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POPULATION, FOOD, AND ECONOMIC
PROGRESS

By

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I. A THOUSAND YEARS OF WORLD POPULATION GROWTH

MAN shares with other living organisms the power of reproducing himself at rates of annual increase almost terrifying to contemplate. In a number of very large national populations the crude birth rate today runs as high as 40 persons per thousand of population—that is, 4 percent per year. It is equally well known that death rates in some large populations—not the same ones, however—today run as low as 10 per thousand of population annually, or 1 percent per year. In a very rough way, then, it can be said that human experience shows that mankind has the capacity to increase his numbers at a rate of at least 3 percent per year.

Such a capacity of increase as 3 percent annually is indeed terrifying to contemplate. It means, if anywhere sustained, a doubling of population about every 25 years. Yet a far more modest rate of increase, of only 1 percent per year, would have resulted in an utterly unimaginable situation, considering the age of the human race. Putnam¹ puts it vividly, though I cannot say how accurately. He writes: “. . . if the race had sprung from a couple living in 10,000 B.C. and if its numbers had expanded at the rate of 1 percent per year since then, there would today be a sphere of flesh many thousand light-years in diameter, whose surface would be advancing into space many times faster than light!” Emphasizing the same point, the able demographer Kuczynski² writes: “This rate (of 1 percent per annum) can best be appreciated when it is pointed out that if the same rate had persisted since Caesar’s death, one couple living at that date would by 1933 have had 700 million descendants.”

Bearing in mind the many scores of centuries during

which mankind has walked the earth, we can readily conclude from calculations such as these that there cannot possibly have been a sustained annual increase of population, whether in the world or in Europe, as large as 1 per cent per year. There is no sphere of human flesh advancing into space faster than light, and there are not 700 million people in Europe even though at the time of Caesar's death the population was not one couple but millions of couples. The rate of increase of population has been not only slow, but very slow. I shall focus attention in this chapter both upon giving a picture of the growth of population in the world and parts of it for several more centuries than others have attempted to do, and I shall seek to explain, so far as I can, why increase of numbers has proceeded at so very slow a pace. In both of these matters there is opportunity for pursuit of John Milton's golden rule: "To be still searching what we know not, by what we know, still closing up truth to truth as we find it. . . ." It will not be within my powers to assemble all fragments of the body of truth. Some pieces, however, may appear to fit together and give an outline, if blurred, of a form.

In illustration of the slow increase of population over a long period of time I have drawn together in a diagram (Chart 1) the opinions of the most competent scholars about the increase in the number of people inhabiting the continent of Europe from 400 years before Christ to the middle of the twentieth century. This is the best-accredited picture we have of population changes in a large segment of the world over so long a period of time. If these estimates can be trusted, the population of Europe, far from growing steadily from century to century, was twice set back—once somewhere during a period of 500 years between 200 and 700

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A.D.; again in a period between 1300 and 1400. It was probably not until the sixteenth century that the population stood at a level as high as that at the end of the second century. The author of these early estimates, Jules Beloch,³ focused his attention upon specific years: upon 400 B.C., upon the first year of the Christian era, and upon the years 200, 700, 1000, 1328, and 1600 A.D. It was not his effort to enlighten us on magnitudes between these dates. From 1650 A.D. it is possible to use the estimates of several students of world population, notably Willcox⁴ and Carr-Saunders.⁵ The indicated growth for the three centuries following that date appears uninterrupted. The loss of life which we associate with World Wars I and II is utterly submerged in the general upsurge of numbers of people in Europe during the most recent half-century.

The second, lighter, line on the diagram indicates what would have been the course of European population growth had it increased steadily even at a crawling annual rate of less than $1/7$ of 1 percent—a rate which would double the population every five centuries. Only in the past century and a half has the actual rate of increase exceeded this crawling rate: crawling, one must say, at least in relation to birth rates well within the capacity of mankind.

Europe is but a segment of a much larger world. It would be absurd to presume that rates of population growth in other parts of the world must have resembled closely those of Europe. Given the known differences in historical developments regionally, we must presuppose regional diversity in population growth. What is needed is inquiry: a survey of population growth either continent by continent, or preferably region by region. Willcox and Carr-Saunders have made such surveys, considering the continents one by one. Their

results give us pictures, not altogether concordant, of population growth in the world as a whole and in major parts of it; but only since 1650—only for a period of three centuries, brief even in terms of what is called historical time. Aided by students in a seminar at the Rice Institute, to whom I make grateful if unduly brief acknowledgments, I have made an effort to push numerical estimates backward in time for another six and a half centuries, to the year 1000 A.D., and simultaneously to review and reconcile the findings of Willcox and Carr-Saunders for years since 1650 in the light of evidence not available to them when they wrote one to two decades ago.

It is proper to give warning against expectations of accuracy. Modern demographers, it is true, have an advantage over their predecessors in the gradual accumulation of credible evidence concerning numbers and growth of populations. Census counts and sample censuses now cover far more of the world's surface than they did even half a century ago; and any new and reliable census or estimation reaches into the past by contributing to the reliability of appraisal of rates of earlier growth. Only 50 years ago it was guessed that the Congo Free State in Africa, now the Belgian Congo, contained 30 million people, but estimation based on far more than guesswork demonstrated later that 10 million at most could be the number. On the other hand, any statement of the world's total population even now may be considerably in error. The compilers of the Demographic Yearbook of the United Nations, when they set down 2,378 million persons as the population of the world in 1949, would not, I feel sure, attest to the accuracy of that figure within a margin of error of at least 50 million in either direction. As we press backward in time, the facts established by

enumeration, by scientific sampling processes, by the linking together over time of data which slowly build up credible trends, become fewer and fewer. Hence conjecture, though I hoped reasoned conjecture, necessarily enters in large degree into the picture which appears in Chart 2. It shows a tentative numerical appraisal—and I must emphasize the word “tentative”—of world population growth from 1000 A.D. to 1949.

What, then, does this chart suggest that is of interest or significance? Perhaps diverse questions to different persons. It suggests such things as these that could not be alleged in its absence: (1) that the world's population has multiplied itself about $8\frac{1}{2}$ times in 950 years; (2) that the population of the whole world in 1000 A.D., somewhere around 275 million, was probably less than half of the population of Europe in 1949; (3) that there has been one century, the fourteenth, in which world population did not increase at all, but declined; (4) that more people—some 800 million of them—were added to the world's population count in 49 years from 1900 to 1949 than in 800 years between 1000 and 1800; (5) that rates of change were different from one part of the world to another not only between 1650 and 1949, which we knew from works already published, but also between 1000 and 1650.

Most striking, however, is the feature of recent population upsurge—a fact widely known, but I think not elsewhere made equally apparent. In no half-century prior to 1650 did the world's population increase by more than about 10 percent. But from 1650 to 1700 it seems to have risen by about 20 percent; from 1800 to 1850 by 27 percent; from 1850 to 1900 by 34 percent; from 1900 to 1949 by 52 percent. Thus the rate of increase has been rising half-century by half-

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century since 1650; and it was not so rising earlier. The date 1650 has the aspect of a turning point in world population development: stagnation before, upsurge thereafter, at an accelerated rate. This is true of the aggregate, not of all the component regions. For some, marked upsurge was deferred for one century or two centuries. But all regions experienced sharp increases of population during the last 50 years. If the world rate of increase from 1900 to 1949, some 52 per cent, should be repeated in the closing half of the present century, the world's population would rise by more than 1,200 million persons. If the rate itself should continue to advance, the population increase would be still larger. And if the behavior region by region should be as it was from 1900 to 1949, all regions would share in the tremendous enlargement of numbers of people.

Malthus, writing in 1798, when the world population was only about 920 million people as against over 2,300 million today, was disturbed by what he conceived as a propensity of mankind to multiply more rapidly than means of subsistence. With the accelerated rates of growth now apparent, it is easily understandable that many a contemporary Malthusian feels and expresses alarm. I shall later venture some reflections upon the problems raised by this continuance of population upsurge, if it does continue; but not at this point.

The evidence afforded by Chart 2 of sluggish growth for more than six centuries, followed by tremendous increase in numbers of people in the past three centuries, with growth rates accelerating to the present time, suggests some sort of profound change in the circumstances governing rates of growth. It is certain that the changes must have been either in circumstances governing birth rates, or in circumstances governing death rates, or in a combination of the two. Migra-

tion, which may swell populations in one region at the expense of another, is not a factor directly affecting population change in the world as a whole. Had one best look, then, toward birth rates and the factors governing them, or toward death rates?

At this point, I think, a presumption of general importance emerges. It is that fluctuations in death rates much more than in birth rates must have determined the course of population growth. It seems to be true that not until the nineteenth century and later—paradoxically, at the very time of most rapid and accelerating population growth—do we find credible evidence of *declining* birth rates; while at no time is there evidence of persistently *rising* birth rates. We must in general suppose, I think, that birth rates in the world as a whole, until we reach a few countries in the nineteenth century, were pressing toward a high potential rate of roughly 4 percent per year. There seems not to be enough credible evidence of protracted non-access of men to women; not enough evidence of deferment of marriage or coupling; not enough evidence of widespread female infanticide, such as would cause a large population to contain an abnormally small proportion of women of child-bearing age, so that birth rates per thousand of total population would be low; not enough evidence of systematic abortion; not enough evidence of inexplicably low rates of fertility among womankind—to lead us to suppose that, up to fairly recent time, the birth rates of large population groups did *not* press toward realization of something like a capacity birth rate which could easily reach 40 live births per thousand of population per year. I say “pressed toward” and not “pressed to.” It is to be granted that mankind has not in historical time bred to full capacity as, I take it, other

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living creatures have done. It is to be granted that in the Middle Ages slavery, polygamy, and abortion may have tended to depress birth rates over a larger fraction of the world's population than has been true more recently. My intention is to make the point that the student of world population growth is on safer ground in presuming prevalence of high and fairly stable birth rates until recently, than he would be in presuming low or widely fluctuating or especially increasing birth rates.

If, then, the specific numerical evidence points toward a very slow rate of population growth in the world prior to 1650, explanation is to be sought far more on the side of high annual death rates, but falling ones, than on the side of low annual birth rates, but rising ones. It seems necessary to imagine general prevalence of high birth rates set against death rates either nearly as high or in some periods higher. The prevalence of death is in strong probability the major explanation of slow growth of populations until we enter a modern era: not only the death which comes to all with age, but death of infants, of children, of youths, of the mature not yet grown old; death by disease, by hunger, by exposure to the violence of nature, and through the violence of mankind upon mankind. It was not without a sharp recognition of immediate reality that our English forebears set these words down only four centuries ago, in the Litany of the Book of Common Prayer: "From lightnings and tempests, from plague, pestilence, and famine; from battle and murder, and from sudden death, Good Lord, deliver us." It seems a pertinent commentary on a changing world that nowadays we focus our prayers against the horror of war. Plague, pestilence, famine, and murder are now in a substantial segment of the earth, though not in as large a segment as

the heart may desire, horrors much less real and far more remote than they appeared to our ancestors.

