FOOD AND POPULATION IN HISTORICAL PERSPECTIVE

By

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> It is a capital mistake to theorize before you have all the evidence. It biases the judgment.
>
> —— A Study in Scarlet

The notion that some sort of race exists between food and population dates back nearly two centuries; that is, to the industrial revolution in Europe and the writings of Thomas Malthus. Prior to that time there was, to be sure, a food problem, but few enjoyed sufficient leisure to theorize about it.

We have all seen charts, such as the accompanying,[1/] indicating that the world's population remained essentially stable from biblical times to about 1750. Although population growth (and contraction) during this period actually came in bursts rather than gradually, the general thrust of these charts is valid. Agricultural productivity was low, with only isolated jumps in output. There was persistent pressure on limited food supplies. Privation and disease were commonplace.

During this period, then, mankind and his economic base existed in something approaching, to use the cliché of the day, ecological balance. A high death rate was the ultimate consequence of low productivity.

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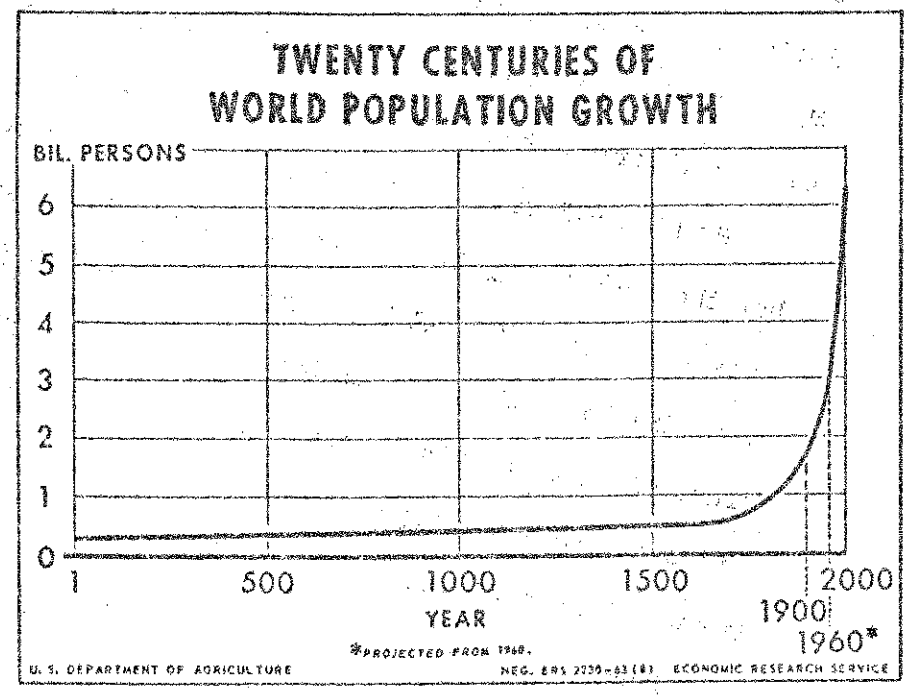
1/ I have long felt that much of the confusion regarding the world food problem and the inability of so many developing countries to engage reasonably in food policy planning stemmed from hopelessly unreliable statistics. Hence much of the work my students and I have engaged in over the past decade has pointed toward the creation of data where none exists. To avoid getting bogged down in this issue, I have consciously used only the data of others in this paper and as they presented it.

CHART 1. WORLD POPULATION, 1 AD-2000 AD, POPULARIZED*



* U. S. Department of Agriculture negative.

