Population Growth and Living Standards

by

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Many countries are pursuing a policy of intensive economic development with the aim of increasing output per head and raising living standards. The fear has frequently been expressed that these objectives will not be attained unless the rate of population growth is substantially reduced. In the following article Mr. Colin Clark presents a long-term global picture of potential food supplies in relation to population. He concludes that, if all cultivable land were cultivated at a level of efficiency comparable with that now attained in Denmark, the world could provide for a far larger population than exists today or than is likely to exist even under conditions of improved medical and public health services and rising living standards. If, however, increases in total output are to keep ahead of increases in population, so as to provide for rising living standards, there are, Mr. Clark considers, three important conditions which will need to be satisfied: free emigration should be facilitated from a few isolated, overcrowded areas, although this is not a necessary economic solution for the problems of the larger countries; markets should be left open to absorb the exports of countries which must industrialise; and, especially for smaller, weaker countries, external assistance will be essential to provide capital for economic development.

The Review hopes to publish from time to time further contributions to the discussion of the problem of the relation of population growth to standards of living.

THE first and most important fact on this subject that we must take into account is that most religions (using the word religion in its broad sense, to include all the codes of belief and conduct by which men feel themselves bound, so that in this sense of the word all but a minority of mankind has a religion) welcome and encourage the birth of a child. This is as much or more the case with Confucianism, Hinduism or Buddhism as it is with Christianity, Judaism or Islam. It is true that ideas and codes of conduct concerning family life differ somewhat and are subject to qualification between different religions and in different times and places, but the general statement remains true.

The next fact that must be recorded is that many people approach this subject with strong materialistic preconceptions. basic aversion to religious belief is the essence of their position (glad though they are to receive support, from time to time, from various minority groups within the different religions). Their object of devotion, which takes the place of religion for them, is economic and material welfare. Such welfare is thought of, not only as an object good in itself (a proposition with which all sensible men would agree), but as an objective of such transcendent importance that any belief which conflicts with it has to go by the This point of view sometimes shows itself in its most board. extreme form among some of the younger American writers and propagandists concerned with the development of backward economies. Some religions, they say, such as Hinduism (but meaning others by implication, too) teach that man ought to practice, at any rate in certain circumstances, asceticism, or the renunciation of material goods for the sake of certain religious objectives. As material advancement and the selling of more goods are our basic objectives (these writers state) it is clear that we must do our best to discredit and destroy such religious beliefs.

Many Malthusians would deny that they had any anti-religious preconceptions. Their point of view, they say, is purely scientific. If that is so there cannot be any other group of scientists so ill informed on the facts with which they are supposed to deal. Many Malthusians have no knowledge of the simplest facts about population; and those who do know some demography seem to be almost universally uninformed on economics.

In another respect also most Malthusian propagandists give an extraordinary illustration of their unawareness of facts. They believe that if they can have the latest European and American contraceptives sufficiently advertised and cheaply distributed (presumably through some system of subsidisation) throughout the oriental countries, the number of children born in the Orient would immediately and permanently fall. Nothing seems more improbable. Children are born in the Orient, as they were among our ancestors, and as most children are born in the Christian world today, because of their parents' wishes and consciences and religious beliefs, not because their parents wish to prevent them from being born but are unable to obtain contraceptives. There have certainly been occasions in the past when men have wished artificially to restrict their families, without any thought or knowledge of modern contraceptives. They have used the method described in the Book of Genesis, which is almost as old as the human race itself. Orientals at the present time would restrict their families if they really desired to do so. Nothing could be more futile—apart from the morality of it—than to attempt to distribute contraceptives among people who do not wish to use them.

It is, however, equally clear—and this is one of the most important of all religious teachings—that we are bound to promote the material welfare of our neighbour. But this objective clearly has qualifications in morals. When Hitler was plundering and enslaving the peoples around him he doubtless reflected with considerable pride on the way he was promoting the material welfare of the German people.

The International Labour Review is not, however, the place to discuss disputed points of religion or moral philosophy, though every prudent man should know when his political or economic proposals are likely to involve him in controversy on these subjects.

Subject to these qualifications, we can now discuss the relationship between population increase and economic and material welfare.

It seems to come as a surprise to many people to learn that there are a great many industries—probably the majority of industries in the modern community—which are quite specifically benefited by increasing population. These are the industries that work under the law of increasing returns rather than the law of diminishing returns. This is one of the simplest but at the same time most important propositions in economics. Many modern students of economics have their heads so filled with new but comparatively unimportant formulae that they do not give adequate attention to these important truths. The law of increasing returns prevails in any industry where, as a consequence of an increased scale of output, we can expect to obtain increasing returns per unit of labour or other economic resources employed.