There seems to be no reason whatever for supposing that the circumstances fostering high death rates, at times even exceeding high birth rates, should have been identical in all parts of the world, or that identical circumstances might not have operated at one time in one region and at another time in another region. We have here good grounds for examining population growth or change regionally. Everyone knows that failure of crops, causing famine and death, never strikes every portion of the world simultaneously; some portions are smitten and some are not. The same is true of great epidemics or pandemics. The world is not and presumably never has been a unit with respect to the calamities it suffers—at least from the unknown time when man came to be widely scattered over the earth's surface. Indeed, less than five centuries ago large concentrations of population had little or no contact one with another: the seas shut off the Americas from the Old World; vast deserts and mountain chains were barriers to contact within Africa and within Asia.

Chart 3 shows tentative appraisals of the changing numbers of people in nine segments of the world, the changes being expressed in index numbers or relatives, with the base year 1000 A.D. Such a chart permits us to analyze comparative rates of growth: where it was slowest, where most rapid; and it permits us to specify broadly the times when, in any particular region, significant changes occurred in the direction of movement. For the year 1650 and following years through 1850 the curves are mostly as they were or might have been plotted by Willcox or Carr-Saunders. But for years from 1000 through 1650, the data are estimates patched

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together from many sorts of sources; it is here that reasoned conjecture looms large.

These curves are arranged more or less in order of my appraisal of their relative credibility; the upper four may reflect the facts more truthfully than do the lower five. Appraisal of relative credibility depends heavily upon the intensity and skill with which scholars have delved into the question of population growth in different regions, and upon

the relative ease of forming an impression of absolute size of a regional population in an early year near 1000 A.D., which may then be linked with a reasonably well-established figure of population in the same area in a later year. Censuses were not unknown even in the Middle Ages. Archaeology, anthropology, ethnology, and written records tell us something of the existence or non-existence of cities and their geographical density, something about focal points from which populations spread. Some inferences about total regional populations can be drawn from this material. History tells of something about plagues, about great migrations, about wars and devastations, about famines—but it tells more about some regions than about others. The summation of evidence, so far as I have it in hand, seems most adequate for Europe and Japan; next for the Americas and possibly India. It seems poorer for China Major (by which is meant China proper plus Manchuria and Korea, Outer Mongolia, Chinese Turkestan or Sinkiang, and Formosa, to name the peripheral areas). Most inadequate is the summation of evidence about Southeast Asia and Oceania (by which is meant what is now Siam, Indochina, the Malay States, Indonesia and other islands of the East Indies, the Philippines, Australia and New Zealand, and the Pacific Islands); about Southwest Asia (by which is meant Afghanistan, Persia, all of Asia Minor, and the Arabian Peninsula); about Asiatic Russia; and about the whole continent of Africa.

It is a temptation to enter upon detailed justification of each of these regional curves designed to represent numbers of population half-century by half-century; but I shall forbear. It may suffice to say a little about three of them: one a fairly reliable picture for Europe, another a questionable

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though still somewhat credible one for China Major, and finally a highly conjectural one for Africa—a “dark continent” in this respect as in others.

We have for Europe Beloch's careful estimates for the years 1000, 1328, 1400, and 1600, which are shown in Chart 1. We have for England and Wales a very detailed inquiry by Russell,⁶ based in considerable part upon the Domesday survey, upon mortality statistics during the period of the Black Death, and upon poll tax records of 1377. We have a great deal of written information about cities and more than a few statements of their size. I find it difficult to imagine that subsequent research will alter really significantly the conformation of the population curve for Europe in Chart 3.

As for China Major, its population even today is not known with certainty. Willcox and Carr-Saunders in the 'thirties were at odds about the level of Chinese population in 1650, one believing in a figure of 70 million, the other in 150 million. They also disagreed about the level in 1900, Willcox preferring 342 million and Carr-Saunders 430 million. Willcox subsequently increased his estimates; and the trend of demographic opinion lately seems to have been to prefer the higher levels. But prior to 1650, even though there were occasional Chinese censuses which are apparently not easily interpreted and reconciled, there seems no recourse other than to accept the view of scholars that China in the year 1000 could hardly have contained more than 100 million people. Quite arbitrarily I use a figure of 70 million, and interpolate from it to a figure of 150 million (Carr-Saunders) in 1650. No one, I think, could read Marco Polo's account of his travels in the Orient toward the end of the thirteenth century and reconcile his description of cities and towns,

their density and age, with ideas of a population of less than some 70 million in the year 1000. If one puts the guess for the year 1000 much above 70 million, the result will be an amount of increase to 1650 so small as seems to me difficult to credit, considering that China was a settled agricultural region and not a region inhabited mainly by nomads or hunters-and-gatherers, whose rates of increase seem generally to be exceedingly slow. But it is possible, in view particularly of bloody Mongol and Manchu invasions and civil wars, that the Chinese population rose and fell, and may have been larger than I assume in the year 1000 and smaller at some later dates.

As for Africa, conjecture dominates the whole picture. Nobody really knows the number of population even as late as 1900. Willcox, reasoning largely in terms of known population density in other parts of the world inhabited by primitive peoples, fixed upon a figure of 100 million in 1650, and held that figure unchanged through subsequent half-centuries to 1850. Carr-Saunders was satisfied with 100 million for 1650, but thought that the slave trade must have reduced the population up to 1800 and supposed an increase thereafter. I find it hard to credit so high a level as 100 million in 1650; it implies greater density south of the Sahara than seems to me probable, and it implies a rather high proportion of the world's population resident there. Considering the really rather small fraction of the population annually affected by the slave trade—even if 10 persons were killed to every slave shipped out, as Livingstone thought—I am unable to feel convinced that slaving actually reduced the African population and prefer to accept Willcox's view that the effect was to hold it stable. As for the period before 1650, it has seemed to me wiser to postulate

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increase than decline or stability for the continent as a whole, considering that there is evidence of populations familiar with agriculture spreading out from centers in the highlands of East Africa and around the bend of the Niger, pushing aboriginal bushmen southward and westward on the eastern side of the continent, and pushing aboriginal pygmies eastward and upward into the central highlands on the west side. But the probable rate of increase from 1000 to 1650 is purely conjectural. One must grant the possibility that African population fell or fluctuated between 1000 and 1650; one simply does not know.

So much for emphasis upon the insecurity of the estimates given in Chart 3. They offer much scope for criticism. It is my impression, however, that the estimated world total for the year 1000, some 275 million people, would be found too small rather than too large if others should seek to improve the estimate. If that were to be shown, then it would also be shown that the rate of growth over the six and a half centuries prior to 1650 was even slower than the exceedingly slow rate indicated in Chart 2; and there might well be even more reason to stress rate of death as the major phenomenon which caused it to be so slow.

We now approach the central and the difficult questions: what forms of death made death rates so high prior to about 1650, and what has happened since 1650 to reduce death rates so as to permit acceleration of rates of growth in the world as a whole and in many parts of it?

The curves in Chart 3 provide some clues. We see, for example, a cessation of growth (though it was a temporary one) in Japan from 1750 to 1850. That is explained by Japanese historians mainly in terms of prevalence of infanticide during the Tokugawa era. We have then a key word in

"infanticide." We see in the curve representing population growth in the Americas a decline in the half-century from 1000 to 1050; and this is reflection of a famine which is supposed to have given rise to migration of the Toltecs. "Famine" is another key word. Also in the curve for the Americas appears a very sharp drop from 1500 to 1650. This pictures the impact of European diseases, notably small-pox and measles among others, upon a population which had never before experienced them and was weak to resist. Its own reciprocal retort is thought by many medical historians to have been syphilis; but one does not note a check to the growth of European population in response to its presumed introduction there in about 1500. The native populations of the Americas suffered also from general disruption of their cultures and governments and systems of food production under the impact of European conquest: one may speak of enslavement, war, mass murder. The curve for Europe, showing a decline from 1300 to 1400, reflects the impact of the plague—the bubonic plague—which, moving from the Middle East, struck violently in the 1340's and later. This drop may also reflect extraordinary deaths from famine only a few decades earlier. The curve for India also reflects ravages of plague in the fourteenth century, as does that for Southwest Asia; and that region was perhaps the outstanding example of an area subject to the devastation of successive invasions and wars, exemplified by the invasions of the Seljuk Turks, of the Crusaders, of the Mongols, who under Hulaku in 1258 destroyed utterly the ancient productive irrigation system in Mesopotamia; by internal warfare between Persians and Arabs, Turks and Byzantines; by the terrible campaigns of Tamerlane toward the close of the fourteenth century; by the conquests of the

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Ottoman Turks. It is a confusing picture, but unquestionably a picture of extraordinary destruction, of life as well as of cities. If there is not depicted in the curve for China Major any decline of population during the thirteenth and fourteenth centuries of Mongol conquest and domination, and if none is depicted in the first half of the seventeenth century in reflection of the successful wars of the Manchus for dominance, it is simply that the probable gyrations of the population curve baffle quantitative expression, and not that decline of population at times, recovery at other times, are at all improbable.

Not all wars represent the clash of the spear-heads, in the form of organized armies, which have behind them large masses of population. Very destructive wars, each on a smaller scale, can be waged by populations, especially of nomadic or hunting types, broken up into small tribal groups. It is not too much to say that such warfare must have been chronic in a very sizeable population in Africa south of the Sahara and in Southwest Asia, and in smaller populations in Southeast Asia and Oceania and in the Americas outside the relatively heavy population concentrations of Incas, Mayans, Aztecs, and Pueblos. No one can yet measure the effect of intertribal warfare on population growth; but it strikes the imagination as an effect too substantial to be ignored.

Quite different from pandemic diseases are and were the persistent killing diseases: infections, dysenteries, respiratory ailments, malaria, leprosy. They may be said to suppress steadily, year by year, the rate of population growth, whereas the great pandemic diseases may strike with fury in some years and in others barely make themselves felt. If the population curves for Japan to 1750 and

for the Americas to 1500 indicate more rapid growth than in other regions, it is in partial reflection not only of freedom from pandemics, but of the existence of a narrower range of diseases than seems to have prevailed in India and Southwest Asia, or even in Europe.