Roughly balancing a high birth rate, it held population growth in check. Writing in the year 1798, the Reverend Professor Malthus concluded that this was the inevitable fate of mankind. In the first of six editions of his Essay on the Principle of Population he wrote (1, pp. 11, 13-16):

> I think I may fairly make two postulata.
>
> First, That food is necessary to the existence of man.
>
> Second, That the passion between the sexes is necessary, and will remain nearly in its present state . . .
>
> Assuming then, my postulata as granted, I say, that the power of population is indefinitely greater than the power in the earth to produce subsistence for man.
>
> Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power as compared with the second.
>
> By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal.
>
> This implies a strong and constantly operating check on population from the difficulty of subsistence . . . The race of plants, and the race of animals shrink under this great restrictive law. And the race of man cannot, by any efforts of reason, escape from it. Among plants and animals its effects are waste of seed, sickness, and premature death. Among mankind, misery and vice. The former, misery, is an absolutely necessary consequence of it. Vice is a highly probable consequence . . . I see no way by which man can escape from the weight of this law which pervades all animated nature . . .

Whether these relationships are inevitable has been debated since 1798, but generally optimistically until recent years. This view was generated in part by the enormous agricultural advances of the nineteenth century. Vast acreages were opened not only in the United States and Canada, but in much of South America, Australia, Africa, and Asia. The Punjab, the Indian subcontinent's great granary, was opened up through improved irrigation facilities, and the surplus rice-producing areas in

Burma, Siam, and Indochina began to be fully exploited.

Immediately succeeding this period of expansion in the geographical sense came a second agricultural breakthrough. Beginning about 1900 and largely concentrated in the advanced countries, it involved the adaption of improved plant varieties and an increased use of fertilizer, pesticides, mechanization, and other technical advances.

By the 1930's Malthus and his gloomy prognostications had largely been forgotten. In the advanced countries concern was not so much with overpopulation as with underpopulation. European governments in particular pursued vigorous programs of population encouragement in order to enhance their political and military power. These included subsidies for larger families and, during the early period of the Soviet Union and Nazi Germany, the awarding of medals to prolific mothers.

On the agricultural side, super-abundance, not shortage, was the key problem. Coincident with the Great Depression, trade barriers sprang up increasingly between the industrialized countries, virtually all of whom were burdened with agricultural produce which could not be marketed at prices "equitable" to the farmer.

Enough time has now passed for us to view the 1939-1945 war as a major watershed of history. Not only did it witness the relegation of the European states to a secondary position and the ascendence of a new set of superpowers; it also saw the emergence of the "third world," the great band of tropical countries in Africa, Latin America and Asia, plus the subtropical giants--China and India. The emergence of these countries took a number of forms: political independence; the introduction of medical and sanitary techniques which enabled them to rapidly reduce death rates; and a more humane attitude on the part of the industrialized nations toward them. Recent wars have all purportedly been fought for hu-

manitarian reasons. Whether through an accident of history or of conviction, the victors of the Second World War were obliged to follow pledges with deeds.

Hence, the beginnings of foreign aid by the United States very shortly after V-J Day, and the establishment in October 1945 of the Food and Agricultural Organization (FAO) as a special agency of the United Nations. The FAO is closely associated with the rise of latter-day Malthusianism; and any discussion of food and population must take into account its attitude and its many pronouncements.

Within a year of its creation the FAO issued its first World Food Survey (2). This survey is important on two counts: it had a weighty influence on popular thinking immediately after the war and in the subsequent 25 years; and it established the analytical pattern which has since been followed in all the global surveys of the FAO and U. S. Department of Agriculture (USDA).

A brief digression into terminology. In all the FAO and USDA studies concerning the world food problem, the terms "undernourishment" and "malnourishment" are widely used. Undernourishment is generally accepted as meaning an involuntary shortfall in total calorie intake such that a person cannot maintain normal bodily activity without losing weight and eventually dying. Malnourishment, on the other hand, is used to describe the lack or deficiency of a particular or several of the so-called protective nutrients--protein, the vitamins, and minerals. Sometimes the contrast is expressed as between "quantitative" and "qualitative" malnourishment or between "hunger" and "hidden hunger."

FAO's method of determining whether and where either hunger or hidden hunger exists was to set against estimates of per capita food availabilities

other estimates of per capita requirements. If and when average per capita availabilities fell below the estimated per capita requirements, the people of the country or region were presumed to be inadequately nourished.

