminary assessment of the "reasonableness" of its findings. If the survey appears to have been conducted carefully, is fairly representative, and is internally consistent in the information it yields, then the findings can be extrapolated with a measure of confidence.

External Tests. The external tests most readily applied are those which compare the characteristics of the sample with those reported for the population as a whole in a recent census. Since food behavior can be heavily influenced by income, ethnicity, locality, and age/sex composition, we are particularly interested in these parameters. Chart 12, drawn from a comparison done 15 years ago between the 1957/58 Household Budget Survey of Malaya and the 1957 Census of Population, is suggestive of the process. Perfection in fit is neither required nor expected. Although the survey gave rather more representation to urban dwellers and the Chinese than was warranted by their importance in the population as a whole, we were gratified that the discrepancies were within a few percentage points. We were also gratified that age breakdown of the sample was similarly close to that reported in the census.

The most difficult of the external checks is determining the applicability of the sample's income coverage. To take the example of Malaya again, there were no data 15 years ago on the distribution of

CHART 12. THE EXTERNAL TESTS APPLIED: THE MALAYAN HOUSEHOLD BUDGET SURVEY (1957/58) COMPARED WITH THE POPULATION CENSUS (1957)*



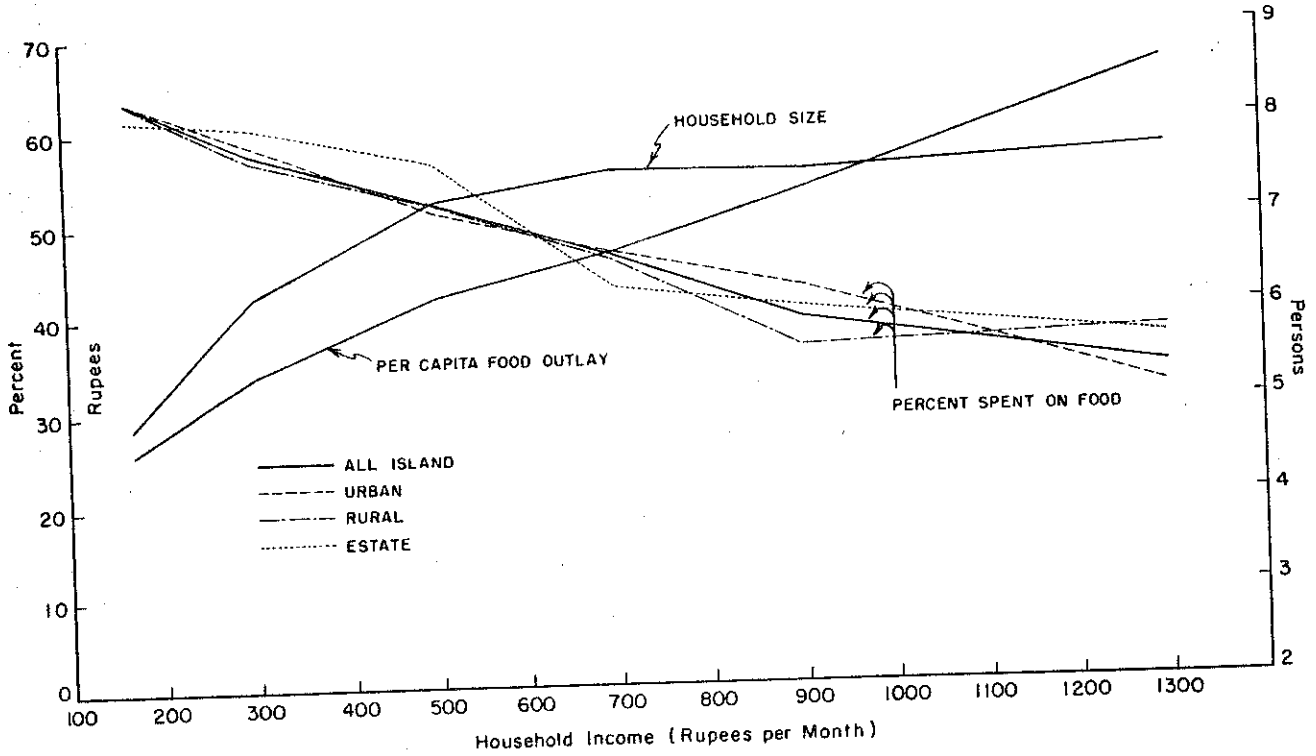
*Adapted from M. J. Purvis and T. T. Poleman, "Research Report on the Food Economy of Malaysia and Brunei" (Dept. Agric. Econ., Cornell Univ., May 1965, mimeo.), pp. 94, 97, 99.

income. However, the distribution by race and locality reported in the survey was consistent with the then folklore of the country--the urban Chinese having incomes on the average much higher than the rural Malays--and also, we were advised, with the findings of confidential market research studies carried out privately (1, p. 98).

Internal Tests. Once the degree to which a budget survey can be considered representative has been established, the next step in evaluating its usefulness is to apply a number of tests of internal consistency to the findings. Implied energy and protein consumption should fall within the realm of the possible and the behavioral changes expected across the income range should show some evidence of operation. Thus that the per capita nutrient availabilities reported for Sri Lanka (Chart 4) fell within reasonable bounds imparted confidence to the 1969/70 Socio-Economic Survey, as did the shift to the more expensive, preferred food groups which appeared toward the upper end of the income spectrum. Our faith in this survey was also strengthened by the extent to which Engel's Law could be seen to be operating (Chart 13). Had these tendencies not been evident or had daily energy availabilities been below (say) 1,500 calories or much above 3,000, on the other hand, our inclination to trust the survey further would have been impaired.

Interpreting the Traditional Budget Survey. The great majority of budget surveys done in developing countries have been carried out for cost-of-living index purposes, have covered a brief period--usually a week, but sometimes as much as a month--and have been restricted to a small segment of the population. Titles such as The Pattern of Income,

CHART 13. SRI LANKA, 1969/70: PERCENTAGE OF TOTAL HOUSEHOLD EXPENDITURES SPENT ON FOOD, PER CAPITA MONTHLY FOOD OUTLAYS, AND HOUSEHOLD SIZE, BY INCOME CLASS*



*Reproduced from T. T. Poleman, Income and Food Consumption: Report to the Government of Sri Lanka (FAO/UNDP, No. TA 3198, Rome, 1973), p. 16. Based on data from Sri Lanka, Dept. of Census and Statistics, Socio-Economic Survey of Sri Lanka, 1969/70, Special Report on Food and Nutrition Levels in Sri Lanka (1972).

Expenditure and Consumption of African Middle Income Workers in Nairobi, July 1963 and Report on Enquiries into the Income and Expenditure Pattern of Wage-Earner Households in Kaduna - Zaria, 1955-56 are both typical as well as suggestive of coverage.[1/] These "traditional" surveys have not, by and large, lent themselves to tidy analysis by food economists.

The problems with them are many. The enumerator is invariably presumed to have links with the tax collector and entire samples invariably report spending more than they say they earn. Analysis, therefore, is best done by expenditure, not income, class. This need not introduce serious distortions in urban contexts, but it is nonetheless not what we seek. Where it becomes truly troublesome is in the countryside, where so much of income is in kind and values and quantities must be imputed.

If there is any consistent bias to the findings of budget surveys, it is in the direction of understatement of consumption. Things tend to be forgotten--between meal snacks and cooking oils, for instance--and items of consumption which are nontraditional in the Western sense--insects, game, leaves, and the like--can be ommitted from questionnaires entirely. The magnitude of understatement will vary from survey to survey and there are no convenient rules of thumb. We may safely assume that consumption of alcohol is underreported, but by how much is just about anybody's guess. We can only compare the survey's findings with what food balance sheet availabilities--themselves an understatement--suggest is average consumption.

1/ An excellent series of household budget survey (and nutrition survey) bibliographies has been issued by the Food Policy and Nutrition Division of FAO: 2, 3, 4, and 5. This series summarizes the coverage of the surveys and the breakdowns by which the findings are tabulated. A companion series issued by the Statistics Division--6, 7, and 8--gives greater detail on the effect of income reported in some of the more important surveys.

But the most bothersome problems in survey interpretation devolve from the fact that household budget surveys have traditionally collected information not on quantities purchased, but on expenditures for them. Where quality considerations do not enter into the choice of foods consumed in differing income classes, it is a relatively simple matter to infer quantities from expenditure data by applying standard price estimates. Unhappily the circumstances under which quality will not vary are few, and attempts to infer quantities from expenditures can produce nonsense results.

For example, a survey covering some 7,080 households was conducted in the northern two-thirds of the Sudan in 1967-68 (9). Information on food expenditures was collected, but not on quantities purchased. Standard price data for the country applied to expenditures for the lowest (less than Sudan £200 per annum) and highest (more than Sudan £500) income classes yield the following apparent intakes of energy (10):

	Apparent per capita daily caloric availabilities	
	Lowest Class	Highest Class
Starchy staples	1,470	3,530
Vegetable fats and oils	115	273
Sugars	153	550
Pulses	27	180
Meat, poultry, and dairy products	118	692
Others	20	152
TOTAL	1,903	5,377

Availabilities of 1,903 calories are not unreasonable for the poorest class, but 5,377 for the wealthiest is impossibly high.

Attempts to derive quantity estimates from expenditure data have led to more than just errors of this type. Yet another mistake has been to calculate expenditure elasticities and assume they are reasonable proxies

for the quantity relationship. For some commodities--salt, perhaps--they may be, but for most food items consumed in developing countries the quality gradation can be bewilderingly complex. Quantity elasticities (or calorie-income elasticities) derived from expenditure data will almost invariably overstate reality by a substantial margin.

In this circumstance, about the only legitimate inferences which may be drawn from expenditure data are the sorts of simple ones illustrated in Chart 14. We note that the relative importance of the various food groups changes as we move across the income range and that so too do relative expenditures on some individual commodities within the groups. But to infer more than this, data on the actual quantities purchased are needed. Fortunately a few recent surveys have had the collection of such quantity figures among their principal objectives.

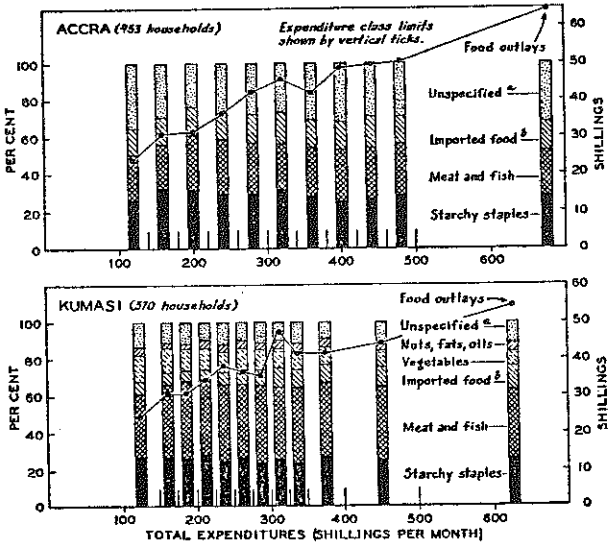
Behavioral Thresholds and the New Type Household Budget Survey

The new type budget survey differs from the traditional form not just in that information on food quantities as well as expenditure is collected. The coverage is invariably broader; in most the focus is on the nation as a whole, rather than on a segment of society. Because background information on socio-economic status is also gathered, the new type survey offers an ideal vehicle for identifying behavioral thresholds of perceived dietary adequacy.