What category of businesses can be more economically run on a large scale ? The list includes most forms of large-scale manufacture, transport, postal communications, banking, insurance and the like. In fact most of the economic operations of a modern community are carried out in such a way that, if there were an increase in the population and the size of the market, organisation would become more economical and productivity per head would increase, not decrease. Without the large and densely settled population of North America and Western Europe, most modern industries would be working under great difficulties and at very high costs—it is doubtful, indeed, whether they could have come into existence at all.

Industries working under the law of diminishing returns are agriculture, mining, forestry and fishing, and some others which are dependent upon the use of scarce materials. Certain other industries, such as building, where the limiting economic factor appears to be shortage of men of the right kind of skill and organising ability, probably work under constant returns, i.e., intermediate between increasing and diminishing returns. On the other hand, some of the most highly mechanised branches of agriculture —production of sugar cane is probably the most interesting example—show every sign of working under increasing returns. That is to say, a district organised for producing sugar cane on a large scale, with its crushing mill and haulage systems laid out accordingly, probably enjoys a higher return per unit of labour than a smaller scale system.

At the time when Malthus wrote—or for that matter Ricardo the law of diminishing returns was supposed to be universal. Although the businessman must have understood, in his own way, the advantages of production on a large scale, it was not until much later in the nineteenth century, at the time of Marshall and his contemporaries, that the law of increasing returns in industry was more clearly formulated. It is now, of course, fully understood and statistically measurable. (Dr. Verdoorn, the Netherlands statistician, has assembled a good deal of evidence to show that something like a definite mathematical law governs the extent to which product per man can rise as the scale of industry is increased.) But at the moment, for various reasons, it seems to receive inadequate attention in economic teaching and practically none in popular writings on economics.

The law of diminishing returns does not in the least mean what most people believe it to mean. It certainly does not mean that the returns from agriculture, or any other economic activity, diminish from year to year. The law has no reference to any supposed diminution in time. What the law of diminishing returns says, or at any rate the form of it which is applicable to our present discussion, is that if you put an increasing number of men to farm a limited area of land, then the returns per man will diminish (though the total returns from the land will increase).

But even stated in this way the law is only valid under certain conditions. A man's experience must be very limited if he does not know of some examples of densely populated farm areas producing more per head than less densely populated areas. The law of diminishing returns can only be said to be, in any sense of the word, a law if two further conditions are fulfilled : first, that the inhabitants of the more densely settled area do not use any different farming methods from those of the less densely settled area, and secondly, that they do not employ any more capital per head.

These two further conditions make the law of very limited application indeed. For the use of improved farming methods and greater quantities of capital per man are precisely the steps taken by progressive countries when they find their population increasing and their area of agricultural land limited. If the law has much validity in practice, the statistician should be able to detect its operation by preparing a diagram in which one co-ordinate measures the number of men engaged in agricultural work per square kilometre of cultivable land and the other co-ordinate measures the real product obtained per man. Anyone who draws a diagram of this sort will soon see that the exceptions are more numerous than the cases in which the rule applies. It is interesting to see, however, that the rule holds moderately well when we are comparing the different provinces or regions within one country-for farming methods and skill and the amount of capital available per head do not differ very much between one region of the country and another.

AGRICULTURAL PRODUCTION AND POPULATION

In the following table are summarised the figures for all the countries for which comparable results can be obtained. Density of agricultural population is classified by the number of persons engaged in agriculture per square kilometre of cultivable land (the definition of cultivable land will be given later). The only countries excluded are a few of the highest-income non-European countries. In countries like the United States, Australia and Argentina there is obviously no question of a shortage of land, so there is no need to put such countries in the table.

We have to use some standard of value to compare agricultural production per head in the different countries. As almost every country has its own pricing system for agricultural products, some international system of prices has to be used. For some purposes United States dollar prices can be used. In this case, however, it is more convenient to use Indian rupee prices of the year 1948-49. The relative prices of different agricultural products in India give results more akin to the price relationships prevailing in most of the low-income countries under study than do the United States relative prices.