The measure of a country's apparent per capita consumption involves, in practice, the construction of a national food balance for a year or series of years. Essentially, a food balance sheet accounts initially for the gross supply of food available in a particular period of time: domestic output, plus imports minus exports. Then, commodity by commodity, the proportions of gross availability not used for food are deducted. These usually include 1) seed use, 2) animal food, 3) waste on the farm and in the distribution process up to the "retail level," 4) industrial non-food use, and 5) the processing or extraction losses involved in turning the product, especially cereals and oil seeds, into the form in which it is usually sold. All these must be estimated and then deducted from gross availability on a commodity by commodity basis before national consumption estimates can be derived.

The resulting data are usually expressed in tons, or in other units of weight or volume. Then, after ascertaining or estimating the number of people in the country, the estimated national availability of each item is divided by the population in order to determine apparent per capita consumption. Finally, these per capita consumption estimates are converted into estimates of per capita nutrient availability by applying nutrient common denominators to determine calories, protein, fat and the like per capita per day.

A key limitation of this procedure is, of course, that it presupposes the existence of a wealth of statistical evidence about individual agricultural economies. Such evidence, unfortunately, is to be found in any-

thing like complete form for only a few of the most advanced countries. For the bulk of the world, underdeveloped statistics go hand in hand with economic underdevelopment. Thus much of the information needed for construction of the balance sheet is either guesswork or unavailable.

A second limitation of the balance sheet approach is its assumption that societies are sufficiently homogenous in their food habits for average data to have meaning. This certainly is not realistic for developed economies where differences in income, locality, and ethnic background all have marked effects on food patterns. Recent work has not demonstrated the presumption of homogeneity to be much more valid for the developing world (3; 4).

But these drawbacks are only part of the problem. For the procedure then calls for the per capita availability figures derived through the balance sheet computation to be compared against so-called "requirements." Nutrition is still a young science and these requirements--more properly, "recommended allowances"--are not nearly so precise as we would like them to be. In fact, the history of the USDA, the FAO, and the Food and Nutrition Board of the U. S. National Research Council in estimating food needs has been one of constant (downward) change (cf.5). The blunt truth is we do not know the nutrient requirements for various people under various environmental conditions. The organizations charged with preparing estimates, therefore, have consciously erred on the side of caution.

Back now to the first World Food Survey, which, as I said, shaped the thinking of many people about the world food problem immediately after the war, and set the analytical pattern which has been followed by the FAO and the USDA since. The first survey, though prepared in great haste, purported to cover 70 countries with something like 90 percent of the world's population. Most of tropical Africa was omitted, as was most of

tropical and subtropical Asia with the exception of India. Still, the survey identified the tropics as the principal area of caloric deficiencies. Half the world's population, it stated, was inadequately nourished.

A figure of 2600 calories per person per day was employed as the criterion for calorie adequacy. This figure is now believed to approximate needs of a moderately active, 70-kg. young man in temperate, urbanized conditions (6, p. 2), and accordingly would be an overstatement for almost any conceivable population group.

The Second World Food Survey (7), published in 1952, employed a somewhat more sophisticated requirement procedure . A conference had been held under FAO auspices in 1950 to try to approximate calorie needs more closely. One result was a sliding scale which was subsequently employed in 1952. This involved consideration being given to national differences in ambient temperature, physical size of peoples, and differing age-sex structures.[2/] Though Africa and the Far East were still largely ignored in the survey, Far Eastern requirements were reduced to about 2300 calories per person per day, African to about 2400, and Latin American to about 2550. The coverage of this survey was rather less ambitious than that of the first one, including only 52 countries and about 80 percent of the world's population.