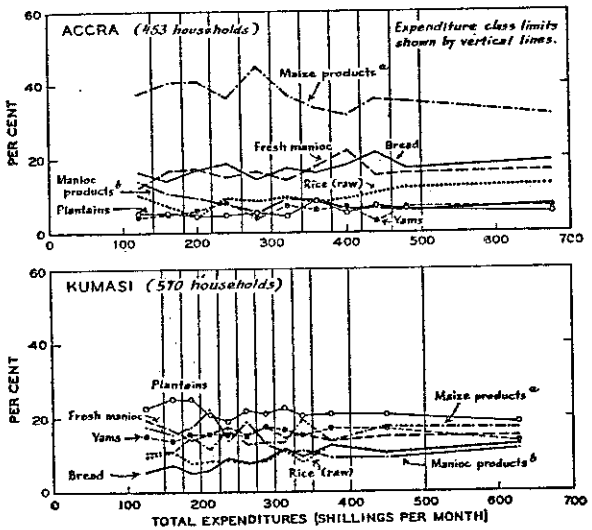
To test the viability of the behavioral threshold approach, examination of five recent budget surveys was begun at the same time as the body of this report was being drafted. The preliminary reports of the three analysts involved have been submitted separately (10, 11, 12, 13, and 14). The countries covered are Sudan, Sri Lanka, Bangladesh, Indonesia, and Brazil. This selection was based in part on a preliminary

CHART 14. ANALYSIS BY EXPENDITURE CLASS OF FOOD BEHAVIOR REPORTED IN TWO TRADITIONAL (EXPENDITURES ONLY) HOUSEHOLD BUDGET SURVEYS: ACCRA (1953) AND KUMASI (1955), GHANA*

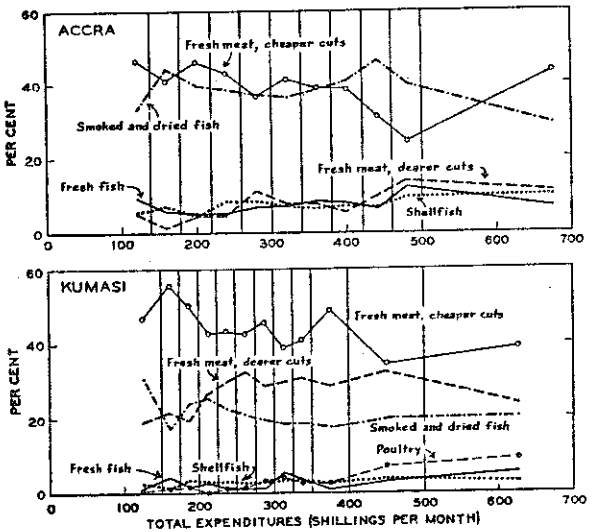
A - Per Capita Monthly Food Outlays and Percentage Breakdown of Food Expenditures by Food Group:



B - Expenditures for Selected Starchy Staples as a Percentage of Total Outlays for These Items:



C - Expenditures for Selected Meat and Fish Products as a Percentage of Total Outlays for these Items:



[a] Kenkey and dough.
[b] Gari and kokonte.
[c] Kokonte.

*Reproduced from T. T. Poleman, "The Food Economies of Urban Middle Africa: The Case of Ghana," Food Research Institute Studies, Vol. II, No. 2, May 1961, pp. 155-57. Positioning of data for extreme expenditure classes reflects actual average expenditures; for other classes the mid-point.

judgment of the quality of the several surveys known to be available in Washington in June 1979, in part on the significance of the countries to the world food drama, and in part on what it was believed the analysts could learn from evaluating the particular survey. The intent was for them to learn the techniques of survey analysis as well as to test the legitimacy of the behavioral threshold approach.

With one exception all of the surveys are of the new type. While the coverage of the Sudan survey was broad, it did not include data on food quantities. The analyst's discovery that quantities imputed from expenditures yielded nonsense results has been noted above and I will dwell on it no further. For her it was a learning experience (10) and others should profit from it.

The following discussion of the other surveys is not intended to duplicate the reports of the analysts, but to point up my conclusions as to the bearing their findings have on the merits and problems of seeking out behavioral thresholds.

Sri Lanka: The 1969/70 Socio-Economic Survey (11). The Socio-Economic Survey of Sri Lanka has already been subjected to considerable analysis. The work of Mr. Tabor and Ms. Weingarten broke new ground, however, in that it evaluated a three-way breakdown of the under-Rs. 200 income class that has recently become available and in that the threshold question was examined. The analysts deserve recognition for the quality of their work.

In Latin America, Africa, and the Near East there is a clear hierarchy of preference among the starchy staple foods, substitution among which would be our most commonly expected behavioral indicator

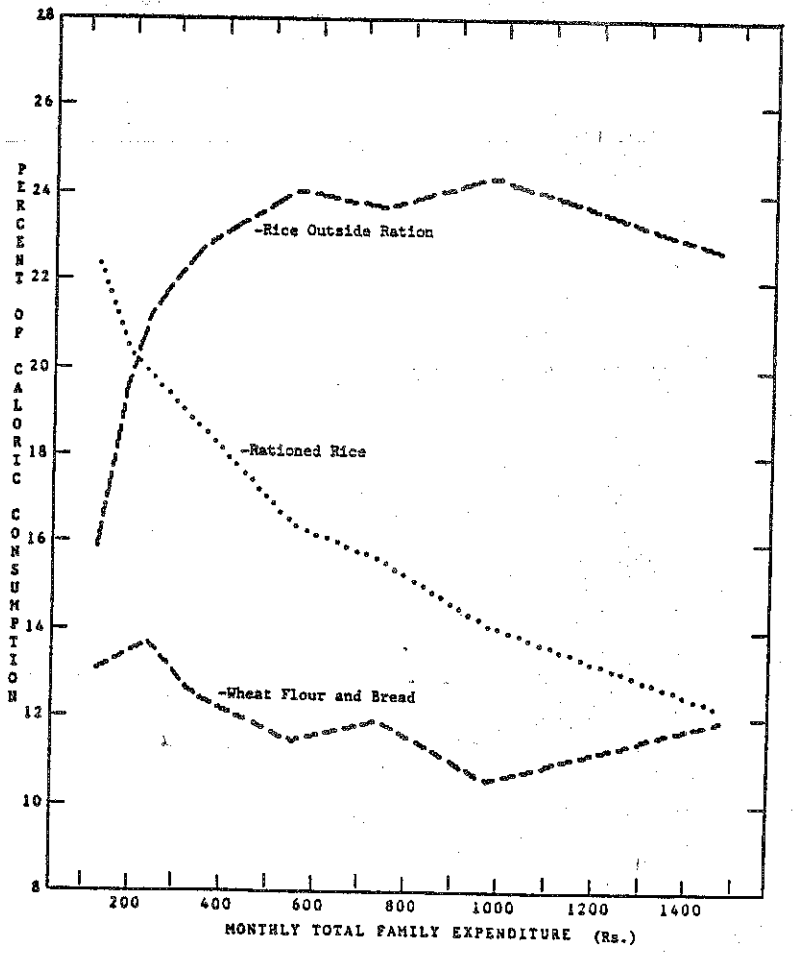
of perceived dietary adequacy. At the top of the hierarchy are wheat products and rice; at the bottom cassava; maize, yams, sweet potatoes occupy intermediary positions. The exact position of the commodities will vary from country to country and even within a country. To seek behavioral thresholds without knowing the hierarchy as perceived by a particular group of a population could clearly lead to incorrect judgments. But as most such preferences are well known, the problem is typically not a major one. Identifying the shifts should be comparatively simple as well, since the substitution will be of one commodity for another.

In parts of South and Southeast Asia, on the other hand, this will not be the case. There rice is all pervasive and much of such substitution as takes place in the staple food category is not between different commodities but between rice of various qualities. Identifying this type of substitution from survey data will not be easy.

Ideally, of course, one would like quality of rice to be specified in the survey, and to some extent this obtained in the Sri Lanka survey. Rice has long been "rationed" in Sri Lanka; that is, virtually all the population has been entitled to a weekly quantity either free or at a subsidized price. In 1969/70 this amounted to two pounds free per capita, or the equivalent of about 475 calories per day. While obviously a better "buy" than free-market rice, the quality of the rationed product is not rated as high. Substitution would therefore be expected to take place as one moves up the income spectrum.

Precisely this sort of substitution would seem to be illustrated in Chart 15, which shows unrationed rice growing in importance with

*CHART 15. RATIONED AND NONRATIONED RICE AND WHEAT FLOUR AND BREAD AS CONTRIBUTORS TO APPARENT PER CAPITA DAILY ENERGY CONSUMPTION, SRI LANKA, 1969/70, BY INCOME CLASS**



**Steve Tabor and Linda Weingarten, "Report on the 1969/70 Socio-Economic Survey of Sri Lanka" (unpublished working paper, USDA, ESCS, August 1969), p. 13.*

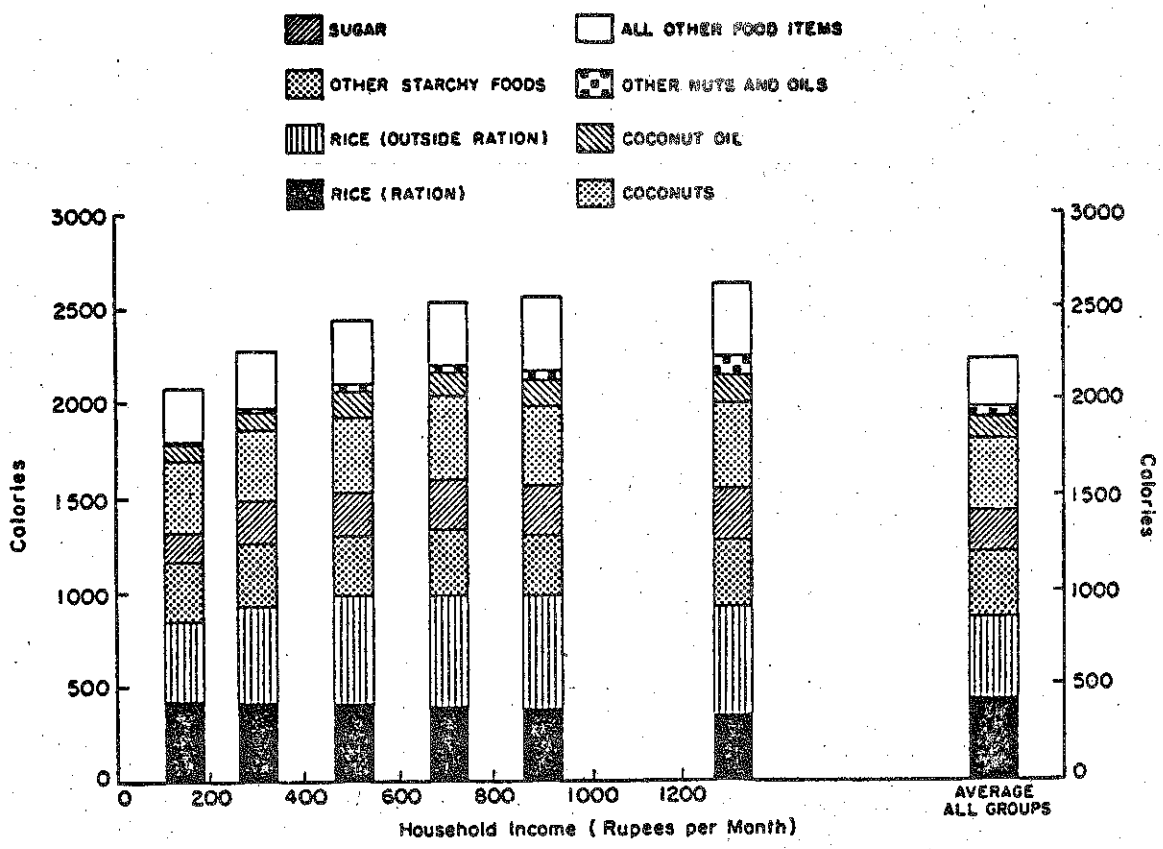
income. But that this does not reflect true substitution is brought out in Chart 16. Only in the highest income class did people begin not to trouble (or not to trouble their servants) to pick up their ration. Nonration purchases were not "in substitution for," but "in addition to."

That the threshold approach is of limited value when applied to the 1969/70 Socio-Economic Survey should not, I think, be taken as particularly damning to the methodology. The free ration is so distorting to expected food behavior at the lower end of the income range that one would be surprised if thresholds among the staples could be spotted. A secondary problem may arise from the very real possibility that in 1969/70 few if any <u>families</u> in Sri Lanka had insufficient access to dietary adequacy.