Another cause of death is infanticide; or infanticide plus abortion, if the latter be taken as a cause of death rather than a cause of non-birth. Demographers seem agreed that these practices have deep roots among nomads and hunters-and-gatherers, and one must assign to them a role of some significance in restraining population growth, perhaps especially in Southwest Asia, India, and Africa. Russell presents some evidence suggesting the possibility of female infanticide even in England before and after the Black Death, for such a suggestion emerges when one finds the number of adult males substantially exceeding the number of adult females. Writing in 1933, and analyzing Indian census data from 1881 to 1931, Shirras⁷ showed the ratio of females to males running as low as 72-86 percent in provinces predominantly Mohammedan—a situation not without pertinence to consideration of the growth of population throughout Southwest Asia and Northern Africa in antecedent centuries.

We may now be in a position to list what appear as the most important reasons for slow growth of world population prior to 1650. Great pandemics exemplified by the bubonic plague, persistent rather than episodic diseases, the diffusion of Old-World diseases to the New World, wars of conquest, intertribal warfare, slave raiding, famines, and infanticide and abortion seem to have been the outstanding causes of death; and it was high death rates, not low birth rates, which held back the increase of population. I doubt the

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possibility of ranking with an acceptable degree of accuracy these causes of death according to their relative importance. Yet two suggestions may be ventured. The first is that famine ought not to be singled out as a factor of particularly great significance. The second is that those influences which strongly affect infant mortality rates ought not to be slighted; it is too common an observation now that where crude death rates are notably and persistently high, it is infant mortality rates that are still more strikingly and persistently high. The very young are relatively more susceptible to death, and they are easily killed.

In conclusion, let me say a few words, but only a few, in speculation about the emergence of an accelerated rate of world population growth after about 1650—for it is an approximate date. Here I am bound to fail; the problems of magnitude and of sequence are beyond my compass.

I find it convenient, however, to think of this accelerated upsurge since 1650 in terms of the lifting of a series of ceilings; or, perhaps in greater part, a pushing up of those ceilings through the accomplishments of men themselves. They were, and still are, ceilings imposed on growth through the mechanisms of death. As death rates are reduced, the ceilings are lifted up or pushed up. The unexplained retreat of bubonic plague to its lair somewhere in the Middle East may represent a lifting of a ceiling. Perhaps the completion of the process of exposing populations to diseases previously unknown to them represents another lifting of a ceiling. We cannot say that the world's climate has somehow improved, has become more healthful or has made food production easier and so reduced death from hunger; if we could, this would be the lifting of a ceiling. Ceilings have been pushed up as well. Possibly, though I think we must be cautious in

saying so, they have been pushed by cultivated improvement of man's morals, such that infanticide and abortion especially, and warfare in some degree, have come to be proscribed by larger and larger fractions of the world's people. Assuredly ceilings have been pushed up by undoubted advance in knowledge of medicine and sanitation, and by application of that knowledge. One might err, however, in ascribing overmuch influence to this accomplishment prior to the past century or less.

Reaching farther backward in time are the pushing upward of ceilings by way of political consolidation and by way of economic advancement. By political consolidation I mean essentially the process of reducing the proportion of the population wherein death-dealing tribal or clannish raids prevail, and enlarging the proportion of the population living under systems of law and order wherein murder and raiding are outlawed. Although wars between large aggregations of men remain with us, it seems conceivable that average annual killings of men by men were smaller in proportion to total population, though not an absolute number, in the war-torn first half of the twentieth century than in the first half of the seventeenth century.

As to economic advancement, I mean essentially a combination of progressively higher per capita productivity of the aggregate of economic goods and services and a progressively higher per capita consumption of economic goods and services. Without such advancement we could not have installed the sewers and water-purifying systems which ward off so much death, or educated so many people to cleanliness, or manufactured and distributed soap and disinfectants, or educated so many educators. Without it the world would have fewer blankets, beds, hospitals, and drugs; less shelter

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from the elements in time of illness; less possibility of transporting, by water and rail and air, any life-sustaining or life-saving item from one part of the world to another. I may put it bluntly: one road for the world to return to universally high death rates and to a crawling rate of population increase would be to force, if one can imagine it, every family to sustain itself solely through its own effort, without any exchange of commodities or services with any other family. Certainly economic advancement has contributed heavily to the upsurge of population, and the acceleration of its rate of growth, since 1650. Its effects have not been spread evenly across the world's population groups. To this subject, and in particular to its interlocking with the provision of food for an increasing population, I shall next turn.

II. FOOD AND FAMINE SINCE THE MIDDLE AGES

I VENTURED in the preceding chapter to estimate that the population of the world multiplied itself about $8\frac{1}{2}$ times in the nine and one-half centuries from the year 1000 to the year 1949. If so, it must be said that the food intake of the world's population was multiplied by approximately the same factor. This assertion is to be credited if by "food intake" we mean ingestion of the energy content, the fuel value expressed in calories, of all kinds of food lumped together, and if we stress a little the word "approximately." Human life cannot be sustained in the protracted absence of sufficient calories; so if life *was* sustained in years around 1000 and in years around 1949, as it was, the calorie intake must have sufficed at both times.

Nor would calorie intake *per capita* of the whole population have differed widely from the early period to the late, unless it is to be supposed that the bodily activity of mankind is very much greater or very much less than it was around 1000 A.D. (for the more people exert themselves, the more energy they expend and the more intake of calories they require to maintain body weight); or unless it is to be supposed that the average body size has changed really significantly in the course of these centuries (for a large and heavy person must ingest more calories than a small and light person, age for age and with activity the same); or unless it is to be supposed that nowadays the population is differently dispersed among the world's climates than was true in the eleventh century (for, other influences equal, persons living in cold climates require more calories than persons living where it is always warm).

It may be that average body size, average bodily activity,

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or the distribution of people among climates has in fact changed; and that is the reason for stressing the word "approximately." But I know of no safe grounds for believing that such changes can have been really striking. They may indeed have been offsetting. It seems possible that the average human body, in the Western world at least, may be larger than once it was, tending to increase calorie intake; this is suggested by the difficulty of fitting today's average young man into a suit of medieval armor. On the other hand, the substitution of work by machines for work by men may have tended to reduce calorie intake. We know how hours of labor per week have fallen within our own memories. We are on sufficiently safe ground, I think, in supposing that per capita intake of food calories is among the most stable phenomena of human history; that it can hardly have changed much in a thousand years; and hence that aggregate food intake of the world's population must have multiplied approximately as the population multiplied.

What can be said about total food intake cannot be said about the intake of particular foods: for example, of sugar or rice, of milk or eggs or beef. It is quite possible, indeed certain, that the components of total food intake have changed drastically over the centuries; and it is this aspect of food since the Middle Ages that I shall explore particularly in this chapter. But I shall also explore the impact of famine, which in general terms is extreme shortage of total food calories, and in historical terms is a localized phenomenon witnessed in a particular place at a particular time. For, while it is true that the world's intake of total food calories must have increased as population did, and that per capita intake of total food calories has presumably changed little from century to century, we know that famines—acute short-

ages of calories—have occurred and that their occurrence represents a horror strongly embedded in historical memory and well worth pondering.

Only in very recent years—say within two or three decades—has it become possible to give any sort of quantitative description of the food intake, and the various components of that intake, of population groups whether large or small. This is a much more difficult matter than counting people, and is subject to much wider margin of error. One cannot now survey the whole world and feel that he knows, nation by nation, the level of total calorie ingestion per capita and variations in it from year to year; much less can one know with satisfying precision what fraction of the calorie intake was provided respectively by grain products, starchy roots, dried legumes, sugars, vegetables, fruits, animal products, and vegetable oils. Yet something of a picture can be patched together.

What we see today is a striking uniformity from nation to nation in the level of per capita utilization or consumption and probably ingestion of all food calories, except in so far as average size of body is so much smaller especially in Southeastern Asia than in Europe and the Americas as largely to explain estimated lower levels of per capita calorie consumption where bodies are small. An average adult male in those regions weighs only two-thirds as much as an average American male.

(Parenthetically, I may say that this explanation of differences in estimated national levels of per capita calorie consumption is not as widely credited as I feel it ought to be. Instead, a statistically low level in a particular country is far too commonly regarded as evidence of hunger and starvation in that country—a conclusion never, I think, to be ac-

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cepted without reserve. If one sees in tabulations issued by the Food and Agriculture Organization of the United Nations that average daily consumption of food calories per capita in such countries as Siam or Indochina or Indonesia is only 2,000 calories as against more than 3,000 in the United States, he should not jump to the conclusion that the inhabitants of those Southeast Asian countries are hungry or starving. He might do better to ask our Department of State what its representatives there actually see.)

While per capita calorie consumption in the world at large varies little from region to region over a period of years, except as is explicable in terms of varying body size and activity and climatic environment, it is different with regard to regional *composition* of diet. In this we see sharp contrasts from nation to nation. Some, of which ours is a prominent example, consume very little of the grain products in relation to all other foods combined. Other nations, of which China is one prominent example, show the reverse behavior: much is consumed of the grain products and little of all other food items together.

The basic explanation is undoubtedly economic. The grain products are everywhere relatively cheap, in money or in labor to produce, per 1,000 calories of energy, as compared with the summation of other food products. Nations sufficiently advanced economically can afford heavy consumption of the more expensive foods and light consumption of the cheaper foods. Nations insufficiently advanced economically must hold more strongly to the items, typically grain, which satisfy hunger at the least cost. Families within nations behave in the same way. There are qualifications of this theory, which I shall point out in due course.

If this rule has validity, it follows that change in the com-

position of the food intake of any segment of the world's population is presumably linked with its economic advancement or retrogression. This presumption has governed my choice of the title *Population, Food, and Economic Progress*. I think it impossible to consider intelligently or intelligibly the relations over time between peoples and food without reference to changes in general economic status. Human activity in food production seems to me scarcely more independent of economic activity generally than, let us say, is human activity in producing coal, or even aspirin. What is so often called "the race between population and food supply" might better be looked upon—if there is a race at all—as a race between population and economic development.

Turn now to the question of food in the early Middle Ages, say the eleventh century. What can be known or surmised of this, granting that even nowadays satisfactory descriptions are not available of food ingestion of nations or regions, in total or as to components?

In the year 1000 A.D., the world's population of some 275 million people, less than an eighth of the number in 1949, was nevertheless about as widely scattered over the face of the earth as it is today. It is an amazing picture. Representatives of this small population lived, in the Western world, in Alaska and Greenland, down the Pacific and Atlantic coasts, in the Mississippi and Ohio valleys, in the central plateau, in the highlands of Mexico and the lowlands of Yucatan, in the West Indian islands, in the Andean highlands, on the Atlantic shores of Brazil, even far south to the Straits of Magellan. They lived everywhere in Europe, from Finland southward and from Ireland eastward. They fringed Asia on the north, were in Japan and the Mongolian plains, in China, Siam, Java, Australia, New Zealand, India, Persia, Turkey,

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and Arabia. They lived along the Mediterranean coast of Africa, in the highlands of Abyssinia, down the east coast and its hinterlands certainly to Mozambique (for ruins exist on the Zambezi in Southern Rhodesia), on the west coast and the basin of the Niger. One may suppose that the areas of the earth likely to have had very few inhabitants or none in 1000 A.D. were the more distant East Indies and the southern end of Africa. Subsequent great growth of population is better described as a swelling of human occupancy of inhabited areas, an increase of density, than as invasion of lands utterly uninhabited a thousand years ago.