A principal finding of the survey was the discrepancy between apparent agricultural growth rates in the advanced as opposed to the underdeveloped countries. It was noted that in Europe and adjacent areas most of the effects of war had been overcome and production was increasing at more

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[2/] But not activity patterns. Because of the absence of data on this critically important variable, allowances for the "reference" man and woman--3200 and 2300 calories, respectively, per day--were set by taking simple averages of extremes; "a range of daily energy expenditure between 2,400 and 4,000 calories for men and 1,700 and 2,900 calories for women would appear to include most men and women . . ." (8, p. 12).

than an adequate rate. Not so in the less-developed countries. Here, on the basis of very sketchy statistics, it was concluded that the average calorie supply per person was below prewar levels. About two-thirds of the world's population, the survey concluded, suffered from undernutrition (7, pp. 10-13).

The next major survey of the world's food situation was published by the USDA in 1961 under the title World Food Budget, 1962 and 1966 (9). The USDA ventured where even the FAO had feared to tread, and on the basis of a number of hastily-prepared balance sheets, drew up a most depressing "geography of hunger." Included were most of the African and Asian countries. Even Mainland China, despite a total lack of evidence, was not ignored. The data were for 1958. The report concluded that (9, p. 5):

> Diets are nutritionally adequate in the 30 industrialized nations in the temperate Northern Area which account for a third of mankind--more than 900 million people. Their production of food and things they can trade for food assures their food supply, now and for the foreseeable future.
>
> For most of the 70 less-developed countries in the semi-tropical and tropical Southern Area, diets are nutritionally inadequate, with shortages in proteins, fat, and calories. These countries contain over 1.9 billion people. In most of them, population is expanding rapidly, malnutrition is widespread and persistent, and there is no likelihood that the food problem soon will be solved.

In this report, as in the FAO earlier studies, some rather arbitrary nutritional standards were employed. "Diet deficit" countries were defined as all those in which average calorie and protective nutrient availability did not meet standards similar to those established by FAO.

Three years later the USDA substantially expanded the exercise to cover 92 countries for two three-year periods, 1956/58 and 1959/61 (10). The map on the cover of the new report indicated no new diet deficit countries; but an important political angle had been discovered. Without being cynical, it is difficult not to conclude that promotion of the notion of hunger

in the developing world was good politics for the USDA, which was faced with increasingly bothersome surpluses. These could be diminished only by gifts or sales to the underdeveloped countries, or by increasingly stringent controls and/or lower prices to U. S. farmers.

At about the same time, the FAO published its third and most recent world food survey (11). Largely the work of Dr. P. V. Sukhatme, the Director of FAO's Statistics Division, this study concluded that "while the world food consumption level has improved over the last decade, up to the half of the world's population is still hungry or malnourished or both" (11, p. 1). The study reiterated that most of the gains in output had occurred in the developed areas, while increases in agricultural production in the less-developed areas were hardly enough to maintain prewar consumption levels.

Specifically, it was estimated that at least 20 percent of the population in the less-developed countries was undernourished; that is, they lacked sufficient calories to maintain their body functions and normal work patterns. At least 60 percent were malnourished, having diets deficit in one or more protective nutrients (11, p. 2).

The study covered 80 countries and 95 percent of the world's population, including Mainland China and the Soviet Union. No one has ever accused Dr. Sukhatme of excessive statistical circumspection.

During the almost 20 years in which the five surveys held sway, a rash of publications on food and population appeared in both the popular and scientific press. Most proclaimed that a new Malthusian dilemma was upon us[3/]. Drawing heavily on the statistics presented in the three FAO and two USDA reports, and on population projections for the developing