<u>Bangladesh: The 1973/74 Household Expenditure Survey (12)</u>. Ms. Goodloe's and Mr. Tabor's analysis indicates that this survey should be interpreted with caution. In particular, the findings imply unreasonably low energy consumption for the four lowest income classes: 882, 1,206, 1,166, and 1,367 calories respectively per capita per day. These classes represent ten percent of the population.

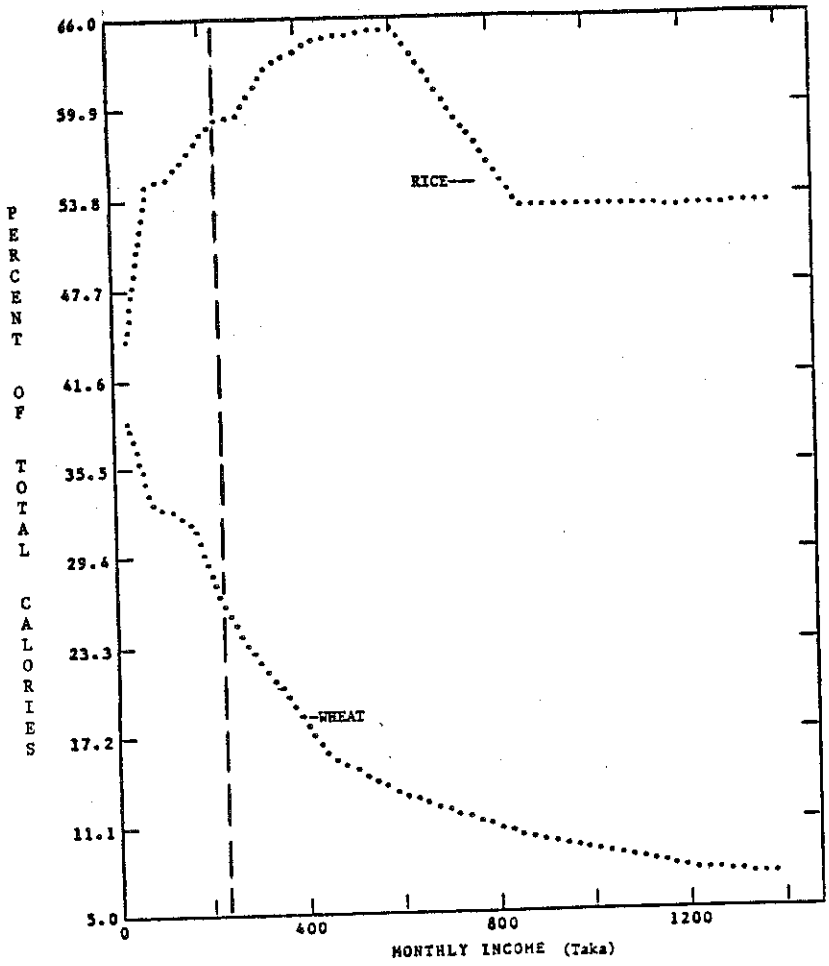
When confronted with unreasonably low estimates of apparent consumption, the temptation is to assume underreporting throughout the survey and to inflate the figures by a standard percentage to make all look acceptable. This should be avoided. There are often sound reasons for underreporting among the very poor: these groups frequently function outside the commercial economy and depend on foods which are not easily recorded. Rather than inflate the results for them, a better practice is to exclude them from further analysis. Thus in Chart 17 it would

*CHART 16. APPARENT PER CAPITA DAILY ENERGY AVAILABILITIES (EMPHASIZING RATION AND NONRATION RICE) IN SRI LANKA, 1969/70, BY INCOME CLASS**



*Reproduced from T. T. Poleman, Income and Food Consumption: Report to the Government of Sri Lanka (FAO/UNDP, No. TA 3198, Rome, 1973), p. 17.

CHART 17. RICE AND WHEAT AS CONTRIBUTORS TO APPARENT PER CAPITA ENERGY CONSUMPTION, BANGLADESH, 1973/74, BY INCOME CLASS*



*Carol Goodloe and Steve Tabor, "Report on the 1973/74 Household Expenditure Survey of Bangladesh" (unpublished working paper, USDA, ESCS, August 1979), p. 16.

be mistaken to conclude that the apparent substitution of rice for wheat among the income classes to the left of the dotted line is indicative of threshold behavior.

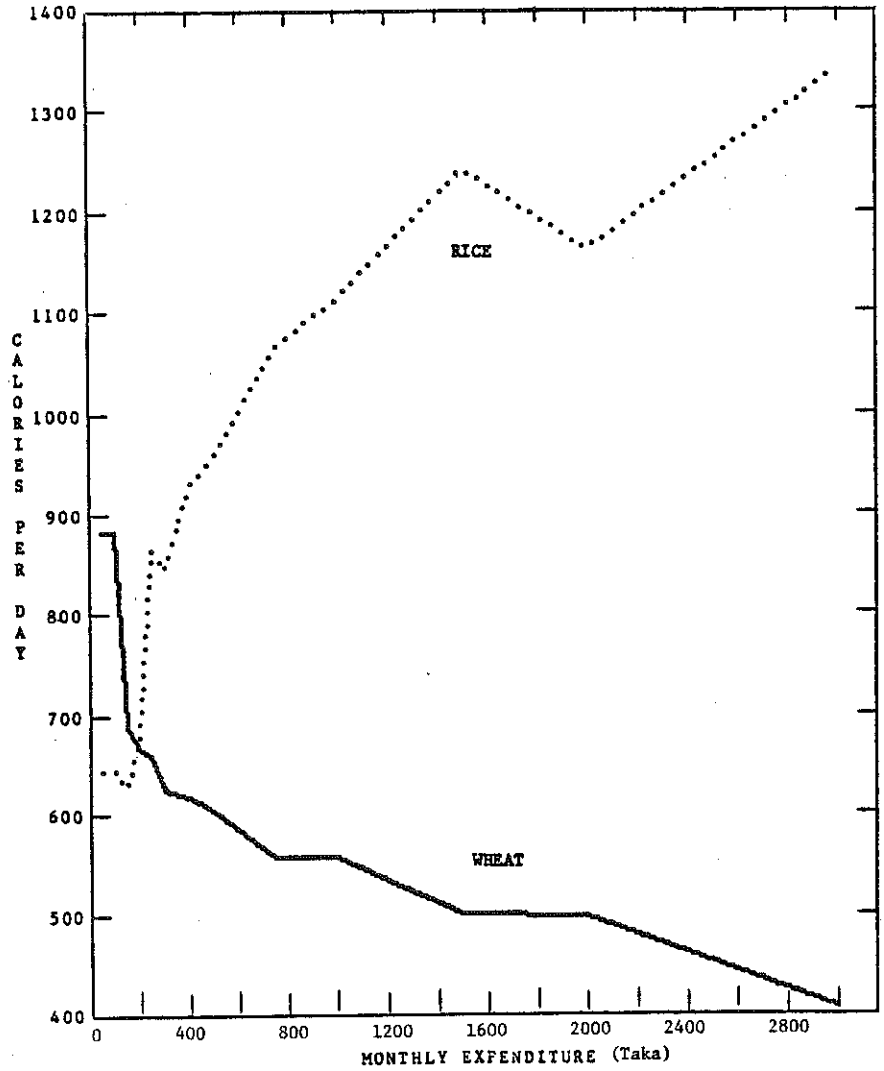
It would also probably be inappropriate to infer much from the apparent substitution to the right of the line, since the data are for Bangladesh as a whole, and differences exist between the urban and rural parts of the country that effect food behavior. The most important of these is the statutory ration, by means of which the largest cities--but not the countryside--are supplied with wheat and rice at subsidized prices. A substantial portion of the ration takes the form of wheat, which is imported on concessional terms from abroad and which occupies a place well below rice in the preference hierarchy.

Chart 18 shows the relationship between wheat and rice in urban Bangladesh. Substitution occurs even among the lowest income classes. As energy intake levels are reasonable even at the lowest level, this points to behavior indicative of perceived dietary adequacy throughout the income spectrum.

Similar analysis, unfortuantely, is not possible for the rural areas. There apparent underreporting of food consumption in the lowest classes was simply too great and the role of wheat too minimal to permit observation of significant substitution (Chart 19).

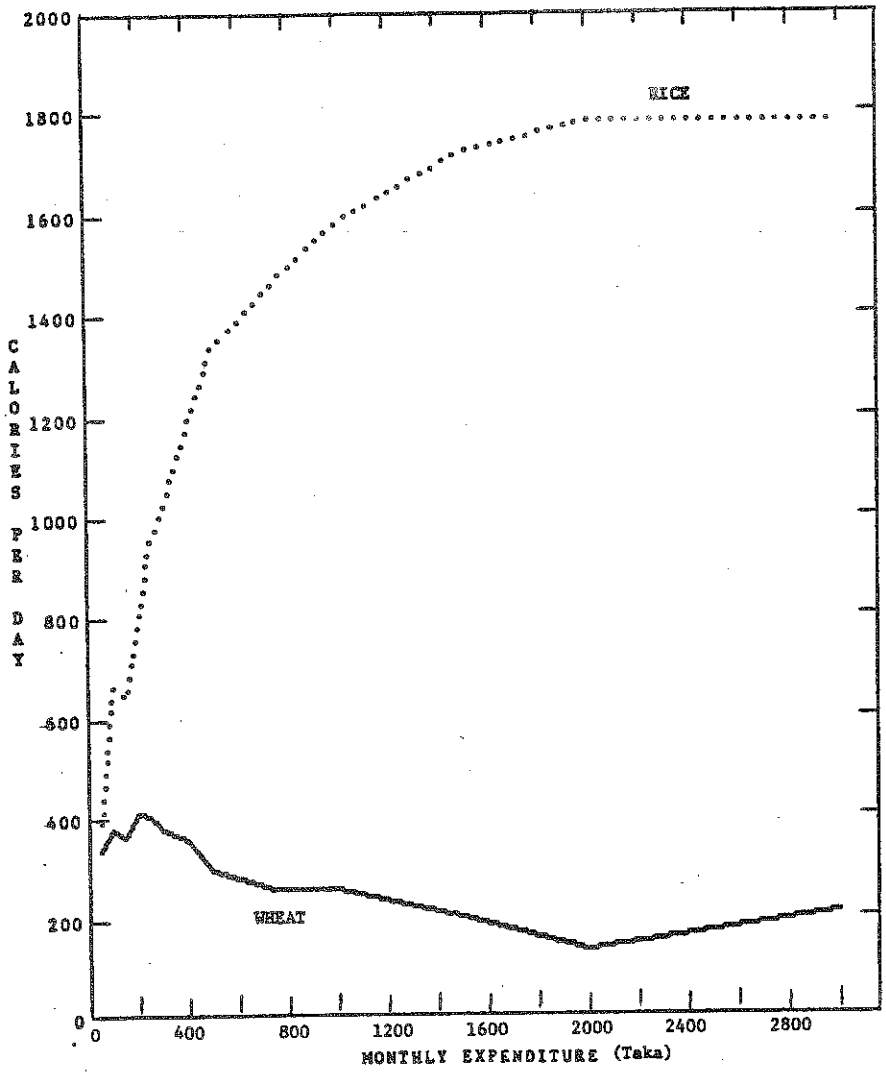
One final comment about threshold behavior in Bangladesh. Chart 20 reveals an interesting relationship between rice and chicken as protein sources. Both are clearly preferred foods, the consumption of which tends to increase at the expense of something else with early rises in income. Farther up the spectrum, as rice consumption approaches satiation, chicken surpasses it as a source of protein. The point where

*CHART 18. APPARENT PER CAPITA DAILY ENERGY AVAILABILITIES FROM RICE AND WHEAT IN URBAN BANGLADESH, 1973/74, BY INCOME CLASS**