We can see from the table how little relation there is, if any, between density of settlement and average product per head. About the same density of settlement prevails in Denmark as in Soviet Russia, but product per man in one case is five times what

CLASSIFICATION OF 26 COUNTRIES WITH RESPECT TO THE RELATIONSHIP BETWEEN THE INTENSIVENESS OF CULTIVATION AND AGRICULTURAL OUTPUT PER PERSON ENGAGED IN CULTIVATION

Value of agricultural production per person engaged	Number of persons engaged in agriculture per square kilometre of cultivable land					
(rupees per year)	0-5	5-10	10-15	15-20	20-25	25-30
Below 1,000	•	Philip- pines	•	•	•	India
1,000-1,500	•	•	Turkey Yugoslavia U.S.S.R.	•	•	•
1,500-2,000	•	•	Poland	Rumania	•	Italy
2,000-2,500	Brazil	Greece	Cyprus Bulgaria	Portugal	•	•
2,500-3,000	•	France Austria	Spain	•	Hungary	•
3,000-3,500	Sweden	Ireland	Syria	-	•	•
3,500-4,000	٢.	•	Germany Czecho- slovakia	Belgium	•	•
4,000-4,500	•	•	•	•	•	•
4,500-5,000		Britain		Nether- lands		•
over 5,000	•	•	Denmark	•		•

it is in the other. Many people are concerned about the density of the agricultural population in India, and it is undoubtedly high. But it is equally high in Italy, where the average cultivator produces about twice as much as does the Indian. There is much talk about the possibility of introducing the Indian to tractors and milking machines and all the most modern agricultural equipment. Let us defer discussing this for the present—its time will come—and meanwhile set ourselves the much easier question, whether the Indian could learn and practise the simple arts of the Italian peasant, and use his simple equipment, for dairying, rice growing, fruit growing and similar activities. For if he could, he would be, within a few years, twice as well off as he is now.

It is difficult to teach the Indians any new agricultural methods. Better to try to obtain the same objective by reducing population density. For the sake of argument, let us consider this latter proposition. To carry it out, you will have to reduce the Indian population to one-quarter of what it is now. (A statistical estimation of the operation of the law of diminishing returns, made by comparing different provinces or regions in the same country, indicates that there is probably an inverse square root relationship between the density of settlement and productivity per man.) The stoutest Malthusian would hesitate at the prospect of having to reduce the population by three-quarters and, in any case, how long would it take him to do it, even if he had his way in every respect, short of murder?

Any observation of these facts must make us realise what immense improvements are possible in agricultural productivity in most parts of the world. Such improvements cannot, of course, be had for the asking. To get them, an immense dissemination of education and technical knowledge will be needed, new equipment to a steadily increasing degree, and capital to provide equipment, livestock and buildings. Whether there is any hope of obtaining this capital is a question which will be discussed shortly.

The most successful farming, as judged by the ability to obtain the highest product at the highest density of settlement, is to be found in Denmark and the Netherlands, with Belgium and Britain not far behind. In Denmark the high figure is obtained with a density of settlement of ten men engaged in agricultural work per square kilometre of cultivable land, in the Netherlands with 17. Farm economists in the Netherlands mostly agree, in the interests of efficient operation, that they would not like to see this high density further exceeded. However, the Netherlands farmers have provided very concrete evidence that agricultural land can be worked, and yield a high product, at this high density of settlement. Their country has, however, a soil of unusual fertility, and some may prefer to take Denmark, with ten men per square kilometre, as the reasonable standard. At any rate, it cannot be said that here we are dealing with soil of unusual fertility. Rather the reverse.

Now we must discuss what we mean by cultivable land. In Western Europe we come to think of practically the whole land surface as cultivable (if we include intensive livestock grazing as cultivation) except for a few swamps and extremely mountainous areas. But extending our view we see that limits are imposed by cold (as we approach the Arctic Circle or mountainous regions) or by aridity (as in parts of Spain). In dealing with other parts of the world these climatic limits are of much greater importance.

Cultivable land is measured in climatic terms. It is true that in some countries there are large areas where, although climatic conditions are satisfactory, the soil is believed to be so poor that no cultivation is possible, particularly in tropical areas. But the concensus of opinion among chemists is that these defects can be remedied, though it is costly to do so. Climatic defects, on the other hand, can only be remedied by extremely costly methods (irrigation or glass houses) and we can assume that no really largescale operations of this nature will be practicable.

Using the Thornthwaite climatic classification ¹, we assume that the poleward limit of cultivable land is where the cold " taiga " climates begin. At the other end we must exclude all arid deserts and all but a very small fraction of the semi-arid land—of which there is a great deal in India, Africa and Australia—where only sparse grazing is possible. The next category is the subhumid lands, half of which are regarded as cultivable, except that where they have a regular rainy season the proportion may rise to two-thirds or five-sixths. The main body of cultivable land in all continents, however, is the land with wet or humid temperate or subtropical climate. The only further exception we must make is that in the areas where high tropical temperatures combine with all-the-yearround rainfall, the land (if fertilised) is capable of growing two crops a year, and is accordingly counted as double in compiling the total estimate of cultivable land.