We may feel certain on several major points concerning the food of this widely scattered world population of the eleventh century. First, the population was more widely diffused than were particular plants and animals, so that diets must then have differed regionally in composition even more than they differ today. Second, with transportation so undeveloped, so difficult and expensive, we may be sure that even within rather restricted localities the food of the inhabitants could only have been what was produced in the immediate neighborhood. The people of London in the eleventh century had very little on their tables that was not produced on English soil, and indeed within a few miles of London: not, as today, beef from Argentina and mutton from Australia, bacon from Denmark, wheat from Canada, oranges from South Africa and Israel, butter from New Zealand, bananas from Jamaica. Third, we may be sure of some population groups then existing that they subsisted on animal products almost exclusively, and of others that they subsisted on vegetable products. So it is today, although the groups living on animal products, the nomadic herdsmen and the hunters of game, must constitute a much smaller fraction of

the world's population than they did in the eleventh century.

It seems in some degree illuminating to conjecture about the occupations of families—what they did to obtain food. One would have been able first to identify a group of town-dwellers who, like town-dwellers today, bought what they ate from others—exchanged their services or their labor or their handicraft work in part for food, and produced no food or little themselves. It seems hardly probable that town-dwellers in the eleventh century could in any reasonably wide sweep of a continent have constituted more than 15 percent of the total population. In all of Africa south of the Sahara, in all of the East Indies and Australasia, in all of North America, and in the vast expanses of Asia beyond the great river valleys of India and China, it must have been a smaller fraction. The mass of the world's people, nine-tenths of them at least, must themselves have been the producers of the food which they consumed. So it is today in wide regions of the Asiatic and African continents; but almost everywhere else the town-dwellers have immensely increased their relative number, while the relative number of self-suppliers of food has greatly declined. This is an aspect of economic advancement; as advancement occurs, so also does urbanization.

The town-dwellers of the eleventh century doubtless purchased their food mainly from a second occupational group, the settled agriculturists—people who stayed in the same place farming the surrounding land year after year. One imagines gradations among these settled agriculturists, some, the nearer ones, selling food to town-dwellers and some not, but nearly all providing their own family subsistence, though not without some exchange of their particular home-grown products for the particular products of other

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producers. Commercial or market farming was then far less prevalent than it is now, subsistence farming far more prevalent. This too is an aspect of economic development.

A third occupational group, again to be encountered today, were the shifting cultivators: people who cleared land, planted crops in it until the yield fell greatly, and then moved on to clear and plant another spot. It is not easy always to distinguish settled agriculturists from shifting cultivators, for one of the ways in which shifting cultivation can be done—and apparently was done in the Mayan civilization—was to divide a piece of land into say 12 or 14 contiguous plots, and to clear and plant one of these each year, returning at the end of the cycle to the first one, by that time grown up again to forest. This system might about as well be called settled agriculture as shifting cultivation; it is in a way a rotation of land if not of crops, and those who practice it need not move their dwellings. In the world of the eleventh century there were not a few families, clans, or tribes which did move as groups from one place to another, who were shifting cultivators. One imagines that they subsisted in part also upon wild game and fish and uncultivated fruits and plants, thus resembling another group which did not cultivate a crop at all but gained its food by hunting, fishing, and gathering. When North America was first examined by Europeans, the native Indians in the northeast were cultivating corn and beans and pumpkins, but they were also gatherers of clams and of berries and fruits, and hunters of deer and turkeys, and they moved their villages.

Finally the world of the eleventh century contained herdsmen, people who subsisted almost entirely on the carcasses and products of domesticated cattle, horses, sheep, and goats. Theirs tended to be grass-land country, their animals rumi-

nants able to sustain themselves on grass alone, and not pigs. The herdsmen were to be found only in the Old World; there were no domesticated ruminants in the New World except the llama of the Incas in Peru. The New World was free of the sort of tribal raiding and warfare represented by the Mongols of inner Asia, who were herdsmen and possessed that swift and fearful implement of war, the horse. Herdsmen, and the animals which they fostered, seem not to have existed in the East Indies or in Australasia and the Pacific Islands. Perhaps they were not to be seen, or were very few in number, south of the southern fringe of the Sahara in Africa. So far as I can ascertain, the incursions into that region by herdsmen in any number—incursions very apparent today—may as well have postdated as antedated the eleventh century. The horse was presumably unknown south of the Equator in Africa, given its peculiar vulnerability to the tsetse fly.

To venture guesses at the distribution of the world's population of the eleventh century among these five occupational groups, I would put it roughly thus: something like 10 percent hunters-and-gatherers; something like 10 percent herdsmen; something like 15 percent shifting cultivators; something like 55 percent settled agriculturists; something like 10 percent townsmen. These are no more than guesses, although I have not resorted to methods of pure chance, like blindfold drawing of numbers out of a box. We do not know precisely the distribution today. But it seems certain that the hunters-and-gatherers have declined in absolute and relative numbers—practically to nothing in relative terms in the much-multiplied world total population of 1949. So also have the herdsmen and the shifting cultivators greatly declined in relative number. The settled farmers have declined

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greatly in relative number but not absolutely. But the townsmen have risen vastly both in relative and in absolute number.

The implications of such occupational changes, vaguely as they must be pictured, are impressive. Over the centuries the production of food per capita by those engaged in food production must clearly have risen a great deal; if it had not been so, there could not have been so great an increase in the proportion of townsmen. Conversely, there must have been a vast increase in the production per capita of non-food goods and services; otherwise the townsmen could not have induced the food producers to part with their product—unless, of course, they could force it, as is not on the whole the historical fact. All this spells economic development, and meant a rising level of per capita consumption of economic goods and services. I do not mean to imply that this occurred at an identical pace in all regions at the same time. Its center was Western Europe, and from there it was diffused in greater or less degree. The process is not yet completed, if ever it will be. In this country we are now concerned, in our foreign policy, precisely with the matter of diffusion of economic advancement. We have other problems too; and it may well be that we prefer to assist in the economic development of those we think of as friends more than of those we regard as present or potential enemies. ECA, its successor, MSA, and Point 4 are symbols.

Let me return now to somewhat more particularized description of the composition of regional diets in the eleventh century. It seems of little significance here to consider in detail the food of the hunters-and-gatherers scattered all over the fringes of the world. They ate meat and animal fat, fish and shellfish, such eggs, nuts, fruits, and edible bulbous roots

as they could find. Their diets were heavily loaded with animal products, though not with milk and butter and cheese, for they had no domesticated animals. The herdsmen, too, subsisted on diets heavily loaded with foods of animal origin. Today the Masai tribe of herdsmen in British East Africa make their meals almost entirely of milk, of blood drawn at systematic intervals from the jugular veins of their cattle, of meat on occasion; and they have little of anything else. So it was among herdsmen generally in the thirteenth century (and no doubt earlier) when Marco Polo described how the Mongols of Genghis Khan lived. Here is what he said of the Mongol armies:⁸

When the service is distant they carry but little with them, and that, chiefly what is requisite for their encampment, and utensils for cooking. They subsist for the most part upon milk, as has been said. . . . Should circumstances render it necessary, . . . they can march for ten days without lighting a fire or taking a meal. During this time they subsist upon the blood drawn from their horses, each man opening a vein, and drinking from his own cattle.

They make provision also of milk, thickened and dried to the state of a paste, which is prepared in the following manner. They boil the milk, and skimming off the rich or creamy part as it rises to the top, put it into a separate vessel as butter; for so long as that remains in the milk, it will not become hard. The latter is then exposed to the sun until it dries. Upon going on service they carry with them about ten pounds for each man, and of this, half a pound is put, every morning, into a leathern bottle, with as much water as is thought necessary. By their motion in riding the contents are violently shaken, and a thin porridge is produced, upon which they make their dinner.

Here we see something of the diet of herdsmen, and equally we gain an understanding of the swift striking power of Mongolian armies, mounted on horses and unimpeded by a cumbersome and lagging supply train.

Perhaps it is possible to say that roughly a fifth of the

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world's population in the eleventh century—the herdsmen and the hunters-and-gatherers—ate diets composed almost exclusively of animal products. The other four-fifths, the townsmen and the settled agriculturists and the shifting cultivators, consumed vegetable products in much larger degree and in some regions almost exclusively. This difference seems explicable in economic terms. I think it can be said of peoples in a stage of hunting and gathering, and of herdsmen, that animal products were the cheapest food products available to them: cheapest in terms of effort to obtain rather than in terms of money or exchange, for the use of money and the possibility of exchange were much restricted even where they were known. On the other hand, among agriculturists and townsmen a ratio of exchange between animal products and vegetable products, a price structure, must have become defined. There is very little evidence to show—although we have some from medieval England—precisely what the exchange ratios between animal products and vegetable products may have been. But generally it is quite safe to say that grain—whether wheat, oats, barley, rye, rice, sorghums and millets, or corn—was cheaper per 1000 calories of the energy contained in it certainly than all other food products combined, and probably than any other food unless, in some localities, it should have been a starchy item like the white or sweet potato, the yam, the type of banana called plantain, the taro or the breadfruit known in the Pacific Islands, or the American root called manioc or cassava. I think we may suppose, with reasonable assurance, that everywhere among peoples engaged in settled agriculture or shifting cultivation in the eleventh century, and also among townsmen, one or the other of the grains or the starchy items would have been the cheapest food per 1000

calories. In distant Uganda in the center of Africa today, in an economy where there may well be about as much barter of goods as exchange for money, a bunch of plantain that will provide the calories for a family of four for four days exchanges for one scrawny chicken with certainly far less than a twentieth of the calorie value of the plantain. Some such exchange ratios must have prevailed in the eleventh century, and indeed in later centuries, outside the realms of herdsmen and hunters. The grains and the starchy roots were relatively cheap foods, and the reason was that they cost far less to produce. It is still true, unless it should be that sugar has finally fallen to about their level in some regional price structures.