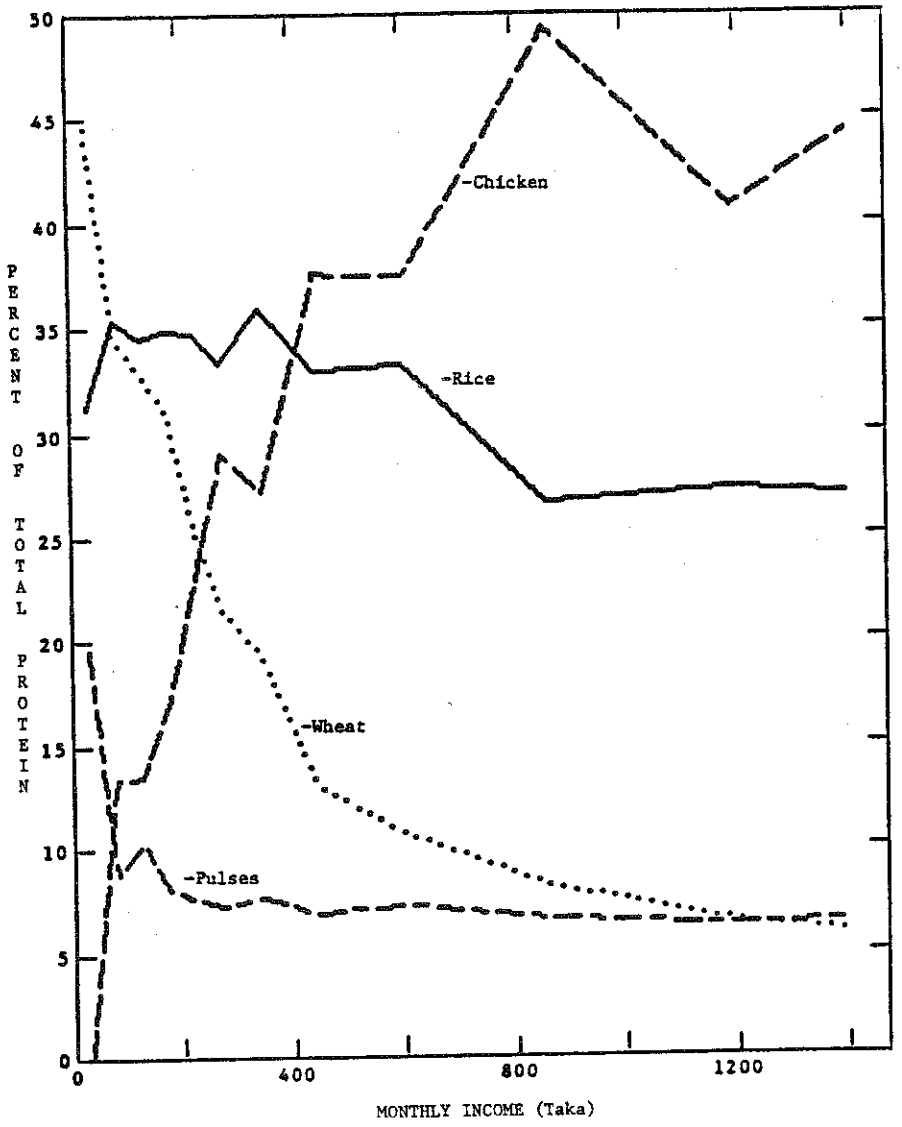
*Carol Goodloe and Steve Tabor, "Report on the 1973/74 Household Expenditure Survey of Bangladesh" (unpublished working paper, USDA, ESCS, August 1979), p. 28.

*CHART 19. APPARENT PER CAPITA DAILY ENERGY AVAILABILITIES FROM RICE AND WHEAT IN RURAL BANGLADESH, 1973/74, BY INCOME CLASS**



*Carol Goodloe and Steve Tabor, "Report on the 1973/74 Household Expenditure Survey of Bangladesh" (unpublished working paper, USDA, ESCS, August 1979), p. 29.

*CHART 20. RICE, WHEAT, CHICKEN, AND PULSES AS CONTRIBUTORS TO APPARENT PER CAPITA PROTEIN CONSUMPTION, BANGLADESH, 1973/74, BY INCOME CLASS**



*Carol Goodloe and Steve Tabor, "Report on the 1973/74 Household Expenditure Survey of Bangladesh" (unpublished working paper, USDA, ESCS, August 1979), p. 20.

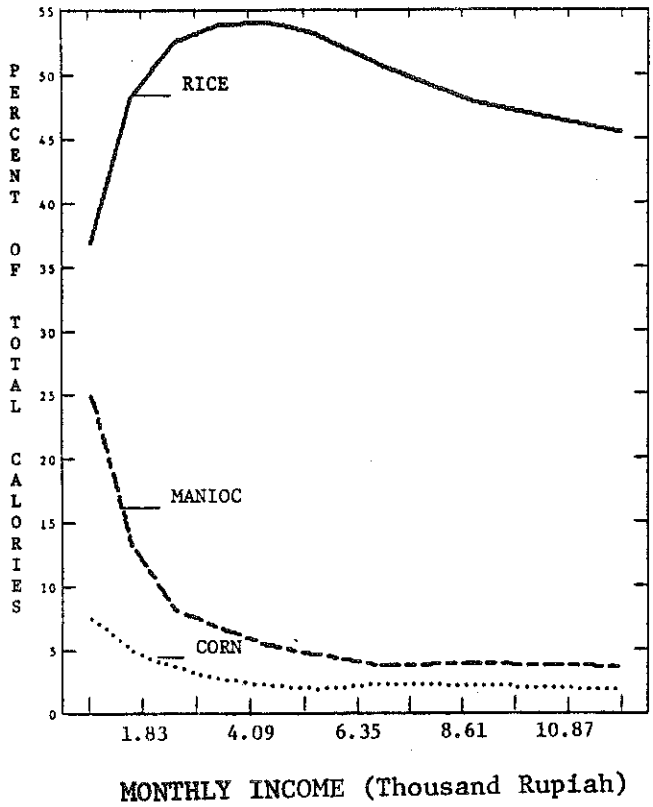
protein from starchy staple sources is replaced by protein of animal origin is a clear indicator of perceived dietary adequacy.

Indonesia: The Fifth National Socio-Economic Survey--1976 (13). Mr. Tabor's analysis indicates that underreporting of apparent food consumption in the lowest income classes also limits the usefulness of SUSENAS V, the fifth and most recent of the National Socio-Economic Surveys conducted in Indonesia. The lowest two classes, representing 16 percent of the population, reported apparent energy intakes of 692 and 1,288 calories per capita per day, respectively, obviously too little.

Substitution between rice, the preferred staple, and maize and cassava, the less preferred, is clearly evident in Chart 21. However, even if the lower two classes are omitted, the chart may incorrectly mirror threshold behavior. This is because the data are for all of Indonesia and the contribution of the three starchy staples varies regionally. Rice is all pervasive in East Java, Bali, South Sulawesi, and portions of Sumatra. Elsewhere in Sumatra and in most of the other "outer islands" cassava and maize play a larger role. In West and Central Java all three are significant. If threshold behavior is to be accurately identified, then, the evidence must be evaluated regionally. Given the importance of Indonesia to the world hunger question, it is recommended that such a regional evaluation be assigned priority by the USDA.

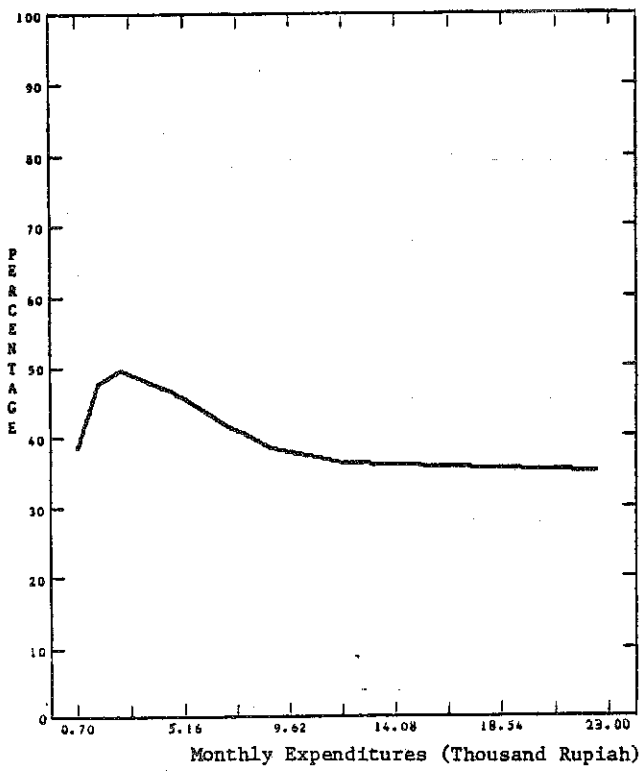
Chart 22 suggests the rice/protein relationship observed in Bangladesh is also operative in Indonesia. The legitimacy of this relationship as a threshold indicator warrants further examination. This should be explored, of course, regionally.

*CHART 21. RICE, CASSAVA, AND MAIZE AS CONTRIBUTORS TO APPARENT PER CAPITA ENERGY CONSUMPTION, INDONESIA, 1976, BY INCOME CLASS**



**Steve Tabor, "Report on the SUSENAS V Survey, 1976" (unpublished working paper, USDA, ESCS, August 1979), p. 23.*

*CHART 22. RICE AS A CONTRIBUTOR TO APPARENT PER CAPITA PROTEIN CONSUMPTION, INDONESIA, 1976, BY INCOME CLASS**



**Steve Tabor, "Report on the SUSENAS V Survey, 1976" (unpublished working paper, USDA, ESCS, August 1979), p. 26.*

Brazil: The 1974/75 National Expenditure Survey (14). As Mr. Tabor's analysis indicates, the Brazilian National Expenditure Survey is one of the most ambitious surveys so far conducted. The approach to collecting data on food consumption may be considered "state of the art," and anthropometric information was collected by means of which nutritional status could be inferred.

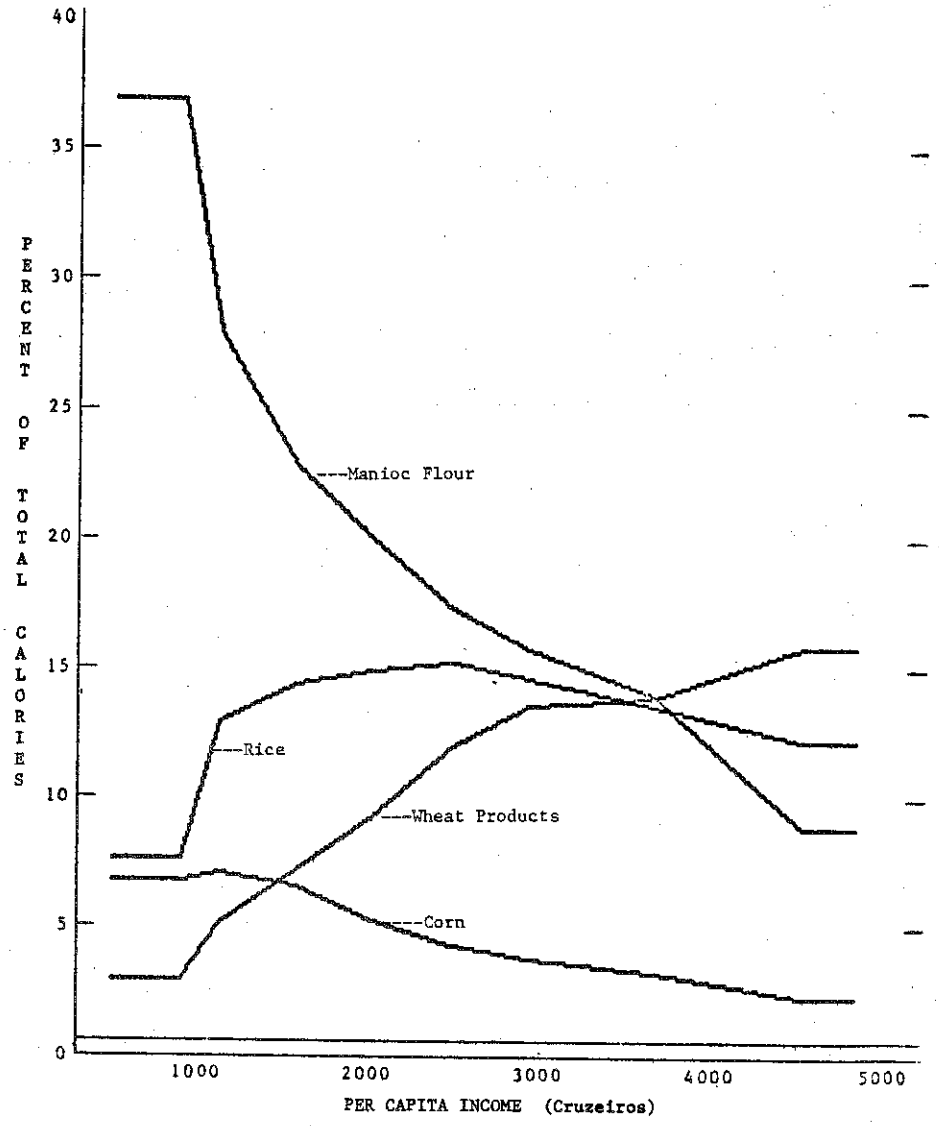
If the survey has problems, it is with its evaluation. For whatever reason, the Brazilian government has been reluctant to release its findings--even to the World Bank, which supported it financially. Explanations for this situation vary. Some suggest that the Brazilians are holding out for additional aid to evaluate it; others that the findings could provide ammunition to the government's detractors. Whatever the explanation, only summary information on food availabilities has been released for the country as a whole. The only region for which a breakdown by income class is available is the Northeast.