Denmark has no more than 39,000 square kilometres of cultivable land. Denmark's net exports (i.e., exports less imports) of farm products are as much as 45 per cent. of net product (defined as output less seeds and fodder used up in the process of production). Denmark, therefore, in effect, feeds not only her own population of 4.4 million, but another 3.6 million people elsewhere, or 8 million in all; that is, about 200 people are fed per square kilometre of cultivable land.

The question is often asked, how many people can now be fed by one man working on the land? There is, of course, no single answer. Net productivity of a man on the land varies in different places and at different times. We must also remember that the amount of food which people expect to have supplied to them also varies. But, under modern Danish conditions, you have ten men working per square kilometre of land and 200 people supplied thereby, or 20 people supplied by one man. If we take dependants into account, we can say that one farm family supplies about eight families all told-itself and seven others. Or, if you like to put it more prosaically, we can say that if we assume that there is no net import or export of farm products a country with agriculture as productive as in Denmark and with a population whose standards of feeding are as high as those of the Danes will have to keep about 121/2 per cent. of its labour force occupied in agriculture.

¹ All these workings and classifications were set out in detail in the author's paper to the United Nations Scientific Conference on the Conservation and Utilisation of Resources (Lake Success, Aug. 1949).

In some of the non-European countries we can of course obtain higher figures of the number of persons fed per agricultural worker, or lower figures of the proportion of the labour force required in agriculture.

At Danish standards, therefore, of productivity on the one hand and of diet on the other, a square kilometre of cultivable land will provide for about 200 people, or a square mile for about 500. On this standard, how much of the world is overpopulated, or how much additional population can it support? On the criterion of having sufficient land to feed one's population at these Danish standards, the only countries in the world which are overcrowded (not counting a few small isolated settlements) are Japan, the Netherlands, Belgium and probably Switzerland (if we take its high proportion of mountainous area into account). The Federal Republic of Germany is just on the borderline. England is overcrowded if considered in isolation, but not if the territory and populations of Scotland and Northern Ireland are considered in conjunction with it. The population of India and Pakistan per square mile of cultivable land is about 400-high, but not above the limit. The corresponding figure for China is lower, probably between 300 and 350. For Indonesia it is much lower, but here the position is complicated by the greater part of the population being concentrated in the one island of Java, while the rest of a very large cultivable area is almost uninhabited.

In countries like Britain, Belgium and Germany it is taken for granted that the population will not try to support itself entirely on its own limited land area and that a substantial proportion of the inhabitants will be engaged in export industries in order to purchase food and raw materials from elsewhere. Until recently this was taken for granted in the case of Japan also. Some people now talk about Japan having difficulty in supporting her increasing population on her limited area. This sort of statement only has meaning if one assumes that Japan is to be excluded from all export trade.

Europe, excluding the U.S.S.R. (pre-war territory), has 1,400,000 square miles of cultivable land. In this area live 450 million people, who obtain (taken altogether) some 95 per cent. of their food supplies from European agricultural production. If all of Europe were as closely settled as Denmark, 700 million people would be able to obtain their food supplies from this area. Europe is the most densely settled of the continents. The United States and Canada have 2,275,000 square miles of cultivable land, with only 175 million people on it, only a small fraction of the numbers it could feed, even on European standards of cultivation. Latin America has approximately the same numbers, about 170 million people, but in this case there are 7 million square miles of cultivable land. Africa, with 6 million square miles, has a population of only 210 million and Oceania only 30 million population with a million square miles of cultivable land.

One of the world's most congested regions is the Middle East, where 78 million people live with only 171,000 square miles of cultivable land. Even so, the density is below the limit which we set ourselves; the land is farmed in the Middle East much less efficiently than in Denmark, and a good deal of now arid land could be brought into cultivation by means of irrigation if sufficient capital were available.

The rest of south-east Asia, apart from Indonesia, is also lightly populated, with only 95 million people on 1,250,000 square miles of cultivable land. There has been so much talk about south-east Asia and its problems that it comes as a shock to realise that a great deal of it is uninhabited. This is the case for almost the whole of Malaya, large areas of Burma and Siam, and a considerable part of the monsoon-climate area of Burma.

Most of the world, therefore, is populated at far below its potential density. The world's total area of cultivable land (allowing for double cropping in the highest-rainfall tropical areas) is 24 million square miles, and at Danish standards of cultivation and consumption could support 12,000 million people, as opposed to the 2,300 million people it supports now.