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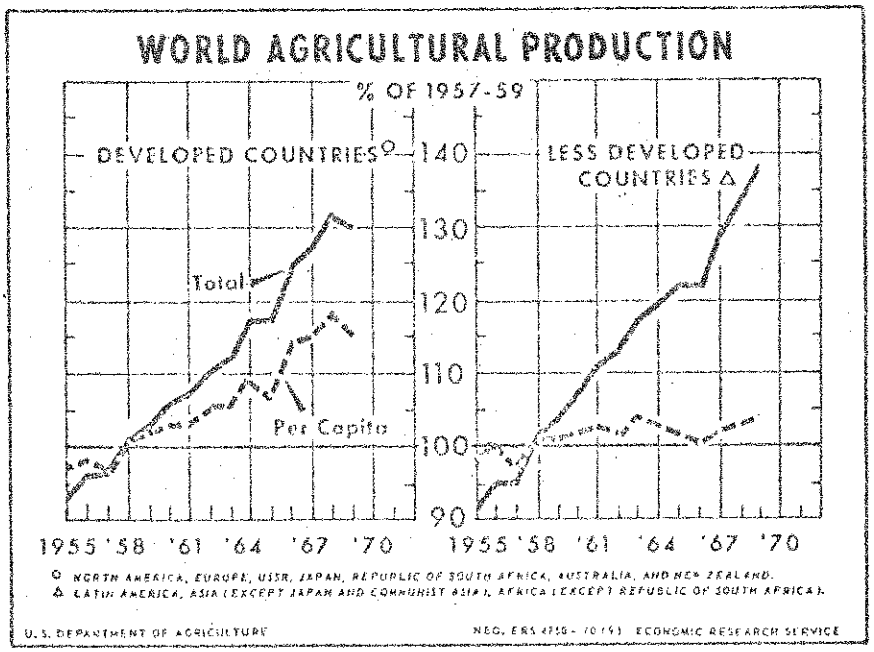
[3/] Their number is legion. Among the better known are 12, 13, 14 and 15.

world, a majority of authors concluded that the world would shortly be unable to feed itself. Certainly starvation would be upon us by the year 2000 when global population was expected to reach six billion people; and some went so far as to forecast widespread famine by 1975 (cf. 16).

A few voices were heard on the opposite side. In the early 1950's M. K. Bennett, in many respects the first student of world food economics, detailed the limitations of the methodology followed in the World Food Survey and persuasively argued (to a limited professional audience) that by 1) overestimating requirements, 2) postulating an unrealistic homogeneity in food habits, and 3) most probably understating actual food production, the FAO was almost certainly overstating the magnitude of the world food problem (17). In amplifying this theme, a few, Colin Clark being the most vocal, carried it almost to an opposite extreme, suggesting that the world could feed a vastly larger population and that population growth in itself was probably a good rather than a bad thing for most nations (18; 19; 20).

Since the Third World Food Survey and the second USDA World Food Budget were published in the early 1960's, there have been two sharp swings in the conventional thinking about global food problems. According to such generally used series of "world" production as that of the USDA plotted in Chart 2, the less-developed countries seemed to be making reasonable, though hardly spectacular, progress from the mid 1950's to 1964. Then suddenly, in 1965 and 1966, there was a leveling off of output and a rather sharp deterioration in per capita availabilities. Cursory disaggregation indicates that this change resulted almost entirely from two serious droughts in India. Indian production bulks so large in the less-developed countries aggregrate that important fluctuations in her output visably influence the index for all developing nations. This fact, how-

CHART 2. WORLD AGRICULTURAL PRODUCTION, 1955-1969*



* U. S. Department of Agriculture negative.

ever, was lost on many commentators. Looking at the figures and hearing of massive PL 480 shipments abroad, it was concluded that we were faced with a truly global problem and that starvation was just around the corner (cf. 21; 22).

A reaction occurred just two years later--in 1967 and 1968. Again the data largely reflected the situation in India. Two comparatively favorable years in terms of weather were accompanied by introduction into the Punjab of high-yielding varieties of Mexican wheat. The result was that the index of production for all low-income countries rose steeply, as did per capita availabilities. The assessment was just as extreme in the opposite direction as it was in 1965 and 1966. The situation in Northwest India, together with the introduction, as a result of experiments at the International Rice Research Institute (IRRI) in the Philippines, of high-yielding, stiff-strawed, fertilizer-responsive rice in wetter portions of Asia, led many to conclude that a "Green Revolution" had occurred and that feeding the world's rapidly increasing population no longer posed unsurmountable problems. Even the FAO, once termed by The Economist "a permanent institution . . . devoted to proving that there is not enough food in the world to go round"(23, p. 456), went so far as to imply in its State of Food and Agriculture for 1969 that the food problems of the future might well be ones of surplus rather than of shortage (24, pp. 1-3).