The Brazilian Northeast is one of the poorest sections of the country in terms of natural endowment. Except for the coastal fringe it is hot and comparatively dry. Its population has long sought opportunities elsewhere. Agriculture is predominantly subsistence in character. Maize, cassava, and rice are the principal staples.

The findings for the Northeast suggest the survey was conducted with accuracy. Apparent per capita energy availabilties fall within the realm of the reasonable, though the figure for the poorest class--1,480 calories per day--suggests privation is commonplace.

That substitution among the staples suggestive of threshold behavior takes place is indicated in Chart 23. Rice and wheat products

*CHART 23. RICE, CASSAVA, WHEAT, AND MAIZE AS CONTRIBUTORS TO APPARENT PER CAPITA ENERGY CONSUMPTION, NORTHEAST BRAZIL, 1975/76, BY INCOME CLASS**



*Steve Tabor, "Notes on the Brazilian Consumption and Expenditures Survey" (unpublished working paper, USDA, ESCS, August 1979), p. 19.

replace cassava flour sharply as one moves from the poorest to the next poorest income class. Detailed identification of precise behavior must, however, await release of more of the survey's findings.

It is suggested that the USDA work closely with the World Bank in attempting to persuade the Brazilians to release more of this uncommonly good survey--even to the point of agreeing to suppress that which may be considered politically sensitive.

- -

In the further evaluation of the foregoing four surveys and others in the future, it is suggested that the format employed in Charts 18 and 19--that is, of plotting the absolute energy (or protein) contributions of the several foods--be followed by the USDA. This is rather more meaningful than percentage contributions--as in Charts 15, 17, 20, 21, 22, and 23--and permits us to make an immediate judgment as to the "reasonableness" of the data.

CITATIONS

1 M. J. Purvis and T. T. Poleman, "Research Report on the Food Economy of Malaysia and Brunei" (Dept. Agric. Econ., Cornell Univ., May 1965, mimeo.).

2 FAO, Nutrition Div., Bibliography of Food Consumption Surveys (Rome, 1964, mimeo.).

3 FAO, Nutrition Div., 1965 Supplement to Bibliography of Food Consumption Surveys (Rome, 1965, mimeo.).

4 FAO, Nutrition Div., 1967 Supplement to Bibliography of Food Consumption Surveys (Rome, 1967, mimeo.).

5 FAO, Bibliography of Food Consumption Surveys 1973 (Nutrition Information Document Series No. 6, Rome, June 1973).

6 FAO, Economics Div., Review of Food Consumption Surveys (Rome, 1958, mimeo.).

7 FAO, Statistics Div., 1962 Supplement to Review of Food Consumption Surveys (Rome, 1962, mimeo.).

8 FAO, Statistics Div., Review of Food Consumption Surveys 1970 (Rome, 1970, mimeo.).

9 Sudan, Min. of Planning, Dept. of Stat., Household Sample Survey in the Sudan 1967-1968: Pattern of Income and Expenditure (1976).

10 Carol Goodloe, "Report on the Household Sample Survey in the Sudan" (unpublished working paper, USDA, ESCS, July 1979).

11 Steve Tabor and Linda Weingarten, "Report on the 1969/70 Socio-Economic Survey of Sri Lanka" (unpublished working paper, USDA, ESCS, August 1979).

12 Carol Goodloe and Steve Tabor, "Report on the 1973/74 Household Expenditure Survey of Bangladesh" (unpublished working paper, USDA, ESCS, August 1979).

13 Steve Tabor, "Report on the SUSENAS V Survey, 1976" (unpublished working paper, USDA, ESCS, August 1979).

14 Steve Tabor, "Notes on the Brazilian Consumption and Expenditure Survey" (unpublished working paper, USDA, ESCS, August 1979).

V - THE NUTRITIONALLY VULNERABLE: WOMEN AND CHILDREN LAST

One comes away from the search for behavioral thresholds in the four household budget surveys with several strong impressions:

- *A recognition that identification of behavioral thresholds from country to country will not be easy and will demand that the analyst know a good deal about the area in question; but a stronger than ever feeling that it is the approach most likely to yield results in the foreseeable future. Additional and better budget surveys are more reasonably to be expected in the next few years than are accurate estimates of food availabilities and minimal nutritional needs.*

- *A heightened respect for the rational and efficient way the people of developing countries allocate their limited resources so as to get by on what by the standards of the industrialized world is very little. There are doubtless those so impoverished as to not get by, but the relatively low levels of income at which behavior suggestive of perceived dietary adequacy begins to manifest itself implies that it is unlikely that their numbers are of the size set forth in the recent FAO or World Bank studies.*

- *Sympathy for those FAO, USDA, and World Bank analysts who have been obliged to offer up to their superiors estimates of the magnitude of world nutrition problems. One is uneasy about extrapolating the implications of threshold behavior from the sample to the national level; to be asked to project them to regions or continents is an intellectually appalling prospect.*

Yet planners and policy makers must program their activities and targets on something, and have every right to expect "expert" guidance. A not illogical first step in this direction is to identify for them those members of a population who are most vulnerable to nutritional shortfalls. For this purpose the threshold approach is of only limited value. It helps us pinpoint the poor, but since the household budget survey disaggregates only to the family level, it does not tell us who within the family eats what.

The Impact of Protein-Energy Malnutrition

If we do not know how many among the poor in the LDCs suffer nutritional deprivation, nutritionists are agreed that the preschool child and the pregnant and lactating mother are those most likely to be adversely effected by protein-energy malnutrition (PEM). There are several reasons for this. The early growth and reproduction phases are nutritionally the most demanding in the life cycle. Yet persons in these phases are precisely the family members whose needs can be reflected least in the choice of foods purchased by the household and who may be the residual claimants on that which has been prepared for all to eat.

During pregnancy and lactation a mother's food needs will be higher than normal and quite specific for certain nutrients. The total energy cost of a pregnancy is estimated to average between 40,000 and 80,000 calories. The extra energy is required not just for the growth of the fetus and associated maternal tissues but for moving the heavier body around. In industrialized countries such movement tends to be curtailed during pregnancy, so that the increment in needs is probably nearer the 40,000 calorie figure. But in most developing countries the mother is expected to continue with her household chores almost to term; there the higher estimate may be more relevant.

Average daily milk production during lactation will be of the order of 850 milliliters. To produce this, the mother's daily energy needs will be about 600 calories above normal (1, pp. 34-36).

Because they are growing so rapidly, the infant and young child have appreciably higher food needs than other age groups. FAO's recommended energy allowances reflect this (1, p. 35):

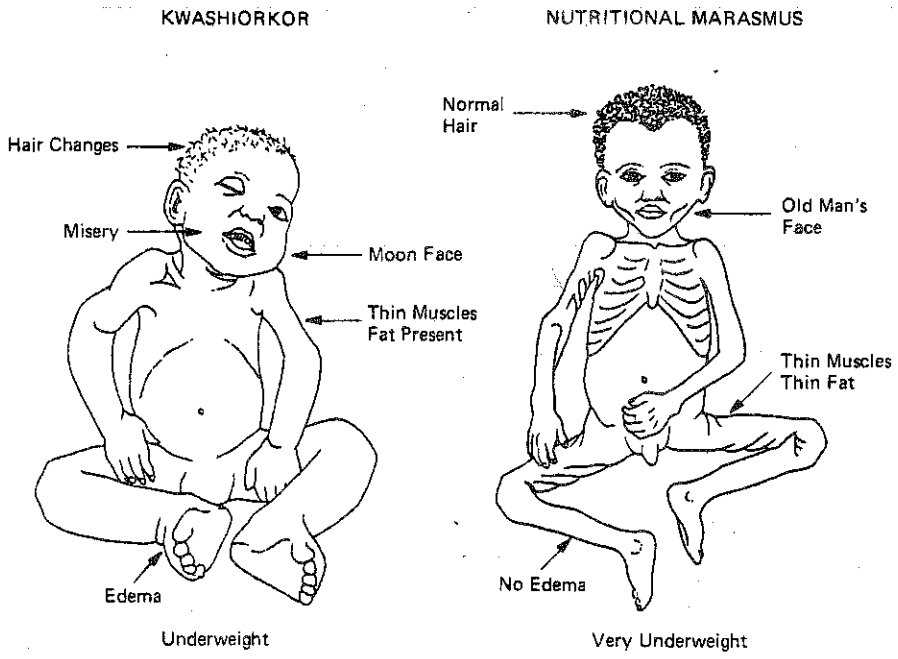
Age	Calories per kilogram body weight daily	
	Male	Female
< 1	112	
1-3	101	
4-6	91	
7-9	78	
10-12	71	62
13-15	57	50
16-19	49	43
Adult (moderately active)	46	40

On a calorie per unit of body weight basis, the infant and preschool child have energy needs more than double those of adults and half again those of adolescents.

Discrimination against mothers and the young in eating habits is, of course, unintentional and will reflect educational as well as income deficiencies. Where households do not eat together, the father and other elders will typically satisfy themselves first, leaving what remains to the women and the young. Adult tastes, rather than those of the infant, will be the usual criteria of dietary excellence, to the end that much of the animal protein a meal may contain can be impossible for the very young to swallow. The younger the child, moreover, the less well he is able to fend for himself at table. And in times of shortage the mother is likely to defer to her children, not realizing that it is not only she, but her unborn child, who will suffer the consequences.

In its extreme form, protein-energy malnutrition among the young will occur either as kwashiorkor or marasmus or some combination of the two (Figure 2). Kwashiorkor is generally the result of an inadequate

FIGURE 2. CLINICAL FEATURES OF TWO FORMS OF SEVERE PROTEIN-ENERGY MALNUTRITION: KWASHIORKOR AND MARASMUS*



*Reproduced from M. A. Caliendo, Nutrition and the World Food Crisis (New York, 1979), p. 10.

intake of protein relative to calories. It typically effects children who, after a period of breast feeding, are weaned on to starchy staples low in protein--such as the tropical roots and tubers--or sugary foods. It is thus most common in tropical Africa, where roots and tubers are the dominant starchy staples; indeed kwashiorkor comes from the Ga and means "disease that occurs when displaced from the breast by another child" (2, p. 13).

Marasmus, on the other hand, arises from an insufficiency of both energy intake and protein. The condition usually occurs in the first year of life and among the children of undernourished women. They are commonly of low birthweight and even in their first few months will show large weight-for-age deficits. Marasmus by definition is chronic, whereas kwashiorkor is an acute condition amenable to rapid reversal.