Now let us leave economics and go back to demography. Some demographers may admit the truth of these economic and geographical facts, but then go on to say that Danish (or any other) standards of high cultivation could never be reached, for the reason that population increases in many of the countries concerned are so unbearably rapid that they are bound to overtake any increase in production. Statements like this, which are often made *a priori* without ascertaining the available facts, soon tend to be generalised until they form a theoretical Malthusian statement that population everywhere and at every time is tending to press upon the means of subsistence. The true facts on this subject are simple, but seem to be known by very few people and conflict with popular belief at almost every point.

THE FERTILITY OF THE HUMAN RACE

If every woman married young, and there were no restriction of births of any kind, what would the average size of the family be ? (We are discussing now not the number of children surviving, but the number born.) The answer is about six. That is to say, this would be the average number of living children born to the average woman who had survived to the age of 45 and had been married all the time. The families of women who died earlier would of course be smaller.

What is the evidence for this? First, uncertain and imprecise, but covering a very wide range of time and place, comes the evidence of the anthropologists. According to their evidence, this seems to be the average number of children born in primitive communities. In these communities every woman marries young, and, as there is nearly always a surplus of males, a woman left widowed will probably be remarried almost immediately. Practices for the artificial prevention of conception, though known among some primitive peoples, appear to be rare.

The next evidence, much more precise but from far fewer sources, comes from certain countries with a simple agricultural economy where good demographic records are available. , (The reader should be aware that outside Western Europe, North America, Australasia and Japan most countries have no proper record of the number of births and deaths, much less the accurate census tables and other material needed for demographic calculation.) Brazil and Ceylon are among the few countries for which proper census records are available from which demographic calculation can be made. China has had no sort of census for more than a century, but one or two carefully conducted sample inquiries by Western observers in limited areas give us some interesting material: The third piece of evidence, from an entirely different source and only recently available, is very concrete. The medical subcommittee of the recent British Royal Commission on Population collected a good deal of information from women which, by an ingenious statistical method, was put together in such a form as to show what the total fertility of the modern English woman would be if she married early and if throughout her married life no restriction were imposed upon conception. The answer here also came to a figure in the neighbourhood of six.

Most people (including many biologists and doctors) have somehow acquired the opinion that the natural fertility of the human race is much higher than this. Popular opinion is even more misinformed. Ask anyone what was the size of the average Victorian family and he will probably say that it was about 12; in fact the average family in Victorian England (or in most of nineteenthcentury Europe) was about five.

The next point which must be made clear is that, in the conditions in which mankind has been living throughout the greater part of its history on this earth, and in which the majority of mankind is living today, an average family of six children barely suffices to maintain the population. Primitive populations, generally speaking, do not increase. At the beginning of the Christian era the estimates of historians put the population of the world at about 250 million. We can accept this estimate with the widest margin of error. It does not matter very much, from our present point of view, whether we put the figure at 150 million or 500 million. The point is that the human race began, so the geologists tell us, 500,000 years ago. (The evidence accepted by geologists and by biologists appears to be of a far lower order of accuracy than that used by economists and demographers, low though that may be ; the geologists sometimes behave as if an extra zero in their figure were a comparatively minor matter, while some of the biologists have recently tried to raise the figure from half a million to a million years.) But on this assumption of half a million years we must deduce that the average rate of increase in numbers of the human race, over the greater part of its existence, was not more than .004 per cent. per annum.

Between the beginning of the Christian era and the seventeenth century, for which period we have rather more population information, the average rate of increase of mankind accelerated somewhat, but was still no more than .04 per cent. per annum. A rate of increase of as much as 1 per cent. per annum became apparent in Britain and Ireland towards the end of the eighteenth century, and from about the middle of the nineteenth century onwards the average rate of increase of the whole world has been slightly over 1 per cent. per annum. In some areas the figure has been as high as 2 per cent. per annum and in a few cases as high as 3 per cent. (natural increase, apart from immigration), for example in the United States in its early years of development and in modern Ceylon.

It is clear that there is, among primitive people, a mortality such as to require an average family of six just to maintain the population. Though wars and famines do occur among primitive people, it would not be in accordance with the evidence to describe them as chronic. Most of their mortality seems to be due to the general hardships of life and the absence of any form of medical treatment.

But we must also realise how widely these conditions have applied, in the past, among supposedly civilised as well as primitive peoples, and how extensively they still apply today. The evidence of Indian history seems to show that the population was much the same in the fourth century B.C., the seventeenth century A.D., and also in the early nineteenth century. It was quite late in the nineteenth century that any real expansion of the Indian population began. It is obviously wrong to say that India's population over this long period was held in check by some natural limits; it stood over most of this period at about 150 million, or not much more than a third of the population which India and Pakistan (without any great improvement in agricultural methods) are carrying now. The long history of India shows varying phases of order and good government, followed by war, disorder and anarchy. In the latter phases not only production but also population is reduced.