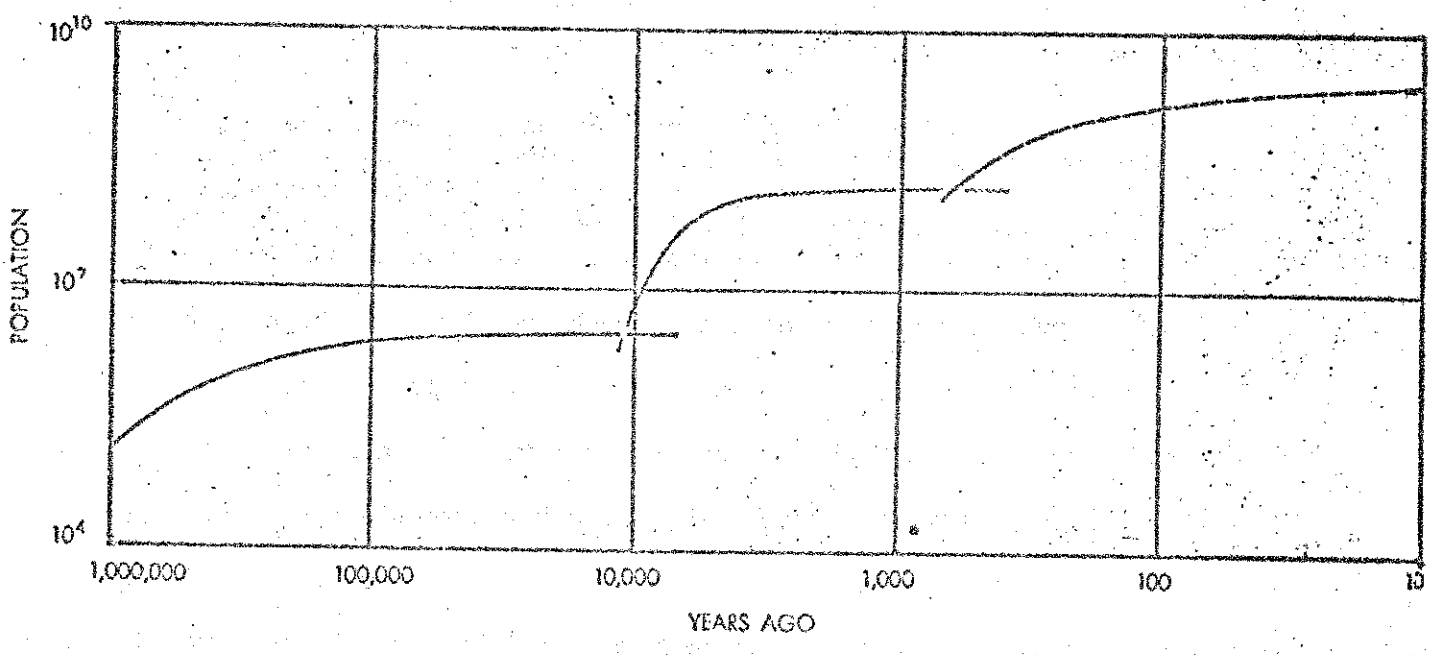
Indicative of the present diversity in popular assessments of the food-population outlook is the range that can be found in estimates of the number of people the world could feed. By making some rather optimistic, but by no means totally unrealistic, assumptions about available land and productivity, Colin Clark has calculated that 47 billion people could conceivably be supplied with an American type diet or 157 billion people with one comparable to that of the Japanese (19, p. 153). Yet

little over a year ago the Secretaries of State and Agriculture advised Mr. Nixon that even with "a US-level of agricultural technology" only about double the present population, 7.2 billion people, could be supported at present dietary standards--hardly up to that of the overfed American--and that this would drop to 6.8 billion "if calories were at least minimally adequate" (25, p. i).