Given this general relationship among food prices, we must expect to meet with two phenomena: first, at any particular decade in history, and in any particular place beyond the realm of herdsmen and hunters, to find the poorest families subsisting mainly on grains or starchy roots or the two combined, with the richer families progressively widening the range of items in the diet to include the more expensive ones. That explains why descriptions of meals in times long past, characteristically of the meals of knights or nobles or other well-to-do, so easily mislead us about the composition of the meals of the common people. The truth of this conclusion depends partly upon validity of the underlying assumption, pretty well confirmed by observation, that all people will vary their diets if they can afford it. Second, we may expect to meet, in any large population group once settled agriculturally, with the phenomenon of a downward trend in the *proportion* of food calories derived from the cheap sources of calories, the grains and starchy roots, *provided* that over the time-period considered there is general

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economic advancement. For such advancement means enlargement of family or group power to purchase, and with that comes not only more freedom to consume a wider variety of food, with greater emphasis upon the relatively expensive, but also more freedom to consume non-food items. General economic development and change in the composition of regional diets, or the world's diet, in the direction of wider variety and higher expense, go hand in hand and are not separable one from the other. Enmeshed in this process is improved preservation of food, whether by elaboration of the ancient procedure of drying, or by canning, or by the use of preservatives, or by artificial freezing; and along with it goes differentiation of quality and greater sophistication in the mixing of food substances together.

The cheap foods—the grains and starchy roots—varied greatly from region to region in the eleventh century. In the Americas, the inhabitants knew no other grain than corn, unless we should count rather trifling ones of merely local significance, like wild rice in Minnesota and quinoa in Peru. They also knew and used the white potato, the sweet potato, and the manioc. Ground corn, and potatoes, were the staple foods of Incas, Mayans, Aztecs. These people were vegetarians in practice if not in principle. They consumed beans and tomatoes not known to the Old World, but no milk and very little meat.

In central and southern China and in Japan one would have found a diet in which rice was the staple food and great source of calories, as it is now; farther north and west, wheat. Millets and sorghums, probably barley, oats, and buckwheat were used in that part of the world, but not rye or corn. The people of India used the same list of grains, oats excepted; rice was probably predominant in the moister eastern part and western coast, sorghums and millets in the central

plateau, wheat in the northwest as is true today. The pattern was set centuries ago, by climate. North of the Himalayas and westward generally, rice was unknown. All the way eastward from the Strait of Gibraltar to western India, in the regions north of the Mediterranean but south of the Alps, and in the fringe of Africa north of the Sahara, wheat was the major staple with barley perhaps a close second, and millets and sorghums a poor third; but no corn or rice, little oats or buckwheat or rye. Rye rose to prominence north of the Alps and Pyrenees in Europe, and far eastward into Russia; and in that region oats and barley were prominent food grains, with some wheat. But there one would have seen no rice or corn, not much millet, no sorghums. And nowhere in the Old World in the eleventh century were the white and perhaps the sweet potato known or used, or manioc. South of the Sahara the only grains available seem to have been varieties of sorghum and millet, and there were none of the important starchy roots.

Of the masses of people in every region, again excluding herdsmen and hunters, it is probably true that the main dish of practically every meal was a grain product. It might be, where wheat or rye was the staple, a leavened bread made with yeast and salt and coarsely ground meal, but rarely of finely sifted flour. It might be unleavened flatcakes, thin or thick, of crushed oats or crushed barley, or in the Americas, of corn. It might be boiled husked grain, especially rice in the regions where it was consumed, oats in some places, buckwheat or sorghum or millet in others. We can think of a heap of mush, a pile of flatcakes, or loaves of leavened bread as the central calorie-providing dishes of the great masses of eleventh-century populations, aside from herdsmen and hunters.

Soups or stews made of pungent vegetables and herbs,

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with bits of meat or fish in them, may have been the most common supplementary dishes; or, in the Orient particularly, dried fish or meat or vegetables sprinkled over the rice. Cheese and butter and milk were apparently used throughout Eurasia and North Africa, but not in Southern Africa, the Americas, or Australasia. Occasionally something sweet would have been available—dried fruits like dates and figs and raisins rather more than occasionally around the Mediterranean; honey, though perhaps rarely, everywhere; sugar only in the Orient. So far as I can learn, the vegetables, at least in Europe, were then more generally looked upon as flavoring materials, like herbs, than as substantive foodstuffs. All peoples seem to have had some sort of a fermented beverage, whether from fruit or from grain or from honey—wine or beer or mead. There was cocoa in the warmer Americas, coffee only near the Middle East, tea only in the Orient. All well-settled regions had a vegetable oil, whether from the olive around the Mediterranean, rapeseed and flaxseed in Europe, soybeans in China and Japan, sesame in India and coconut as well, the oil palm in lower Africa, peanuts in the Americas—and of course there were animal fats too. All regions seem to have had some form of a dried legume, peas or beans or lentils. The American Indians had the best beans.

The poorer people everywhere no doubt consumed more of the basic mush or flatcake or leavened bread than did the well-to-do, and less of all the other items in combination. Townspeople fell into the wealthier class. Similarly the more well-to-do, including townspeople, ate the finer qualities of the grain products—the better-polished and whitest rice in the Orient, the whitest and finest wheat flour in Europe.

For about six centuries the regional availabilities of basic grain products, and of the starchy roots, remained much as

I have described it. But there was some change. Rice slowly edged westward into the Mediterranean Basin and probably northward in Japan. Barley, oats, and rye in northwestern and central Europe slowly yielded ground, and position in the diet, to wheat. So far as this occurred, it also constitutes evidence of economic advancement, of increasing fractions of populations becoming able to purchase and consume the choicer grain products. When Samuel Johnson spoke of oats as food for men in Scotland, feed for horses in England, he provided us with an illustration of differences in stage of economic development.

After the discovery of the Americas, though with a lag of many decades, came a veritable revolution. On the one hand corn spread from the Americas to Europe, to the Orient, to Africa; white potatoes to northern Europe and elsewhere; cassava to Africa and southern Asia. The contributions of America included also peanuts, tomatoes, peppers, probably snap beans and several of the best types of dried beans, squashes, pumpkins, pineapples, the papaya, the avocado. The staple foods of almost all of Africa south of the Sahara today were imported: corn and manioc from the Americas, plaintain from Southeast Asia. On the other hand the full range of Old-World plants and domestic animals branched into the Americas. Some population groups, conspicuously those in southern Africa, abandoned their old staple foods and took to new ones; diversity in the staple became more common. The productivity of agriculture was greatly enhanced as the number of crops available and able to grow in a given locality was enlarged. One is almost tempted to say that the great upsurge of world population after about 1650 could not have occurred in the absence of this dispersion of plants and animals. But the temptation is to be resisted; for

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other things were happening too. We should not overlook the inventions and innovations in every line of economic effort: the saving and investment of capital, the division of labor or economic specialization of which Adam Smith wrote, the growth of exchange which accompanied it; the expansion of facilities for transport more efficient than the backs of men and animals and crude carts; the widening use of crop rotations—in short, economic advancement on a very wide and ever-widening front. No doubt this became most readily apparent after 1750, though more than one aspect of it emerged earlier.

What has happened most notably since 1650 may be summarized, I think, as progressively rising output per capita, and consumption per capita, of economic goods and services generally. Food is a part of the complex, not separable from it. Beyond any doubt, the composition of diets has become more and more diversified, less and less concentrated upon the cheap grains and starchy roots, to the extent that peoples have shared the fruits of economic advancement. That sharing, however, has been enjoyed by some groups more than others. I will not attempt to answer the question: Does the population of every segment of the world enjoy a more diversified diet than it did in the eleventh century? What can be said with assurance is that some segments do: western and central Europe and the Americas and Australasia and Japan certainly, and very likely most of Africa, India in spite of her present teeming population, and Indonesia. Of China Major and parts at least of southwestern Asia, I feel less confident. And it must be said, also, that general economic advancement, when men organized as governments harness it too confiningly, can occur, for a time at least, without appreciable diversification of diet. The Soviet experiment seems

to be a case in point. No doubt there have been setbacks and falterings in the sweep of history—but particularized and localized ones, not altering the drift in the world at large.

Finally I reach the subject of famine. This is a word properly meaning, as J. S. Davis⁹ puts it: “. . . an acute, extreme, and general shortage of food for the population of a region, small or large, insufficiently relieved by in-shipments and distribution of essential foodstuffs, and leading to a marked increase in death rate from starvation and from diseases that flourish when food is desperately scarce.” It does not mean mere shortage of beefsteak, or of any other particular sort of food, when a sufficiency of other food is available. Nor does it mean a temporary relative rise in food prices such as to create for lower income groups a difficulty, but not an insuperable one, in purchasing enough food to satisfy hunger. There is always difficulty in distinguishing a “famine” from a “dearth” or a “scarcity.” This is clearly to be seen in Cornelius Walford’s extended essay,¹⁰ published in 1878, “The Famines of the World: Past and Present.” Of this fascinating essay I shall say no more than that it well emphasized the difficulties of ascertaining either causes, precise location, size of population affected, degree of severity, or duration, of the famines in world history.

An outstanding characteristic of famines, however, is that they have always been localized. Another is that, more often than not, they seem to have been one-year calamities, not repeated in successive years; though sometimes, as when the overflow of the Nile is said to have failed for seven consecutive years in 1064-71, the duration is longer. The arrangement of climatic zones over the earth is such that an excess of rainfall, ruining crops in one locality, becomes on the peripheries of that zone a blessing to crops there which

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would do better with more rain than they usually get. Or a drought, while ruining the crops in a chronically dry locality, is advantageous to the crops in a normally wet zone. In considerable degree the vagaries of weather are compensatory. One sees this very clearly on measuring in percentage terms year-to-year variations in world wheat crops and comparing them with year-to-year variations in regional or local wheat crops. Vagaries of the weather—of rainfall, of temperature, of winds—have presumably been responsible for a great many famines, though not for all. Locusts may ravage a region, or blight such as caused the famine of 1846-49 in Ireland when potato crops were ruined. And then there are wars which may destroy the harvest or interfere with sowing, or decimate essential draft animals, or interrupt a customary inflow of food.

If we imagine a population living in a climatic zone such that the whole spread of it is subject to identical variations in rainfall and temperature, cut off from any contact with a different zone, economically so unproductive or so improvident as not to be able to accumulate reserve stocks of food, and focusing attention agriculturally upon a single crop, then we see a community highly vulnerable to famine. A flood, a drought, a freeze, a typhoon, a plague of locusts, a blight, a sudden invasion by an enemy: any of these might precipitate famine. If, on the other hand, we imagine that same community establishing easy and cheap contact with others, enhancing its economic output so that it has stocks of valuable goods to sell or well-established credit, then it can withstand without famine the shock of flood, drought, freeze, wind, or insect invasion. Its remaining hazard is war, whether civil or with an external enemy. There was no famine in the drought-stricken Great Plains of this country in the middle 1930's. It could withstand the shock.