More or less similar conclusions can be drawn from a study of Chinese history. What very few people realise, however, is that the Chinese population has apparently been in a stationary or declining phase ever since 1850—this is the opinion of two of the world's most careful demographers, Sir Alexander Carr-Saunders and Professor Wilcox. The tragic events of the last two decades have apparently greatly accelerated the decline, and there is evidence now that large areas of cultivable land in China are uninhabited.

Still more striking is the possibility of seeing in our own times an actual change of trend taking place. Indonesia, before 1941, caused some concern among demographers by maintaining a persistent rate of increase, under Netherlands rule, of as high as 2 per cent. per annum. The problem was complicated, as has been mentioned before, by the concentration of almost the whole of the population in Java while the other islands were largely uninhabited. But now the (extremely uncertain) estimates of population are only a few per cent. above the 1941 level. Sir Alexander Carr-Saunders has evidence to show that in Africa population has been stationary over very long periods. Probably it only began to increase in this century. Still more surprisingly, in Latin America, which was supposedly civilised, there were long periods of stagnation in the seventeenth and eighteenth centuries.

Both the historical and present-day evidence seems to point to the same conclusion, that any appreciable population increase is only possible when two conditions are fulfilled, namely, the establishment of a firm and ordered political system and the dissemination and utilisation of some medical knowledge. It is doubtful whether there has ever been, in historical fact, an actual instance of the supposed Malthusian universal, of population overtaking agricultural productivity, multiplying right up to the limits of subsistence, and then being held in check by some new form of "vice or misery". Agricultural methods themselves are susceptible of considerable change. In most modern communities improvements in technique lead to a rise in agricultural productivity, without any additional labour force or the cultivation of any additional land, at a rate faster than any probable rate of increase in population. This does not apply in the West alone. In Japan product per man in agriculture has risen steadily since the 1890s at a rate of 2 per cent. per annum.

Ireland is sometimes quoted as an example. Population increased fairly rapidly in the eighteenth century, not because of

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abnormally large families but because of good health and reduced mortality. British legislation forbade this increasing population to find employment in industry, but a new form of agriculture based on potato growing provided adequate food supplies—until the famine of 1845. But the important point is that the Irish population had practically stopped increasing by 1831—emigration was outbalancing almost the whole of the natural increase. The famine was mainly due to a fungal disease of potatoes which could easily be checked under modern conditions, and its worst consequences could have been avoided under more far-sighted and humane administration.

Another example sometimes quoted is that of the irrigation settlements in India. It is said that as soon as additional land is made available for cultivation through irrigation works the population of the district rapidly increases, and density of population per square mile of cultivable land is soon as high as it was before. This is probably true; but there is no evidence that it is due to either increased births or reduced mortality among the inhabitants; all the probabilities are against this. What has happened is precisely what one might have expected—the migration of a large number of would-be settlers from other parts of India.

All the above facts and reasoning constitute a very unexpected approach to the problem, though it may be claimed that they are both true and important. Some readers may accept them, but still have misgivings. They may grant that no part of the world has ever yet come within sight of overpopulation in the Malthusian sense of the term, and that Malthus's ideas of history were as odd as his ideas of agriculture. They may grant that the world still contains enormous areas of cultivable land capable of settlement. But they will also point out the immense acceleration of the pace of medical improvement during the past generation. There is some (not complete) evidence that the rate of decline of mortality in Asia in this century is far more rapid than was the rate of decline of mortality in nineteenth-century Europe. With the prospect of continuously decreasing rates of mortality, and with the hope of world peace and good government (for which we are all certainly labouring our hardest), will we not create in the course of the next century a world population problem of quite unmanageable dimensions? An average of six children per family, which appears to be the natural rate of reproductivity of the human race, just suffices to keep population stationary under primitive conditions and allows for a rate of population increase of 1 or 2 per cent. per annum in a settled and civilised agrarian economy, but what might it lead to if the whole world enjoyed rates of mortality as low as those of advanced western communities? Under such conditions about 90 per cent. of the children born survive to child-bearing age, and even if we allow that a certain proportion of them remain unmarried we are still going to get a rate of population increase of about 4 per cent. per annum, or population doubling every 20 years. The 3 per cent. per annum rates of increase already observed in the early years of the United States and in present-day Ceylon arise from the conjuncture of very large families with low mortality rates.