Cases of pure kwashiorkor or marasmus seem to be the exception rather than the rule. Instead, most severely malnourished children will present signs and symptoms of both conditions and perhaps even alternate between the two. In addition to low weight for age and the overt signs noted in Figure 2, symptoms are apathy, instability, and poorly developed motor skills (3, pp. 46-47).

Although marasmic children may be at risk of outright starvation, the main danger to the severely malnourished lies in their diminished resistance to other disease. Should they survive these, they are likely to go through life permanently impaired, both mentally and in the height and weight they will ultimately attain. Although the linkages between severe PEM and brain growth and development are by no means understood, they give rise to particular concern.

Compared with its impact on pregnant and lactating mothers and the very young, the adverse effects of PEM on the other elements of a population are likely to be moderate. This is because these elements are either not growing so rapidly or have stopped growing altogether and can adapt to reduced energy intake by either taking off body weight or by curtailing activity.

The human body is remarkably adaptive to reduced levels of food intake. Controlled studies among adults have shown that if caloric intake is cut to 50 percent of normal, body weight will drop within a few months by about a quarter. Thereafter a reduced level of activity can be maintained for many months before additional weight loss sets in and the incidence of nutrition-related disease rises. Thus the aftereffects among adults of war-induced privation in the Netherlands in 1944-45 and in Biafra in 1968-69 are not thought to have been lasting; and certain groups in Africa regularly experience with no apparent impairment significant changes in body weight in association with the preharvest hunger phenomenon. This is not to suggest that the lethargy often observed among the poor in developing countries is not an adjustment to inadequate dietaries; only that it is reversible and need only be temporary.[1/]

1/ In the first World Food Survey, FAO advanced the notion of "hunger breeding hunger:" that is, of inadequate diets causing poor physiques and lowering potential energy output to such a point that people are physically unable to produce more food (4, p. 8). This vicious cycle argument has never found support in fact--poverty breeds hunger, not the reverse--and is not suggested here.

Some nutritionists have suggested that cases of frank marasmus and kwashiorkor among the very young are but the tip of an enormous iceberg of protein-energy malnutrition in the developing world and that for every child demonstrating symptoms of clinical PEM there may be 99 others who are inadequately nourished, grow poorly, and are highly susceptable to disease infection (2, p. 7). The iceberg analogy seems indeed appropriate, but measuring the submerged portion is not easy.

Some Assumptions and Numbers

Nutritionists commonly define severe PEM as being evidenced by a weight for age of less than 60 percent of standard and the moderate form as being reflected by weights in the 60-80 percent range.[2/] Following (more or less) these definitions, the findings of 101 nutrition surveys have been summarized as shown in Table 10 and Chart 24. It is apparent that only a small fraction of children--in most of the surveys just one or two percent--suffer from severe PEM and that perhaps for each one of these 10 or 15 may be moderately afflicted. But beyond this, generalization is impossible. Most of the surveys covered small samples of questionable typicality, and the range in findings is too extreme to permit extrapolation.

Two other approaches to quantifying the nutritionally most vulnerable in a population suggest themselves: the rates of infant and child mortality and weight at birth. Both are intuitively reasonable indicators and both seem sensitive to what we know of international

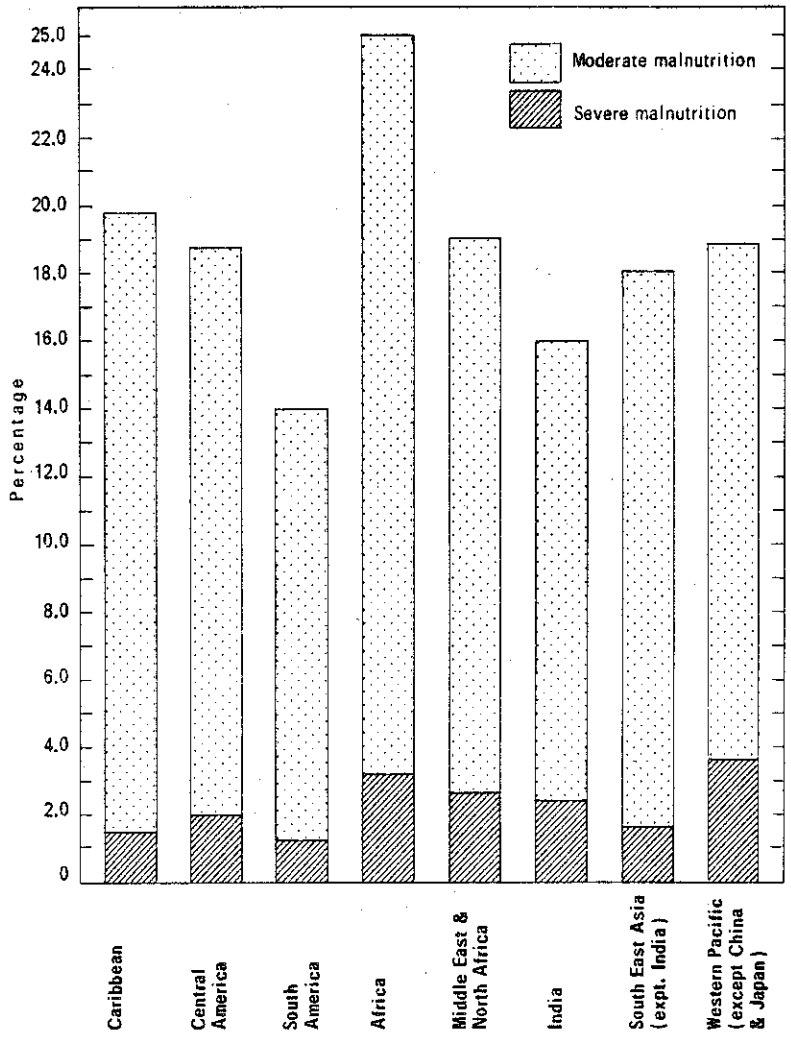
2/ There is, however, no agreement as to whether the standard should be an international one or be based on country-specific healthy children.

TABLE 10. PREVALENCE OF SEVERE AND MODERATE PROTEIN-ENERGY MALNUTRITION, BY REGION, 1963-73: MEDIAN AND RANGE FINDINGS OF 101 SURVEYS*

Region	Countries	Surveys	Children Examined	Percent Malnourished			
				Severe PEM		Moderate PEM	
				Median	Range	Median	Range
			(thousand)				
Caribbean	7	14	18.2	1.5	.4-12.0	19.8	5.0-35.0
Central America	7	8	9.6	2.0	1.1-5.9	18.8	10.8-27.5
South America	6	10	140.5	1.2	.2-6.3	14.0	3.5-25.7
Black Africa	16	30	35.9	3.2	.5-22.9	25.0	7.3-66.0
North Africa and Middle East	10	17	14.1	2.6	.3-10.1	19.0	6.4-81.7
Southeast Asia	6	8	2.7	1.6	1.4-1.8	18.0	8.3-60.0
India	1	6	32.2	2.6	1.1-20.0	16.0	15.4-52.7
Western Pacific	6	8	13.5	3.6	1.9-6.2	18.8	3.5-46.4
TOTAL	59	101	266.8	2.3	0.2-22.9	18.8	3.5-81.7

*Data from J. M. Bengoa and G. Donoso, "Prevalence of Protein-Calorie Malnutrition, 1963 to 1973," PAG Bulletin, Vol. IV, No. 1, 1974, p. 30.

CHART 24. PREVALENCE OF SEVERE AND MODERATE PROTEIN-ENERGY MALNUTRITION, BY REGION, 1963-73*



*Reproduced from J. M. Bengoa and G. Donoso, "Prevalence of Protein-Calorie Malnutrition, 1963 to 1973," PAG Bulletin, Vol. IV, No. 1, 1974, p. 31. Charted are the median findings given in Table 10.

disparities in levels of living. Thus the WHO estimates that about one-sixth of the babies born each year weigh less than 2,500 grams and that 95 percent of these are born in developing countries (5, p. 43):

	Percent of babies weighing less than 2,500 grams at birth
North Europe	4
Western Europe	7
North America	7
Southwest Asia	10
North Africa	10
Caribbean	11
West and Central Africa	15
Tropical South America	20
Southern Asia	30

The frequency of low birth weights is below 10 percent in the industrialized countries, rises to about 15 percent in tropical Africa, and approaches 30 percent in Southern Asia.

The problem is that the above tabulation is about the only one on the subject in existence and may be of questionable validity. Babies born in developing countries rarely do so in hospitals and even more rarely are their weights monitored by the statistical services.

The same is true of the death rates for infants and young children. To the extent that they exist, they bear out a logical hierarchy of nations (6, pp. 382-90).

	Deaths rates per 1,000 in the age group	
	Less than 1 year	1-4 years
Japan (1975)	10.0	.8
Switzerland (1975)	11.5	.7
United States (1975)	16.4	.7
Ecuador (1974)	78.1	16.6
Pakistan (1968)	182.4	17.4
Central African Empire (1959-60)	189.6	27.4

But few developing countries maintain civil registers that pretend to completeness of coverage.

If policy makers are to design their nutrition programs to effect those at greatest risk, then, we have no alternative but to offer them "guesstimates" arrived at rather arbitrarily.

Table 11 offers one method for doing this. In it the number of pregnant and lactating women is approximated by doubling the birth rate. To this figure is added the number of infants below five years of age. Arbitrary percentage estimates of those likely to be at risk nutritionally are then applied. The ten percent assumption is not an unreasonable minimum for most developing countries, while the 50 percent figure would seem an absolute maximum. The resulting range of those at risk--62 million to 309 million persons--is interesting primarily when set against the findings of the World Bank study and The Fourth World Food Survey:

	Insufficient Protein-Energy Supply		Vulnerable People at Risk	
	Fourth Survey	World Bank	10 percent Assumption	50 percent Assumption
	(millions)			
Far East (ex-China)	297	736	26	131
China	-	-	14	71
Africa	83	190	9	46
Latin America	46	113	7	37
Near East	29	91	5	24
	455	1,130	62	309

Although Table 11 includes China, which the two studies did not, even the 50 percent assumption yields figures well below the number of those considered to have an insufficient protein-energy supply in The Fourth World Food Survey and about a fourth the number arrived at by the World Bank study.

This approach to quantifying the number of women and children at risk is obviously very crude. It is suggested that the

TABLE 11. NUMBER OF WOMEN AND CHILDREN AT RISK NUTRITIONALLY ACCORDING TO TWO ASSUMPTIONS, 1975, BY REGION*

(millions)

Region[a]	Total Population	Infants (Age 0-4)	Births	At Risk[b] 10 Percent Assumption	At Risk[b] 50 Percent Assumption
Far East (ex-China)	1,057	174.3	43.5	26.1	130.6
China	823	98.6	22.1	14.3	71.4
Africa	331	60.6	15.8	9.2	46.1
Latin America	319	50.4	11.7	7.4	36.9
Near East	188	31.9	8.1	4.8	24.0
TOTAL	2,718	415.8	101.2	61.8	309.0

*Population data from World Bank, World Atlas of the Child (Washington, 1979), pp. 24-33.

a/ Regional breakdown follows current FAO usage and includes only those countries classified as "developing." See FAO, The Fourth World Food Survey (Statistical Series 11, 1977), pp. 67-68.

b/ Assumptions are that 10 percent and 50 percent of the vulnerable groups (infants up to five years of age and pregnant and lactating mothers) can be considered malnourished. The number of pregnant and lactating mothers is taken as being twice the birth rate.

USDA explore whether it might be possible to refine it by extrapolating the percentages found in certain of the nutrition surveys collectively summarized in Table 10 and Chart 24. While most of these surveys probably related to atypical groups, some may be more representative of populations as a whole. Tests not unlike those described on pages **IV-4** *to* **IV-8** *for evaluating household budget surveys could no doubt be devised for separating the good from the bad.*

CITATIONS

1 FAO, Energy and Protein Requirements (Nutrition Meetings Report Series 52, 1973).

2 M. A. Caliendo, Nutrition and the World Food Crisis (New York, 1979).

3 Ernesto Pollitt, Early Childhood Intervention Programs in Latin America: A Selective Review (Submitted to the Ford Foundation, January 1979, mimeo.).