The story of famine is precisely the transformation, or a great movement toward transformation, of communities of people from those of the first type to those of the second type. Famine springing not from war but from natural hazards is a risk hanging over the heads of a far smaller fraction of the enormous world population of 1952 than it was over the heads of the much less numerous population of medieval times. The only portion of the world where famine due to natural hazards is still a perennial risk is, I think, the interior of China where average annual rainfall is low and variable, and which is effectively shut off from other areas jointly by lack of transportation and by lack of economic reserves. Practically all other regions either have more dependable climates, or economic reserves and established contacts with other regions. The Russian famine of 1932-33, the Bengal famine of 1943, the famine of Western Holland in 1945, represent basically the failure of men to accord relief that could have been made available in the absence of political reasons for withholding it.

Following the harvest of the year 1315 in Europe there was a famine of exceptional severity and extraordinary geographical range. It severely affected the British Isles, and all of continental Europe north of the Pyrenees and the Alps eastward about to what is now the Russian frontier. Lucas¹¹ has studied the contemporary records carefully. He assembles a picture of unheard-of persistent downpour of rain beginning in May of 1315 and lasting through the summer: of such floods as made chroniclers believe that the prophecies of Isaias were being fulfilled; of dykes washed away; of armies bogged down, their horses girth-deep in water, men knee-deep in mud; of lowering cloudy skies and low temperatures; and hence of failure of grain, the staple food, to mature normally either in quantity or in quality. The price of wheat in Eng-

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land, about 5 shillings a quarter in 1313, had risen six-fold to 30 shillings by the spring of 1316. In Louvain in Belgium, the price was more than trebled between October, 1315, and June, 1316. Probably every food rose similarly in price; and so with salt, which could not be made by the customary simple process of evaporation in that wet summer. There was a plague—a murrain—among cattle and sheep.

The poor and lowly, says Lucas on good authority, “. . . were forced to feed themselves as best they might; they ate dogs, cats, the dung of doves, and even their own children. Cannibalism certainly was common.” Thieves in prison, unfed, “. . . ferociously attacked new prisoners and devoured them half alive.” Contemporaries saw “. . . the emaciated forms of starving men and women in the streets of London; dirty dead bodies were everywhere to be seen in the wards and lanes.” In the towns, “. . . people tried to relieve the pangs of hunger by eating leaves and roots or an occasional fish caught in the streams. Even the king found it difficult to get food.” A man might travel for three days and not be able to buy any. And, as is so usual in such circumstances, “Pestilence accompanied the famine.” There was “. . . a great increase in crime”: murder, robbery with assault, theft of all manner of articles usable as food or for purchasing food. Starving people ate the flesh of animals dead of the pest, and sometimes of criminals snatched from the gallows or of freshly buried corpses disinterred from graves. A record of persons who were buried each week in Ypres in Flanders was kept by a town official during the height of the famine, which was of course in months preceding the new crop of 1316, after the meagre harvest of 1315 was exhausted. From 54 burials in the first week of May, 1316, the count rose to 107 in early June, to 167 in early July, to 191 in early August.

Then, as the new harvests came, it fell: to 124 in a week of early September, to only 15 in the week ending October 9. If one takes that 15 as the normal weekly death rate of Ypres, or even something midway between it and the weekly toll of 37 for the week ending the preceding September 25, he is forced to conclude that the famine and accompanying pestilence—one cannot separate the causes—brought the death rate in the worst week of the calamity to nine or ten times its normal weekly level. Of course this would not be the multiplication for the whole year. It is partly for the very reason that famine normally swells death rates markedly only during three to five months preceding the next harvest following a bad one that I may seem to have played down famine as a cause of death in my previous discussion of the slow growth of world population from 1000 A.D. to 1650. People are amazingly tough in their resistance to deprivation of food. The experience of World War II, particularly the well-documented famine experience of the Western Netherlands in 1944-45, has so demonstrated.

Could the dreadful experience of much of Western Europe in 1316 be repeated today? No reason is known why there might not come a summer of equally excessive rain—it might be this summer for all that anybody knows. But, under identical assault, would the large population of 1952 suffer as did the small population of 1316? The answer is very clear: it would not, if we assume the seas open to traffic and governments willing to permit the passage of goods into every afflicted area. The Western European community is no longer dependent upon local food production, and it has the economic reserves and the credit, also the mechanisms of transport, to tide itself over with amazingly little impact on food consumption. There would be a retreat to heavier consump-

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tion of grain, simply because it is cheap; but no necessary reduction in total calorie consumption. Additionally, Europe now has dykes and drainage far better able to withstand floods and the waterlogging of land, and it has an agriculture better fitted to cope with climatic adversity. The medieval farmers of Western Europe often sowed wheat and rye mixed in the same field—meslin or maslin the mixed grain was called—and they did so as insurance against vagaries of weather. The wheat would flourish better than the rye in a dry season, the rye better than the wheat in a wet season. Nowadays it is not necessary to resort to such insurance, and the wheat and the rye can be put regularly in the particular soils and fields where each thrives best. Again, it is economic advance on a wide front that has changed both prospect of suffering from chancy weather, and agricultural practice.

It seems fairly clear, then, that since the Middle Ages the food intake of populations has widened greatly in variety in a great many parts of the world; that per capita calorie consumption has generally kept approximate pace with tremendous growth of population; that the risk of famine from natural causes has vastly diminished. The explanation lies in that many-faceted phenomenon, economic advancement, and not more narrowly in expansion of land under cultivation or in improved techniques and lowered costs of purely agricultural activities—though of course they are a part of it.

Yet men have not overcome their inclination to warfare with arms or to warfare of the milder sort, with barriers to trade, to movement of people, to movement of capital toward investment. And, so far as we know, the population continues to grow at an accelerated rate. There are questions—many of them unanswerable ones, I am sure—about the future of economic expansion, and population expansion. It is this general topic which I propose to examine next.

III. CURRENT PROBLEMS OF EXPANSION

DISCUSSION of "population problems" seems almost inevitably to bring forward immediately the name of Thomas Robert Malthus. The impact of what he wrote in 1798 is powerful, in no small part because of the forcefulness of his style and the evidences of character and quality of the man that shine through the pages—of thoughtfulness and high purpose and integrity, of an attitude truly scientific and free from arrogance. We should not forget the full title of his work: *An Essay on the Principle of Population, as It Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Godwin, M. Condorcet, and Other Writers.*

Here is the skeleton of his argument, quoted from his first chapter:¹²

I think I may fairly make two postulata.

First, that food is necessary to the existence of man.

Secondly, that the passion between the sexes is necessary, and will remain nearly in its present state.

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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

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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. . . . And it appears, therefore, to be decisive against the possible existence of a society, all the members of which, should live in ease, happiness, and comparative leisure; and feel no anxiety about providing the means of subsistence for themselves and families.

Consequently, if the premises are just, the argument is conclusive against the perfectibility of the mass of mankind.

From these passages, one may well gain the impression that Malthus' power of expression bears a resemblance to the power he ascribed to population: an overwhelming power.

I find myself wondering whether Malthus would have developed his argument precisely as he did, had he not been so deeply concerned with the then-current philosophical discussion about the "perfectibility of man." Can this have induced him to select evidence in a particular way, to choose particular phrases? This we cannot know. And yet I am unable to escape the feeling that if so sharp a mind had set itself to a more specific and limited question—for example, what are the world's chances of increasing its population in the next century and a half, and at the same time achieving a wider spread of comforts and conveniences and variety of food among mankind?—the tone of the presentation might have been less pessimistic, though perhaps not optimistic.

But Malthus did not occupy himself with an examination of possible or probable developments, in the world or any part of it, over a limited time-period. He was concerned with ultimates, and above all with driving to the general conclusion that perfectibility of the mass of mankind is impossible and unbelievable. I have cited the full title of his essay and the full skeleton of his argument, which drives to that con-

clusion. It needs only to be added that not much more than a third of the first edition of his essay is devoted to development of the propositions concerning the relationship of population growth to subsistence; the larger part consists of argument against passages in the writings of Wallace, Condorcet, Godwin, and Adam Smith.

It seems fair to ask, however, if Malthus' first essay yields evidence that he would have been surprised, perhaps shaken in his convictions, if he had lived all through the nineteenth century and until now, observing the enormous growth of the world's population and equally an elevation of consumption level and an interrelated diversification of diet experienced by large population groups. The level of world population in Malthus' day of writing, as he could not know but modern demographers believe, was about 900 million people; it rose by half-centuries to about 1,150 million in 1850, to 1,550 million in 1900, to nearly 2,400 million in 1949, and the rates of increase by half-centuries were progressively higher—successively 27 percent, 34 percent, and 52 percent. While economic progress cannot be expressed numerically, I hope that I have already shown convincingly that consumption levels had risen over a large fraction of the population, that calorie consumption per capita cannot have fallen, that, again over a large fraction of the population, diets had become more diversified in composition, that famine from natural causes had fallen from its status as nearly a universal risk to a status of risk to a much diminished fraction of the swollen population of today.

I suspect that Malthus would have been surprised at all this. It is much to be doubted if he expected such things to happen. I feel confident that, living today, he would admit that his expectations, so far as he had formulated them in 1798, had not on the whole been borne out.

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Yet I suspect that he would stoutly reaffirm his view that perfectibility of mankind is out of the question. Conceivably he might insist that his "principle of population" retained a general validity, clearly requiring modification mostly with respect to the proposition, "Subsistence increases only in an arithmetical ratio." History would cause him to retreat from that. Still, he might feel that the necessary modification here had best be interpreted to mean that an access of misery and vice has been postponed but cannot possibly be postponed forever; that it must and will appear. Yet we can only conjecture about the extent of revision he might make.

Living today and reviewing a century and a half of population growth, Malthus would encounter other aspects of it which might additionally shake his views. Some surprise he might have felt in learning of such extensive decline of death rates, to which I assigned a major role in explaining why world population began about 1650 to shoot upward at an accelerating rate. Certainly he would have been surprised at the speed and geographical extent of general economic advancement, perhaps especially at the development of transport and its rapid creation of close and easy contact and trade. The spread of literacy and education, a concomitant of economic advancement, would have surprised him, for he wrote:¹³ "I would by no means suppose that the mass of mankind has reached its term of improvement: but the principal argument of this essay tends to place in a strong point of view, the improbability, that the lower classes of people in any country should ever be sufficiently free from want and labour, to attain any high degree of intellectual improvement." He could not have used these words if he had foreseen the economic changes of the fifteen succeeding decades, which have made feasible in some countries compulsory school attendance by the young.

Most of all Malthus would have been surprised, I feel sure, at what has happened to birth rates and how it happened. This subject I touched upon only lightly in considering the great population upsurge since 1650; it was not necessary to probe deeply, for the effect of changing level of birth rates was to reduce the rate of this upsurge, not to accelerate it.