Where lies the truth? I don't pretend to know, but if pressed would opt for Clark's lower figure as more nearly suggestive of the numbers which conceivably could be fed, but the Secretaries' as more realistic (for the wrong reason) approximations of the earth's carrying capacity. For just as it is clear that the scope for increasing agricultural productivity is substantial--and barely tapped in the developing countries of Africa, Asia, and Latin America--it would seem obvious that other constraints will come to bear on population growth long before the earth's sheer abilily to produce food energy. Indeed, to argue the population question optimistically in terms of food is to fall into the same intellectual trap as did Malthus when he reasoned so gloomily. More is involved.

Viewed with the advantage of almost 200 years of hindsight and in the context of a graphing of historical population movements such as Chart 3, Malthus emerges at best a dubious prophet and an historian of questionable perception. The chart--which is plotted on logarithmic scales to make both time and numbers more manageable--makes clear what the conventional picture of population growth obscures: that the present upsurge in numbers is not unique, but the third in a sequence of bursts which have been associated with major breakthroughs in man's ability to cope with his environment. The first occurred about a million years ago (give or take the odd 100,000 years) and attended man's emergence from the primate line into a maker of tools able to hunt and gather over a range of conditions. The

CHART 3. WORLD POPULATION, 998000 BC-1950 AD*
(Logarithmic vertical and horizontal scales)



* After E. S. Deevey, "The Human Population," Scientific American, September 1960, p. 198. 10^4 = 10,000; 10^7 = 10,000,000; 10^{10} = 10,000,000,000.

second marked his domestication of plants and animals some 10,000 years ago and the beginnings of agriculture.

These breakthroughs, of course, did not take place simultaneously around the world, but were staggered in their impact. Just as the industrial and scientific revolution occurred first in Europe, food-gatherers and hunters first became agriculturists in the Fertile Crescent and Southeast Asia. Still the effect in a particular locality was rapid and profound.

> Twenty thousand people would probably be an extreme estimate of the population of hunter-gatherers the Egyptian section of the Nile valley could have supported at the end of palaeolithic times. The population of the Old Kingdom two thousand years later has been variously estimated at from three to six millions (26, p. 26).

That such epochal technological breakthroughs would be accompanied by rapid population rises seems obvious. What is less obvious is the nature of the forces which ultimately acted to force a leveling off. Malthus' food supply, together with such other essentials as space, water, and air, clearly set an upper limit, but one wonders how frequently an operative one. The long-term population equilibria of the past would seem to have been at levels below those associated with marginal starvation.

Thus, "a Paleolithic man who stuck to business should have found enough food on two square kilometers, instead of [the] 20 or 200" believed to have been available per capita, respectively, in the Upper and Lower Paleolithic ages (27, p. 198). And it is not weather but changed political circumstances that is most clearly linked to the great swings in China's population over the last two millennia (28, pp. 49-53).

If we accept the notion that social forces have historically been a more powerful determinant of the human adjustment to a changed technological milieu than absolute potential for sustenance, it behooves us to examine those likely to come into play now that the third of the great upheavals--the industrial and scientific revolution--has at last made itself

felt the world over.

In so doing, it is important that we bear in mind that this revolution is effecting the developing countries in a fashion unique in history. Few if any nations are now able to enjoy the luxury of adjusting to new circumstances unimpinged on by developments in other countries; and it has been the benefits, not the causes of technical change which have visited them first. Medical gains reduced the death rate almost everywhere at least several decades before the scientific method was seriously applied to food production.

If the various agricultural breakthroughs being introduced in the developing world today have any characteristic in common it is selectivity. The high-yielding varieties in particular were not designed to be introduced alone, but are demanding in a host of complementary specifics: fertilizers and disease, insect, water, and weed control to mention only the more obvious. The IRRI "miracle" rices, for instance, are highly fertilizer responsive--as the Indica varieties they are meant to replace are not--and yield well only under irrigated conditions.