This all turns on the question of whether the average family is likely to remain as high as six. Instances have been given from the primitive and the modern world. But in India, for which we have a considerable number of sample studies, it appears doubtful whether the average family of Hindus was ever more than five. (Among the Moslem and Christian minorities larger families are found.) This is apparently due to the curious Hindu rule which forbids the remarriage of widows. In Japan we can trace the fall from six at the beginning of the present century to a figure of only four by 1940, and apparently lower again now. Dr Lorimer's study of Soviet Russia traces a similar movement up to 1938. In India sample studies show a considerable fall in the size of family in industrial cities, and some statisticians qualified to judge think that, taking India as a whole, the average family may now be as low as four.

We have not enough information to make a detailed and accurate analysis of what is going on in most of these countries, and it will probably be many years before such information is available. But one point which is brought out in the writings of Dr. Ghosh about Indian population is that the marked decline in reproductivity in the partially industrialised areas of the Orient is probably due not to the restriction of births in marriage, but to later marriage. Throughout the Orient very early marriages have been until recently the rule, and a deferment of only a year or two may make a very considerable difference to total fertility. Alike in the medical and statistical evidence of the fertility of the average human family we see clearly that the greater part of the births occur in the comparatively early years of married life.

Even though the statistical interpretations of it may differ somewhat, there can be no doubt about the deceleration of the rate of India's population growth. Prior to 1921 the rate of growth was less than 1 per cent. per annum. From 1921 to 1931 India's population grew by 11 per cent., and from 1931 to 1941 by 16 per cent., but between 1941 and 1951 the increase was again only about 11 per cent. (taking India and Pakistan together for the latter year). The Bengal famine of 1943 and the massacre of refugees on both sides of the border at the time of the separation of Pakistan from India in 1947 were both dreadful events, but they cannot account for more than a small fraction of the observed deceleration of the population increase. For the decade 1951-61, on the basis of the information available, there is every indication that the net rate of population growth will prove to be less than 1 per cent. per annum.

In Ceylon, likewise, there is fairly clear evidence that the average total fertility has fallen from six to five in one generation.

There is neither need nor space to attempt to trace all the causes of these phenomena. In an urban population the desires to accumulate money and achieve social position are a far greater force than in a static peasant community, and the incentives to bring up families are thereby weakened. To what extent religious beliefs become weakened when a peasant community becomes urbanised is also a matter for discussion ; sometimes it undoubtedly occurs, but even among those urbanised Hindus, for instance, who retain their religious beliefs in full, there is clearly some tendency to reduce the size of the family.

In India, therefore, which many people thought to possess the world's most intractable population problem, the situation is very different from what is commonly supposed. The work of Indian statisticians shows that the rise in production has since 1870 been far greater than the rise in population, and there is every prospect that, with increasing industrialisation, this process will continue. Neither is this the place to discuss the extraordinary change in the population trend in North America and Western Europe that has occurred during the past decade. Many of these western communities now have a rate of natural increase far higher than that of Asia, and look like maintaining it.

High net rates of population increase are found in Latin America, in Africa, in the Middle East (it is here that the problem is so serious, because resources of land are very limited, and increasing cultivation by irrigation works is bound to be a slow and costly process) and in some, but not all, of the countries of south-east Asia. Most of the countries with the highest rates of population increase are those which have very considerable resources of unused agricultural land. There cannot, therefore, be said to be any serious danger of food shortage, except that which is brought about by their own misgovernment.

CAPITAL RESOURCES

We can now bring this discussion to a conclusion, and also examine one final point—capital accumulation—on which serious misgivings may be felt. For the more advanced countries, which already have a fairly dense population and a good transport system, the obvious line of development is industrialisation. Once the earliest difficulties have been overcome—admittedly a slow and hazardous process—the law of increasing returns comes into operation, and every further increase in population makes the industrialisation process more remunerative.

Industrialisation for the purpose of developing exports is not a possibility open to every country. In some cases even industrialisation to supply local needs is hopelessly uneconomic. Generally speaking a sparse population, lack of transport, lack of education and remoteness from world markets are factors which may make industrialisation very difficult. The presence or absence of local raw materials is a matter of very secondary importance. Japan and Switzerland are examples of highly successful industrialisation, and both are virtually lacking in indigenous raw materials.

Where industrialisation is not possible, or involves too great difficulties and hazards, the alternative policy of extended agriculture must be followed. Most of the countries involved have resources of unused land. This is not the case in a few isolated densely populated areas, mostly islands, such as Mauritius, the Cape Verde Islands, and the British West Indies. In such cases, where transport difficulties impede industrialisation, emigration is the only satisfactory solution.