Curiously enough, about when Malthus wrote, or not long after, the birth rates of some of the world's population groups began to decline. The facts were not clearly apparent at the time. Retrospect calculations suggest that a decline in the birth rate of the white population of the United States set in at least as early as 1800; births are reckoned to have fallen from 55 per thousand of population annually then to 43 per thousand in 1850, to 30 per thousand in 1900, to only 20 per thousand in 1930. From over 60 per thousand in 1770 the birth rate of the Catholic population of Quebec in Canada is reckoned to have fallen to 40 per thousand in 1910. The trend was downward in Sweden after 1830; in France, certainly after 1845, if not earlier; in England and Wales, possibly after 1800 and unquestionably after 1870; in Ireland, certainly after 1864. In Australia and New Zealand, crude birth rates fell from levels of 35-40 per thousand in 1875 to less than 20 per thousand in 1930. Evidence of downturn of birth rates in Eastern Europe became conclusive only later, after 1910.

The causes have been examined. In these particular countries and in these particular decades it is not necessary to look for explanation toward widening spread of practices of female infanticide, of abortion, of slavery, of prohibition of remarriage of widows. The directions in which to look are non-marriage, deferment of marriage, abstinence from marital relationships within marriage, and contraception. Additionally, prolongation of average length of life might inde-

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pendently give rise to some decline of birth rate. For with such prolongation the ratio of women of child-bearing age to total population would fall and if so, other things equal, the crude birth rate—the number of children born in relation to total population—would fall as well. Demographers stress the widening sphere of birth-control, that is to say of contraceptive practices, as by far the major though not the exclusive explanation of declining birth rates in practically all of the regions specified above.

Quite possibly Malthus would not have looked favorably upon this, though he condoned deferment of marriage. Contraception he might have regarded as resort to vice. He might have looked similarly upon the urbanization of countries accompanying their economic development, for he seems commonly to identify cities with vice. However, Malthus would certainly have found it surprising that birth rates have fallen in a good many parts of the world.

Still more surprised might he have been to find that in some countries decline of birth rate had so far fallen by 1930 and even earlier, although death rates were falling too, that prospects began to emerge for absolute decline in numbers of population. Carr-Saunders wrote in 1936:¹⁴ "We may anticipate that in north and west Europe there will be no further increase of population of any importance, and that before 1950 the population will be on the decline in most countries in this region . . . the drop in numbers will only become rapid about 1960." And of the United States, Australia, New Zealand, and non-French Canada he added: ". . . the maximum population will not be more than 10 to 15 per cent larger than the present population. Thereafter decline will set in assuming that fertility does not rise."

This prospect, of absolute decline of population attribut-

able to low birth rates rather than high death rates, was an idea about future development widely current only a few years ago, perhaps so generally believed in that many cling to it now. My colleague, J. S. Davis, writing in 1949,¹⁵ was the first to shake it. He pointed out that in the United States birth rates had so reversed their apparent trend, so risen since 1940, and most strikingly in years beginning with 1946, that it was no longer reasonable to count upon an early turning-point downward in total population. A similar upsurge of births has occurred in several of the very countries wherein Carr-Saunders, writing in 1936, expected to see declining populations within a few decades. Already the mothers of the future have been born who are very likely indeed to prevent this. The fertility rate has risen sharply of late, though for how long to persist no one can say.

All this would have astonished Malthus. It looks very much as if birth rates in some parts of the world may have become mobile, sometimes falling so low in relation to rather steadily declining death rates that a prospect of declining total population emerges, sometimes rising so that this prospect is submerged again. Perhaps a stage has been reached in many countries wherein people by the summation of individual choices as to births largely determine whether total population shall rise or fall. Nothing could be more different from Malthus' ideas of causation. Although he spoke of "preventive" as well as of "positive" checks, he seems to have counted upon death rates to hold population down—upon external compulsion to govern the changes in population numbers, and not upon the choices of people to do it. I cannot interpret him as having much faith in the effectiveness of his "moral restraint," meaning deferment of marriage plus chastity.

A full explanation of recent changing mass decisions about

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births, and hence about rates of population growth so far as birth rates affect them, seems not to be at hand. Notably it is not clear whether the younger generation of Americans now marrying or recently married has a different ideal of family size from that prevalent, say, one to four decades ago. However, it seems probable that decisions whether to have more or fewer children, whether to marry early or late, whether to marry at all, may be linked with appraisals of the prospects for the economic welfare of children as they become mature. There may be a connection with the cycle of economic activity. Forethought and prediction seem to enter into decisions, and contraceptive means are widely available. It has been shown conclusively that the higher-income groups are those who most carefully restrict family size. There is correlation between high income and education. In general terms I think it has become safe to say: with rising consumption levels, the long-run tendency is for birth rates to fall—marriage to be somewhat deferred, family size to be limited through exercise of forethought and contraceptive practice; and when consumption level rises sufficiently high, birth rates may stabilize or fluctuate with mass appraisal of economic prospects. It is a generalization which I should not care to limit to the United States or to Western civilization, though I should be the first to grant that customs and ideals differ so much between population groups of the world that a given percentage increase in consumption level could not be expected to have the same impact on birth rate in each group.

Let me now leave Malthus, while reiterating the belief that a man of his penetration and integrity would not today state the population problems and prospects of mankind in terms nearly as pessimistic as were his in 1798. The fact is

that we no longer feel intellectual compulsion to blanket all mankind with a prospect of poverty or misery or vice—at least if we are willing to regard as non-vice that which demographers look upon as the dominant instrument in control of birth rates, contraception. What troubles students of population problems today is appraisal of the prospects for specific population groups, perhaps over a rather limited number of decades, even of years, to come.

We find current pessimism expressed in such sentences as these, quoted from a report published in 1950 by the Rockefeller Foundation under the title, *Public Health and Demography in the Far East*.¹⁶ The countries or regions considered in this report are Japan, Taiwan and Korea, China, Indonesia, and the Philippine Islands. The sentences quoted from it are: "Declining mortality and stable fertility cannot coexist permanently within a finite universe, whatever the level to which technology may advance. Sooner or later the increasing pressure of people on subsistence will lead to the re-establishment of the forces of death, whether by general debility of the people or by famine and pestilence." Turning to India, one may see something similar in *Newsweek* for January 28, 1952. There is shown a photograph of Indian mothers and children, under it the title: "India's mothers: Cut the birth rate or starve." This I take to be American journalese; at least, it catches the eye.

The first statement, however, is not journalese. It might be interpreted either as a statement about the very long-run prospects of the world as a whole, or as a statement about the prospects as of 1950, in a particular part of the world called the Far East, for a time-span of decades rather than centuries or eons. The second interpretation is to be preferred, for the writers of the statement know very well that declin-

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ing mortality and stable fertility definitely are not features of population behavior throughout the Western world, but are observed phenomena of recent years in parts at least of the Far East—also in parts of Africa, the Middle East, Latin America.

Yet one also rather frequently encounters, currently, statements which bear the stamp of universality and concern the fate of the world many hundreds, even thousands, of years hence. The world's land, it is said, is finite in quantity. So must be the land's capacity to produce food. Man's capacity to reproduce himself is far from being equally limited. Man is expanding his numbers at the rate of one per cent per year. If that rate should be continued for a thousand years, there would be on the earth in the year 3000 not the 2.4 billion people of 1949, but 95,000 billion people. This is too many to imagine on so little land. So we must put a stop to this current rate of growth, because if we do not, there will be pain and trouble. A powerful remedy is at hand: fewer births. Let us do everything we can to reduce the number of births. It is an urgent problem. Let us waste no time. Let us even block the flow of medical and sanitary knowledge and equipment to countries which will not find ways, or at least promise to find ways, to reduce their birth rates. At the same time soil is being washed away and blown away and robbed of its fertility; watersheds are being denuded of their water-retaining cover; underground water levels are falling. Let us put a stop to every evidence of this. Let us correct the ratio of man's number to land, the future if not the present ratio. And let us be about it now, at once, and in a big way.

This is not, I think, a misrepresentation of fairly common current attitudes toward what is called the population problem, though they may be popular rather than scientific atti-

tudes. I feel a touch of hysteria in them. Many people will not take these positions. The feature of interest here is the mingling of a long-run point of view expressed globally with various shorter-run points of view having respect to particular places.

In the long-run global analysis I must confess to a complete lack of interest. It is a reversion to the Malthusian form of statement: that population has *power* to increase faster than land, or perhaps food, or perhaps consumption level (different people define variously the dividend in this piece of arithmetic, wherein population is always the divisor), so that ultimately the quotient of per capita land, or food, or consumption of goods and services *must* fall so as to be painfully low. If experience shows anything, it is that the *power* of population to increase is not necessarily exerted, but lies within the control of mankind, and a moderately painless sort of control too. We know also from historical evidence that the *power* of food output or consumption level to increase has not necessarily a ceiling upon it or a rate of change that is either stable or low; it does not have to increase in arithmetical ratio only. There is no compelling necessity for level of food intake or consumption level to decline or for misery to increase. If I do not assert the same about vice, it is because a firm and unchanging definition of vice lies beyond my powers. There is no necessary ultimate outcome.

No one ought to be impressed by calculations of land-man ratios, such as will show in arithmetical perfection that *if* world population should increase at its current rate of about one per cent annually, a specific year in the future could be named when only one square inch of the earth's surface would be available per person. This is purely an arithmetical exercise. It is also a sterile one. Why bother with it? Few

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people spend time worrying about future division of the world's wealth if a man should invest \$1,000 at $3\frac{1}{2}$ per cent interest, specifying in his will that it is to compound for the benefit of an heir only six hundred years hence. The arithmetic says that the heir would receive 1,000 billion dollars. Are we therefore to wring our hands? I think not. We may feel a sublime confidence that something would have happened meanwhile such that society would not permit it. So it is with the arithmetic of population growth: society may be counted upon to act in such a way that the impeccable arithmetical calculation fails to work out; society has the power to act. The arithmetic carries in itself no element of prediction, no element of compulsion. Equally sterile and uninteresting are all efforts to calculate how many people could ultimately be fed by the produce of the earth's surface. All this dabbling with global situations a thousand or ten thousand years hence may have its charm and fascination for some, along with its pitfalls for many. Serious students, however, tend nowadays to turn their analytical powers and tools on parts of the world rather than upon all of it; on history and observed tendencies more than on prophecy; on prospects for a few decades rather than for centuries or eons to come.