Because of this selectivity, it would be a mistake to view the new systems as a panacea. Simply to provide the conditions under which they can be introduced--controlled water, abundant inorganic nutrients, and favorable transportation, credit, and pricing mechanisms--can be time-consuming and expensive. And to the degree that they are appropriate to only certain ecological conditions, benefits will be restricted. Systems devised for (say) irrigated as opposed to rainfed conditions can, in certain countries, exclude up to 80 or 90 percent of potential producer beneficiaries, dooming them, at least in the short run, to a rural backwater. Similarly, the new systems can exacerbate already serious income inequalities between landlords and the moderately well-situated and the great mass

of peasants, tenants, and landless workers. The systems so far developed are capital, not labor, intensive.

A particularly complex group of corollary problems, both present and potential, stem from this fact and the "push" effect it has on migration into cities throughout the developing world. Whereas total population in these areas is increasing at something like two percent per annum, major cities are probably expanding by 10 percent or more. Migration to town was formerly in response to sound incentives and an integral phase of economic and social transformation. The city, with its concentration of capital, technology, and commerce is the logical seat of non-agricultural employment, affording higher wages and greater opportunities to the worker than farming.

Today the movement rests on less solid foundations.

Unlike the urban centers which developed in Europe and North America during the nineteenth century, most cities of the developing world have sprung up in advance of any fundamental change in the local economy and its attendant stimulus to industrialization. To a remarkable degree they remain administrative and trading centers, built up to dispatch raw materials to the developed countries and to receive and distribute manufactures in exchange. Unemployment is rife--30 percent or more of the labor force without jobs is the rule not the exception--as are crime and disallusionment, and will continue so for the foreseeable future.

The prospect, then, is for two groups of disadvantaged to rise coincident with a modernizing agriculture: those by-passed by technical change in the countryside and the unemployed of the towns. Both groups pose political problems of the first order; and that the Green Revolution can lead to a Red one has become almost a cliché. But let he who doubts look to Ceylon or the eastern wing of Pakistan, where the second wave of

postwar revolutions--Chou would say the first wave--has already begun. And let him visit such cities as Kampala or Georgetown, where within the last couple of years all but the foolhardy have learned to lock up tight and stay home at night.

There are, to be sure, other reasons why malallocation of earning power and dynamism in agriculture are incompatable. The most obvious, of course, is that the stimulus to increased food production must ultimately lie in rising effective demand. Diets in low-income countries are efficient in the sense that they are built heavily around calories supplied directly by foodstuffs high in starch content: the grains and the starchy roots and tubers. The portion of calories so supplied declines with improved living levels, being replaced by more expensive, processed calories--meat, eggs, milk, and the like. Such calories are less efficient--the trade-off between potatoes and steak is of the order of ten to one--but are basic to an agricultural economy that will not gag on its own productivity.

Less widely appreciated is the linkage between income and population growth. Only a few years ago it was thought that all that was needed to bring the birth rate under control were a loudspeaker and a supply of contraceptives. Today the experience of such countries as Mauritius, Ceylon, Singapore, and Taiwan indicates that family planning can indeed be rapidly introduced, but only after certain preconditions come to exist. These include increased education (especially of girls), social security, and reduced infant mortality; all of which fall under the heading "improved living levels" or "development" (29). To the extent that people are excluded from either, the tendency is to behave as before.

How the income/employment problem will ultimately resolve itself is a source of great debate and speculation. Most have reasoned that in the short run it must necessarily take the form of an increasingly labor-intensive agriculture, acknowledging this to fly in the face of evidence that

the basic components of technical change in the countryside are capital- not labor-demanding, and that people infected with rising expectations do not seek out farming (cf. 30; 31).

My own guess is that the answer lies equally in the direction of controlled stimulation of demand--in a semi-welfare effort perhaps so massive that it will cease to be welfare. As all who have bounced over what pass for roads can testify, there is great scope for public works in the developing countries. But whether such works can be any more labor intensive than agriculture is problematic, as is, in the light of China's experience with "walking on two legs" during the Great Leap (cf. 32), the ability of low-income countries to mount them. About all that is clear is that the solution will not come easily.

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