But we must mention in this connection Puerto Rico, which for many years has been sitting heavily upon the American conscience, and has provoked many Americans into believing it to be a case of overpopulation. The American conscience can now be at rest. After a long period of stagnation Puerto Rico has shown since 1939 a rate of development of real income, and economic development generally, without parallel in world history, leaving the Japanese rate of growth far behind. This has depended upon two elements, an intensification and technical improvement of sugar production and a widespread programme of industrialisation. Emigration has played a comparatively minor role. Though dependent upon a rather costly shipping service Puerto Rico is near enough to the United States market (and within the same tariff wall) to be able to participate very remuneratively in the United States industrial structure.

But, whether for industrialisation or for the extension of agricultural production, considerable capital resources are required. It is very easy to underrate the amounts necessary. Satisfactory agricultural development often requires amounts comparable with those required for industrial development. It is a great mistake to consider solely factories or livestock. Whoever hears now of the Bombay Plan, the project which attracted world-wide attention in 1945, whereby India's real national income was to be doubled in 15 years? This Plan was prepared by businessmen, and made quite careful estimates of the capital which would be required for the large-scale industrialisation of India. These were literally true; what the Plan forgot was the enormous further investment which would be needed for housing, transport, education and other social needs.

The amount of capital required per head in these countries is generally equal to about four years' income per head. The figures, of course, vary enormously between trades. A carpenter needs no more capital than a bag of tools; the capital used by a telephone operator is more than she could earn in a lifetime. But generally speaking, averaging all trades together, the four to one rule holds. (Some people may ask, does this mean that each unit of additional capital earns a 25 per cent. return ? It does, in the sense that 100 units of capital invested cause national income to rise by 25 units per annum. But of this additional product labour will demand at least 15 units, even in an oriental country—more like 20 units in a western country—leaving something between 5 and 10 units per annum as a remuneration to the investor of the 100 units of capital.)

This means that, to cover an increase in the labour force of 1 per cent., a capital investment equal to 4 per cent. of the national income will be necessary. We thus get a very simple rule. Take the expected rate of population increase and multiply it by four. This gives us the percentage of national income which has to be invested in order to provide employment, of the same average kind as now exists, for the increasing population. This investment may come from internal savings or external borrowing. It is only in so far as the rate of investment exceeds the rate of population increase multiplied by four that anything will be left over for industrialisation or for raising standards of real income per head.

It is unfortunately impossible to test out this interesting rule because of the almost complete lack of reliable statistics of the rate of saving in the underdeveloped countries. Some figures from India before the war indicate a rate of saving of about 6 per cent. of the national income. There are unfortunately some signs that this rate of saving was not resumed in the post-war years, but if anything like this figure prevails now it is well in excess of four times the rate of population growth, and therefore leaves a margin (though less than might be desired) for industrialisation, before any inflow of external capital is considered. But India is in a more fortunate position than many of the underdeveloped countries. In many cases, where rates of population increase are higher and rates of saving in all probability lower, there will be a retrogression of economic standards unless a substantial inflow of external capital is possible.

CONCLUSION

We can bring it all down in the end then to a single conclusion. Any foreseeable rate of population increase, in any part of the world, can be economically provided for at a satisfactory and indeed rising standard of real income, subject to three conditions. The first, which is of comparatively minor importance, is that free emigration should be facilitated from a few isolated overcrowded areas. Here the numbers involved are small. Emigration is not a necessary economic solution for the problems of the larger countries, whatever may be the rights and wrongs of it in general.

The next condition is that for large and densely populated countries, such as India, which have reached the stage where industrialisation is obviously their only suitable prospect of economic advancement, the rest of the world, even if it cannot offer direct help for such industrialisation, should at least co-operate by leaving markets open for these countries to sell their goods and not place tariff and quota restrictions upon their trade. Japan was treated with gross unfairness by the Western powers in the 1930s, and this played a considerable part in forming her determination to go to war.

Countries which have already reached the size and stage of development of India and Brazil, for instance, will probably be able to proceed with industrialisation using their own resources only, though it will be much slower than would be possible if they received external assistance. In the smaller, weaker countries the receipt of external assistance is a necessary condition without which further development will not be possible. How this should be organised, and how the responsibilities should be shared among the different lending countries, cannot now be discussed.

It may well be that many of those who advocate population limitation in the oriental countries do so precisely because they do not like the idea either of emigration or of leaving markets open to oriental goods, or of giving any capital assistance to weaker countries. If there are any such it is time that their uncharitable motives were exposed.