I think I may say truthfully that there is widening recognition among social scientists of weakness in the available tools of analysis for attacking problems of economic development or, if you choose, problems of population. The question usually posed in this field, if formulated historically, now tends to be stated thus: Did the general consumption level of the population of area X rise, fall, or fluctuate between years a and b; how much; and why? Some, it is true, might use the words "level of living" or "standard of living"

rather than the words "consumption level" in framing the query. The conceptual differences between consumption level and consumption standard, between level or plane of living and standard of living, are important. But I cannot here enter into technical discussion beyond indicating that a standard, whether of consumption or of living, might better be regarded as something to which a population aspires than as something within its experience. If formulated as projection or prospect, the question usually posed now tends to be stated: May we expect the consumption level of the population of area X to rise, fall, or fluctuate between years b and c; how much; and why?

The tools of analysis are discouragingly weak even for providing an answer to the question: Exactly what populations in the world, in some specified year or period within a decade or so, were characterized by low consumption level, by low real income per capita, by population pressure, or by overpopulation? For the words "low consumption level," "low real income per capita," "population pressure," and "overpopulation" are used as different phrasings for describing a condition of prevalence of poverty, although distinctions might well be drawn more sharply among them.

In the matter of differentiating between nations as to their relative status in consumption level or something resembling it, some progress has been made in recent decades. One can now turn to various publications¹⁷ and find a long list of estimates of per capita national income, expressed in United States dollars. Tabulations pertaining to 70 countries showed national income per capita in 1949 ranging as low as 25 to 50 United States dollars in the following: China, Burma, Thailand, Indonesia, South Korea, the Philippines, Afghanistan, Saudi Arabia, Yemen, Ethiopia, Liberia, Ecuador, and

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Haiti. In the same year the per capita incomes were above 500 dollars in the United States and Canada, Australia and New Zealand, the United Kingdom, Belgium, Luxembourg, the Netherlands, Switzerland, Denmark, Norway, and Sweden; and they were between 300 and 500 dollars in France, Czechoslovakia, Poland, Finland, the Soviet Union, Ireland, Iceland, Israel, Argentina, Uruguay, and Venezuela. Or one can turn to Colin Clark's work¹⁸ and find a survey of the world showing his estimates of "real income per man-hour worked" in 1939 and some earlier years, for most geographical regions. Or one can turn to my own appraisals of relative consumption levels in 31 countries in the period 1934-38,¹⁹ wherein I left aside all calculations in money and turned to such indicators of consumption level as consumption of calories per 100 pounds of humanity, per capita consumption of calories not from grain, of tobacco, of sawn lumber and cement, of textile fibres, of household energy and energy used in manufacturing and in transport, of pieces of mail circulated, and of freight tonnage transported; also rates of infant mortality, number of physicians per thousand of population; percentage of children attending school, and numbers of motor vehicles, telephones, animal units, and movie theatres per thousand of population. This method well illustrates the important point that a generally low consumption level means low consumption of nearly everything. It is a method that has its flaws. So also does the method of comparison of per capita money incomes expressed in United States dollars, for relative prices of commodities and services differ widely from country to country. I have mentioned before that a shilling in Uganda will buy a bunch of plantain sufficient to provide calories enough for a family of four for four days. A shilling is 14 cents. But you will not be able in

the United States to buy for 14 cents anything like the number of calories that would supply a family of four for four days. You can buy a chicken in Uganda for 14 American cents, too; but not here. The Uganda per capita income will buy more of many things in Uganda than the same monetary sum will buy in the United States. If you wonder how the Chinese can survive on per capita income of 25 dollars yearly, you will find an answer in the prices they pay, especially for food.

Such measures as these, however, show us in a general if inexact way where consumption levels are highest, where lowest, and where intermediate. We see that there is no sharp dichotomy between low and high, but a gradation between population groups more like a ladder or a flight of stairs. The United States usually stands on the top rung, and Canada, Australia and New Zealand, and various countries of Western Europe on rungs next below. It always appears that Japan stands on a higher rung than other Oriental countries, Argentina on a high rung as compared with most other Latin American countries, the Union of South Africa high among African countries. But it remains difficult if not impossible to say exactly where consumption level is lowest, and to differentiate between the countries grouped near the bottom of the ladder. In this respect the available tools are decidedly dull. And yet it is precisely about relative levels in those low-level countries that interest currently centers.

Above all, students would like to have evidence pertaining to these countries such that we could feel certain, looking backward, whether they had risen from still lower levels or had fallen from higher ones; and looking forward, whether they appeared to be rising or falling. In this respect the tools of analysis are very blunt indeed. It is only for

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the more advanced countries that we can trace economic advancement or retrogression (for we can tell that Germany and Japan enjoyed higher consumption levels before the war than now); and this is easily understood because it is the more advanced countries that can afford to compile statistics and are interested in them. The tools for historical and predictive analysis of changing consumption levels are, then, greatly in need of sharpening, and this for the very countries where population growth in relation to economic advancement gives most concern.

Translated into more concrete terms, what I have said about the inadequacy of analytical tools means that I cannot confidently answer, and I believe that no one can, the question: Has the consumption level of India risen or fallen since 1900 with its population growing so rapidly, and is the consumption level tending now to rise or to decline? Some evidence suggests one answer, some another. It requires exhaustive analysis, and the invention of improved analytical tools. Such problems as these now occupy the attention of social scientists, and they cannot rest content with the mode of thought set forth by Malthus. Not many experienced students of population problems or problems of economic advancement will feel easy about the journalistic caption I quoted earlier: "India's mothers: Cut the birth rate or starve." They might rather be inclined, I think, if their opinions should be asked, to suggest movement on a far wider front: encouragement of innovation, of domestic capital accumulation and investment and inflow of capital from abroad, of education including access to information about birth control along with access to information about death control and about agricultural and industrial techniques. They will shrink from trying to identify a single bottleneck to economic advancement.

If, now, you insist upon putting the question: *Can* the world's population possibly grow between 1950 and 2000 at its rate of growth from 1900 to 1950, implying an addition of 1,200 million people to the count, I will say it *can*, and it *can* do so with rising consumption levels. If you ask, *will* the population so rise, I must say: Who can tell? For the rate of increase, already a matter of human choice in many parts of the world, may become so in more; and I doubt if there is appreciable predictive value in our knowledge of the way in which human choice may operate to restrain or swell births. That people everywhere will cling to technical knowledge and will advance it, including knowledge of control of death rates, I see nothing in recent history to deny, but equally nothing to permit estimate of probable speed of advance, for this too involves choice. If you should ask, can consumption levels everywhere rise within 50 years to a position of world-wide equality, I should be inclined to say that this is virtually inconceivable. So far as history is a guide, the specified time, only half a century, seems far too short for the laggards to catch up with the leaders. Achievement of international equality of consumption levels seems to me a misconception of goals attainable within a generation's vision. But achievement of rising consumption levels everywhere, with differentials persisting but varying, does not.

I shall close with three observations. The first is that I do not identify differentials in consumption level with differentials in human happiness. I might hold the opinion that people seem to strive to achieve higher consumption levels, and are seeking happiness at the same time, but I have no proof to offer that they will not have grasped a nettle with the achievement.

The second is that the connection between wars and

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striving for higher consumption levels appears to be not at all simple. Malthus did us an injury, I think, in ascribing the historical invasions of Europe by barbarians to pressure of their swelling populations upon their local food supplies. Certainly those movements were largely pure raids in search of loot and of tribute, sometimes merely a ruler's wish to exert authority over more people. Yet raiding itself, so far as it expresses a consensus among the raiders and not pure willfulness of a leader, may be looked upon as search for higher consumption level. It does not seem, however, to be from population groups who experience the lowest consumption levels that aggressive war is to be expected. Their power to conduct war is restrained by their poverty, more so today than was true when armaments were simpler and cheaper. Aggressive war can have its origin based firmly in desires of peoples already at high consumption levels, perhaps whipped up by leaders, to elevate their own consumption levels further at the expense of others, and not necessarily based in the yearnings of poverty-stricken peoples to elevate theirs. So far as I am able to comprehend history, it yields no evidence that with all population groups equally prosperous or equally poor, equally well fed or equally ill fed, or equal as to rates of population increase, wars must become less frequent or easier to avoid. The problems of war seem to lie largely beyond the problems of population, food, and economic advancement.

Third and last, I hope not to have conveyed the impression that the future must or will unfold painlessly, without effort on the part of mankind and without any current reason for the thoughtful to be troubled. We see Britain struggling with "dollar shortage," which is an expression meaning, in essence, the effort to hold consumption level as high as

possible or to advance it in the face of crippling losses of income-yielding assets during World War II. We see Germany, Japan, France, and many another country struggling in much the same way. We see clearly enough many countries wherein production per capita of agricultural commodities, including foodstuffs, has not yet recovered to the levels of 1938 or 1939; in a particular sense, it can be said that population has outrun food supply, or at least that food supply, while recovering, has not yet caught up with population. One would be blind or foolish to laugh off clearly apparent situations of this sort, to sit back comfortably, feeling that all is well and must remain so. One would be equally blind in failing to see in Western Europe that recovery of industrial output, indeed expansion of it, has moved with truly amazing speed since the end of the war to levels well above those of prewar days. The prospect for consumption levels to rise is today a brighter prospect than it appeared to be in 1947. It may or may not be still brighter in 1957. The burden of my argument has been not that higher consumption levels are somehow assured, not that lower levels are inevitable, but that man has it within his power to turn one way or the other.

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APPENDIX

APPROXIMATE POPULATION OF THE WORLD AND ITS SUBDIVISIONS, 1000-1949 (Millions of persons)

Year	Europe	Asiatic Russia	Southwest Asia	India	China Major	Japan	Southeast Asia, Oceania	Africa	The Americas	Total
1000	42	5	32	48	70	4	11	50	13	275
1050	46	5	32	49	74	5	12	52	12	287
1100	48	6	33	50	79	6	12	55	17	306
1150	50	6	33	50	84	7	13	58	20	321
1200	61	7	34	51	89	8	14	61	23	348
1250	69	7	35	49	94	10	14	64	27	369
1300	73	8	33	50	99	11	15	67	28	384
1350	51	9	30	47	106	12	16	70	29	370
1400	45	9	27	46	112	14	16	74	30	373
1450	60	10	28	51	118	15	18	78	35	413
1500	69	11	29	54	125	16	19	82	41	446
1550	78	12	30	60	132	18	20	86	23	459
1600	89	13	30	68	140	20	21	90	15	486
1650	100	14	30	80	150	23	22	90	9	518
1700	115	15	31	100	205	27	24	90	10	617
1750	140	16	32	130	270	32	28	90	11	749
1800	188	17	33	157	345	28	32	90	29	919
1850	266	19	34	190	430	33	37	95	59	1,163
1900	401	20	35	290	430	44	71	120	144	1,555
1949	548	45	74	439	503	82	158	198	321	2,368