4 FAO, World Food Survey (Washington, 5 July 1946).

5 FAO, The Fourth World Food Survey (Statistics Series 11, 1977).

6 U.N., Demographic Yearbook--1976 (New York, 1977).

VI - APPROACHES TO ALLEVIATION

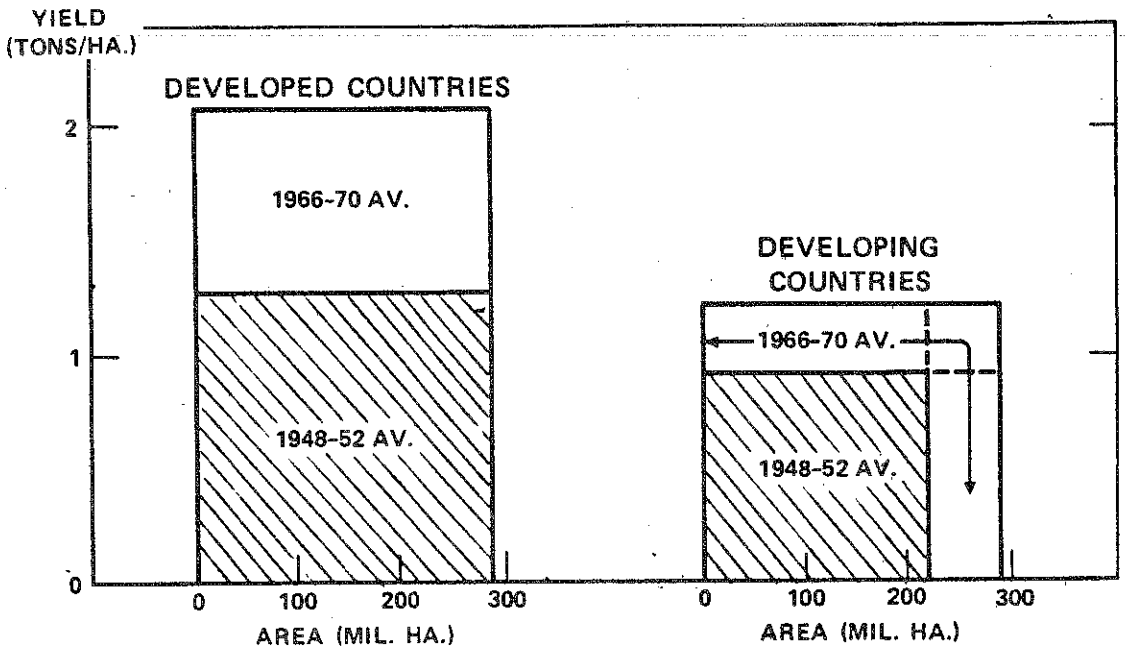
Since the nutritional problems of the developing countries are less a reflection of insufficient production than of the poor's inability to effectively demand a satisfactory diet, the remedial strategies to be pursued, both nationally and by the international community, will be influenced by the extent to which the normal course of development can be expected to raise incomes.

Can The Income Effect Be Relied On?

Increased levels of food production will, of course, continued to be required, but the evidence points to this being forthcoming. We have noted (Chart 2) that the record of LDC agriculture over the past quarter century has not been unimpressive; that despite the minimal attention given agriculture in most LDCs, output has expanded no less rapidly than in the industrialized countries and more than kept pace with population growth.

What is all the more remarkable about this is that it has taken place without the upsurge in yields which has so dramatically altered agriculture in the developed countries. Chart 25, in which are compared the production, area, and yield of all grains immediately after the war and recently, offers some perspective. Prior to the war, grain yields everywhere averaged in the neighborhood of one ton per hectare. By the late 1960s, as the result of greater use of fertilizer, improved seed varieties, and better cultivation practices, yields had about

CHART 25. WORLD PRODUCTION, AREA, AND YIELD OF GRAINS, 1948-52 AND 1966-70*



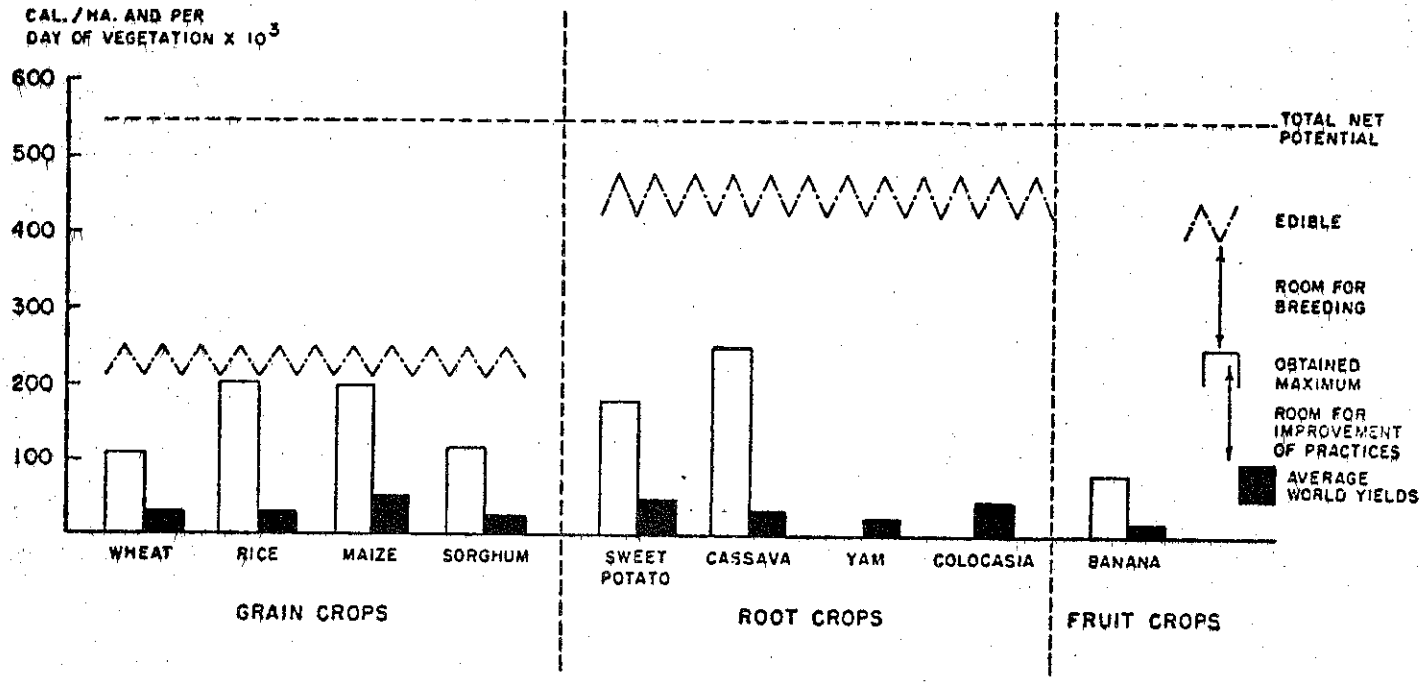
*Reproduced from USDA, ERS, The World Food Situation and Prospects to 1985 (For. Agr. Econ. Report 98, December 1974), p. 65. The area of the rectangles, determined as the product of the amount of land in grains (in million hectares on the horizontal axis) times the yield (in tons per hectare on the vertical scale), represents total production. All four rectangles may be compared in height, width, and area.

doubled in the developed countries. In the LDCs, on the other hand, the gains were quite modest. Despite the publicity given the Green Revolution and certain spectacular accomplishments, LDC yields remain now about where they were in the developed countries at the beginning of the postwar upsurge.

The systematic application of the scientific method to food farming in the developing world is very recent, dating no further back than the mid-1940s. It is not surprising, then, that the scope for improving yields has been only superficially exploited (Chart 26). Moreover, breeding work until just this decade ignored the root crops and concentrated on wheat, rice, and maize; and even for these crops yields have risen to only a fraction of the potential. A substantial share of the rice produced in Bangladesh and Thailand is of the floating variety, able to grow up to a foot per day if flooding demands it. It is hardly an exaggeration to say that work is only beginning on this unusual crop. That the payoff is likely to be great goes without saying.

If the LDCs are potentially capable of enormous increases in food production, it is not possible to be equally sanguine about the outlook for providing productive employment for their populations. In part this pessimism recognizes the selective nature of all economic change--some are caught up in the process, others left out--but above all it mirrors the number of people who will be entering the labor force between now and the year 2000.

CHART 26. AVERAGE WORLD YIELDS, MAXIMUM YIELDS OBTAINED IN SELECTED TROPICAL EXPERIMENT STATIONS, AND ESTIMATED YIELDS TO BE REACHED THROUGH BREEDING AND RESEARCH*

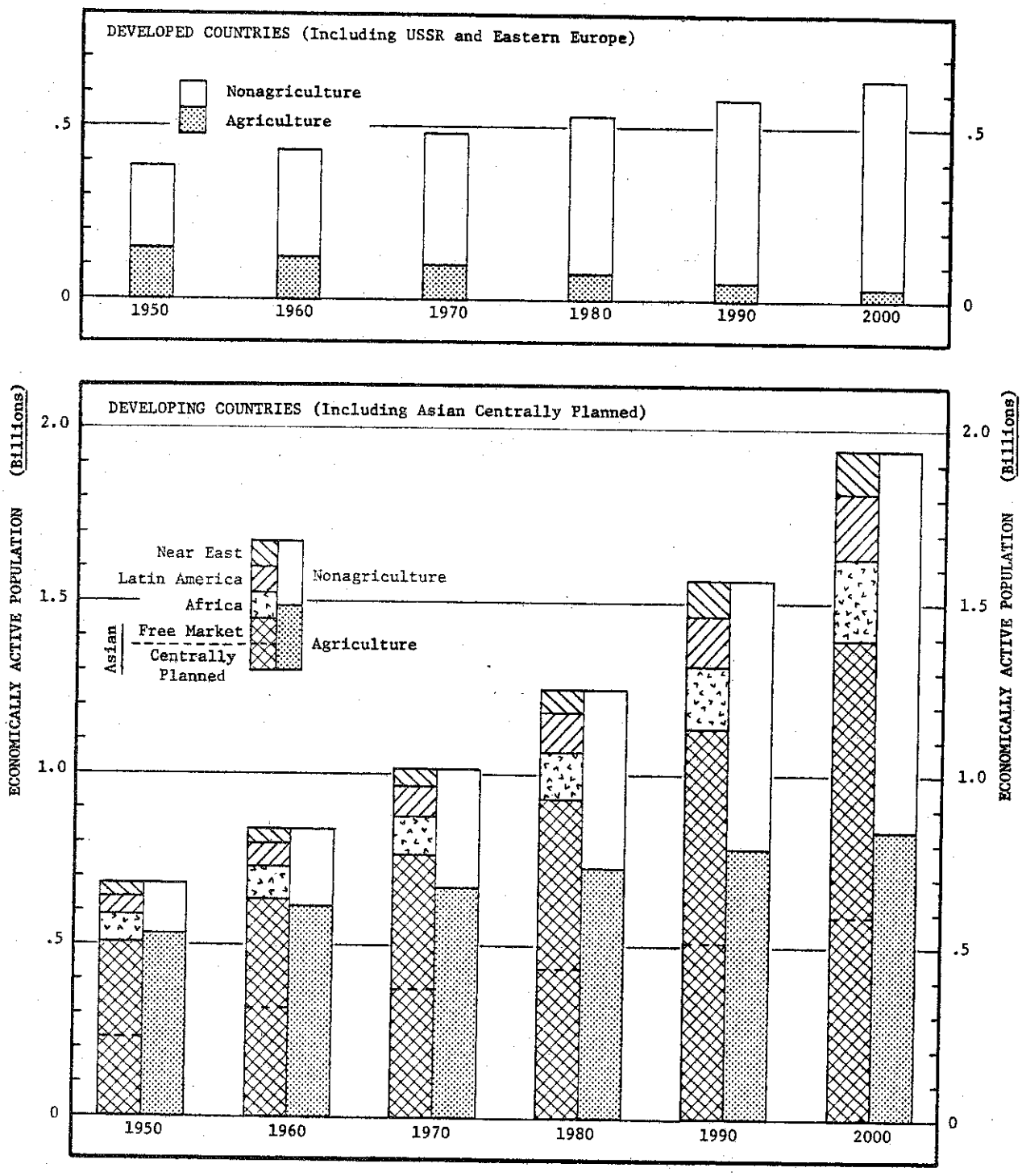


* Reproduced from C. A. de Vries, J. D. Ferwerda, and M. Flach, "Choice of Food Crops in Relation to Actual and Potential Production in the Tropics," The Netherlands Journal of Agricultural Science, November 1967, p. 246.

Their number is truly staggering. Chart 27 illustrates a recent projection of the International Labor Office. Between 1970 and 2000 it is expected that the LDC labor force will double--from one to two billion people. The billion new jobs that must be found are roughly twice the number presently existing in the industrialized countries and mean that the LDCs will be called on to transform themselves at a rate and on a scale unprecedented in history. In terms of just one country, it means that during the remainder of the century Mexico will be adding to its labor force each year about the same number of new entrants as the United States and Canada together were able to absorb during the boom years of the 1950s and 1960s (1, p. 16).

The projection sees few of the new entrants being absorbed into agriculture. This is consistent with impact so far of the Green Revolution and devolves from the selectivity of the various technical improvements that are likely to be made. The high-yielding varieties, for instance, are not designed to be introduced alone, but call for a host of complementary inputs: fertilizer, water, disease control, and the like. Thus the "miracle" rices are highly responsive to fertilizer--as the Indica varieties they replace are not--and yield well only under irrigated conditions. Simply to provide the conditions under which they can be introduced can be very time-consuming and expensive. To the extent that the new systems are specific to particular ecological conditions, benefits will clearly be restricted. Equally obvious is that those best able to command the new inputs--the larger and wealthier farmers--will reap the lion's share of the benefits.

CHART 27. ECONOMICALLY ACTIVE POPULATION, RECENT YEARS AND PROJECTIONS TO 2000*



*Data from ILO, Labor Force Projections (Geneva, 1971) as reproduced in FAO, The State of Food and Agriculture--1973 (Rome, 1973), pp. 131 and 138. Projections are based on U.N. medium variant for total population.

This much history would have us expect. The changes that transformed European and North American farming during the nineteenth century were similarly selective. The difference lies in the cities. A hundred years ago the disgruntled or displaced farmer could look to the cities for opportunity. Industry was growing and, as industry then had high labor requirements, virtually all who left the land found new jobs. Today the movement to town rests on less solid foundations. Though urbanization in most LDCs is proceeding at a breakneck pace--many of the larger centers are doubling in size every ten years or so--most of the cities remain administrative and trading centers. Though industry is growing, the bulk of it is capital-, not labor-demanding. Jobs are far fewer than people in search of them.

The prospect, then, is for two groups of persons to be excluded from the course of development: those bypassed by progress in the countryside and the unemployed of the towns. The proportion of the population presently falling within the two groups is anybody's guess. Governments in the developing world do not collect data on unemployment and underemployment, and if they were to the findings would be too distasteful politically to permit release.[1/] The World Bank and other international agencies speak of the "lower 40 percent," and even if this figure is a very rough estimate, it is probably a fair one. Somewhere between a quarter and a half of the population of the developing world is being bypassed by the forward march of economic change.

1/ Some spurious figures are, however, published. The Mexican 1970 population census, for instance, put unemployment at 485,000, out of an economically active population of 13 million. The 3.7 percent figure that results would make Mexico the envy of the industrialized world! More reasonable estimates suggest that perhaps 45 percent of the 13 million, or six million persons, were either unemployed or underemployed, of which four million were in agriculture (1, p. 16).

Recognition that the income effect cannot be relied on to eliminate all nutritional deficiencies within the lifetime of many of those most seriously afflicted has given rise to a host of alternative proposals, their number, in the words of one observer, being indicative "of how much of a growth industry human nutrition and world hunger activity has become" (2, p. 7). They divide in two broad groupings: those which aim to correct the causes of economic inequality and those which aim at affording a measure of short-term relief.

Treating the Disease

Proposals falling within the first category--those that would treat the disease--range from the hopelessly naive to the outright revolutionary, but include a broad center setting forth conditions for "growth with equity." These include:

- An emphasis on developing the rural sector and on the immediate implementation of land reform.
- The retargeting of production toward meeting the minimum needs of all.
- The use of "appropriate"--by which is meant labor-intensive--technology.
- A willingness to view the Chinese and Cuban experiences with tolerance.

As the strategy's most eloquent proponent puts it (3, pp. 65-67):

> . . . the problem of development must be defined as a selective attack on the worst forms of poverty. Development goals must be defined in terms of progressive reduction and eventual elimination of malnutrition, disease, illiteracy, squalor, unemployment and inequalities. We were taught to take care of our GNP as this will take of poverty. Let us reverse this and take care of poverty as this will take care of the GNP. In other words, let us worry about the content of GNP even more than its rate of increase.

. . . the developing countries should define minimum (or threshold) consumption standards they they must reach in a manageable period of time, say a decade. Consumption planning should move to the centre of the stage; production planning should be geared to it. And consumption planning should not be in financial terms but in physical terms, in terms of a minimum bundle of goods and services that must be provided to the common man to eliminate the worst manifestations of poverty: minimum nutritional, educational, health and housing standards, for instance. There are two major implications of this strategy. One, we must get away from the tyranny of the demand concept and replace it by the concept of minimum needs, at least in the initial stages of development, since to weight basic needs by the ability to pay is outrageous in a poor society. It will only distort the patterns of production and consumption in favour of the "haves," as has happened in many societies. Two, the chase of elusive present day Western standards and per capita income levels, which cannot be reached even over the course of the next century, must be replaced by the concept of a threshold income which each society defines for itself and which can be reached in a manageable period of a decade or so.

. . . the concerns for more production and better distribution should be brought together in defining the pattern of development; both must be generated at the same time; the present divorce between the two concerns must end. If the pattern of production (and exports and imports) is geared to satisfying minimum consumption requirements and to employing the entire labour force, higher production will itself lead to better distribution.

. . . employment should become a primary objective of planning and no longer be treated as only a secondary objective. Let a society regard its entire labour force as allocable; over this force its limited capital resources must be spread. Let us reverse the present thinking that, since there is only a fixed amount of capital to be allocated at a particular time, it can employ only a certain part of the labour force, leaving the rest unemployed, to subsist on others as hangers-on or as beggars, without any personal income, often suffering from the worst forms of malnutrition and squalor. Instead let us treat the pool of labour as given; at any particular time it must be combined with the existing capital stock irrespective of how low the productivity of labour or capital may be. If physical capital is short, skill formation and organization can replace it in the short run. It is only if we proceed from the goal of full employment, with people doing something

useful, even with little doses of capital and organization, that we can eradicate some of the worst forms of poverty.

This more humanistic strategy has taken on a certain cloak of dogma at the World Bank and at USAID, and its legitimacy is the issue in development studies today. It is idle to pretend that it can receive here the attention it warrants. Morally, its goals are commendable. But three questions arise, the answers to none of which are in:

- Could not the approach just as well lead to equity without growth, since it tends to play down the capital-intensive character of most agricultural change and makes minimal provision for capital accumulation?
- By emphasizing rural development, may it not slight the employment-generating potential of urban growth, and may it not be forced to reconcile the revolution of rising expectations with what Marx termed "the idiocy of rural life" by repressing the individual's right to choose?
- Since so many of changes visualized fly in the face of the interests of the established elites, may not a revolution be necessary to implement them?

The final point is, in practice, the most important. The political elites of the developing countries are no different than their counterparts in the industrialized world: they show no impatience to hasten their own demise. Far better the palliative, especially if it gives promise of buying time.

Treating the Symptoms

Measures for easing the plight of the nutritionally deprived without transforming the social structure include those designed to increase food consumption without a corresponding rise in food expenditures and those that improve the nutritive value of given foods.

Fortification of traditional foodstuffs with special nutrients is the most attractive means of accomplishing the latter. Iodization of salt is a classic example, as is the admixture to milled cereals of niacin, iron, thiamin, riboflavin, and calcium. The impact of such measures can be widespread and immediate. Beriberi, for instance, was endemic on the famed Bataan Peninsula of the Philippines immediately after the war. With the introduction of thiamin enrichment of rice, it virtually disappeared (4, p. 110). The problem with this approach, of course, is that enrichment is only possible when foods are centrally processed; and in the LDCs few are.

Similarly flawed are most of the schemes designed to permit greater consumption of food for a given level of expenditure. These usually involve some form of price manipulation by government, whether through direct procurement in the countryside, by subsidizing aspects of production or consumption, or by controlling the price paid by consumers.

Virtually all LDCs have one or more programs of this type and, as their effect is to transfer income, the motivation for them has been more political than nutritional. Nonetheless their nutritional impact can be appreciable. The Sri Lankan rice ration is credited with contributing to the prolonging of life there, as is the Egyptian program of subsidizing the retail prices of staple foods (5). The cost, however, can be very high. The rationing program in Sri Lanka regularly absorbs between 15 and 20 percent of the government's budget, and one estimate of the cost of Egyptian food subsidy puts it at a twelfth of

the country's GNP (6, p. 71). Neither program would be possible without concessional food from abroad.

In addition to their expense, the problems with programs of this type are several and severe:

- They tend to be restricted to the urban centers--the Egyptian and Bangladesh cases being the most prominent--and thus have minimal impact on the very poor, most of whom still live in the countryside. In Bangladesh, proof of employment is a prerequisite for being issued a ration card.

- If not political from their inception, they quickly become politicized, with the result that modification is very difficult. An attempt to reduce the consumer food subsidy triggered such severe riots in Cairo in January 1976 that the plan was immediately rescinded. The price and wage distortions they engender thus tend to become permanent.

- Where not dependent on food aid from abroad, the schemes tend to rely on low procurement prices in order to keep costs down. In either case the effect is to discourage the growth of domestic agriculture.

This disincentive effect is probably the most telling of the objections to both food aid and the various distribution and subsidy schemes as vehicles for treating the symptoms of malnutrition. To get around it a number of two-price systems and other devices have been proposed. By far the simplest and most appealing of these is to channel assistance in kind directly to those at greatest risk through maternal and child clinics. The bulk of the million or so tons moved annually under Title II of Public Law 480 now takes this form, but whether the recipient countries could muster the technical expertise and administrative competence to accept very much more is open to question. Probably it will be many years before they could.

There are, then, no tidy solutions. Hunger and nutritional deprivation are part and parcel of the broader problem of world poverty and unemployment. Only with more and better jobs are they likely to disappear.

CITATIONS

1 T. T. Poleman, "Food, Population, and Employment: Some Implications for Mexico's Development," in Fomento Cultural Banamex, Alimentacion: Reto de Mexico (Mexico City, 1979).

2 Sol Chafkin, "The Emerging Concern for Human Nutrition and World Hunger," Agricultural-Food Policy Review (USDA, ESCS, ESCS-AFPR-2) September 1978.

3 Mahbub ul Haq, "A New Perspective on Development," in A. E. Rice, ed., Development Targets for the 70's: Jobs and Justice (12th World Conference of the Society for International Development, May 1971).

4 Alan Berg, The Nutrition Factor (Washington, 1973).

5 F. C. Roche, "The Demographic Transition in Sri Lanka: Is Development Really A Prerequisite?" (Cornell Agric. Econ. Staff Paper No. 76-5, January 1976).

6 N. Edirisinghe and T. T. Poleman, "Implications of Government Intervention in the Rice Economy of Sri Lanka" (Cornell Internat'l. Agr. Mimeo. 48, January 1976).