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The following paper on Population and Socio-Economic Development was presented by Dr. L.T. Badenhorst, Head of the Social Research Unit of the Department of Sociology, University of the Witwatersrand to the Social Sciences Research Conference at the University of Natal in July, 1962. The unprecedented growth of population which is now taking place and which will accelerate in the coming years will be of increasing importance in international relations. Dr. Badenhorst's paper gives facts and forecasts which no one interested in international affairs can ignore.

The Institute is grateful to him for permission to reproduce it and to circulate it to members.

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THE RELATIONSHIP BETWEEN POPULATION AND SOCIO-ECONOMIC DEVELOPMENT

by

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Before turning to the main subject of this paper, it may be advisable to take a brief look at the background of the problem. A survey of the most important facts relating to our most urgent, and seemingly insoluble, world population problem will allow us to see the specific relationships between population growth and social and economic development in the right perspective.

Recently the world population passed the 3,000 million mark. It is growing at an unprecedented and accelerating rate of 1.7 percent p.a. This rate of increase, if continued, will lead to a doubling of the world population in about 40 years. By the year 2000, when humanity will number 6,000 million, growth rates will be such (on the basis of rather conservative estimates) that the population will double again in only 23 years.

It is estimated that over 100 million babies were born in the world during 1959, and that some 50 million people died[1]. The resulting annual increase of about 50 million almost equals the entire population of the United Kingdom.

According to careful estimates by the Food and Agricultural Organisation of the United Nations, more than half of the human race do not get enough to eat. In a recent period (1947-53) the world's food production increased by 8%, a remarkable achievement for agriculture and one not likely to be repeated. But during the same seven years the world's population increased by 11%; at the end of the period humanity was hungrier than at its beginning. In forty years there will be twice as many people, and with the best success that may reasonably be expected with regard to food production, there may be twice as much food

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available; so still more than half the people will be underfed, but the absolute number then will be twice as great.

Even if one is relatively optimistic about actual and potential natural resources and the development and spread of technology and their effect on food production and other necessities of life, it is obvious that present rates of increase cannot continue for any length of time. Either birth rates must be reduced or death rates must increase. It is simple arithmetic that if the current rates of births and deaths, and the resulting geometric rate of increase, are continued into the future, human reproduction will completely outrun any estimate of production, no matter how large[2].

The principle and the implications are therefore clear: considering the world population as a whole, low death rates are incompatible with high birth rates in the long run. What about short-term developments? As recently as 1953, Colin Clark, assuming a rate of increase of world population of 1.1% for 1950 and estimating that the world could feed 12,000 million people, concluded that population growth constituted no serious threat to man's existence on earth[3]. This assessment is extremely short-sighted, to say the least, in view of the fact that a population of 12,000 million could quite possibly be reached by 2023.

It is an unrealistic abstraction to talk about the "world population problem", or the increase of world population in relation to mankind's capacity to feed, house and clothe a growing number of people. Though we live in one world, there is no world government which carries responsibility for providing a decent standard of living for its citizens. We have, rather, a series of national problems; each individual country is confronted with its own peculiar population problem. The problem already stated is enhanced by the very uneven distribution of world population and resources. For example, Asia has more than half of the world's population, but only one-fifth of the land area. The average number of arable acres per person is estimated at only 0.7 of an acre in Asia (0.1 in Japan), compared to 2.9 acres in Northern America, 4.7 in Australia and New Zealand, 2.6 in the U.S.S.R., Northern America and the U.S.S.R. also have vast tracts of land suitable for agriculture which are not being cultivated, as well as large forest and mineral reserves. In proportion to its population, Asia has a much smaller share of such resources. It is true that many of the under-developed countries in Africa and Latin America have tremendous reserves of unused natural resources, but they lack the capital and technically trained personnel to develop them. In fact, the distribution of man-made equipment and of manpower suitable for employment in an advanced modern economy is even more unequal than the distribution of natural resources[4]. The world's great industrial installations are concentrated largely in a few countries of Europe and North America, while the poor nations are handicapped by a lack of the most simple tools and implements, and a grave shortage of personnel with even an elementary education. Although the need for a certain minimum education is now generally recognised, the under-developed countries are still lagging far behind in this respect; for example, 79 percent of the population in Turkey, 85 percent in Egypt, and 90 percent in India are unable to read and write.

At the same time, population growth is most rapid in the economically under-developed areas where well over half the world's people now live in abject poverty. At least two thirds

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of all the babies born each year first see the light of day in Africa, Asia and Latin America. Latin America is growing faster than any other major region (at 2.5 percent p.a. in 1954-58). In certain parts of Africa and Southern Asia, the population is growing almost equally fast (1.9% p.a. for the whole of Africa, and 1.8% p.a. for Asia, excluding Japan). Western Europe has the slowest growth (0.6% p.a.) while the United States and the Soviet Union are increasing at about the world average. However, these figures conceal great variations in growth between the various countries. For example, in Africa, Egypt, Algeria, Tunisia and Morocco now have an estimated annual rate of increase of between 2.5 and 3%; in Asia, India has a rate of 2.0%, mainland China 2.5%[5], Indonesia 2.5%, Ceylon 2.7%, the Philippines 2.8%, Malaya 3%, and Formosa 3.5%; in Latin America, an annual growth rate has been observed of 3.6% for Venezuella, 3.4% for Mexico, 3.3% for Honduras, 2.9% for Costa Rica, 2.5% to 3.0% for Brazil. A rate of 3% p.a. means doubling the population in 24 years and a nineteenfold multiplication in a century if maintained. Such rates of increase are entirely unheard of at any other period of human history. Enough Indian babies are being born to add (nett of deaths) another New York City to the world's population every year, and enough Chinese babies to add another South Africa.

What about the immediate future? The very conservative estimates of the United Nations (assuming some decline in fertility in the near future) expect the world population to grow more rapidly than at any time in history during the next few decades. Growth will be fastest in those already over-crowded, agrarian countries where levels of living are lowest and where no effective birth control is practiced. (Most of Asia - except Japan and Israel - Africa and tropical Latin America). A more moderate rate of growth may be expected in the economically mature countries where living levels are high and where family limitation is now increasingly practiced to control numbers. (All countries of Europe, and Soviet Union, the United States, Canada, Japan and the Temperate Zone countries of Latin America and Oceania). Thus the gap between the "have" and "have-not" nations is bound to widen during the years ahead[6]; and not only as regards population and population growth but also in respect of wealth, economic development and standard of living. This spectre, to my mind, constitutes the greatest social, economic and political problem with which man is confronted in the 20th Century. A recent United Nations report phrased the dilemma in these words: "The growth of world population during the next twenty-five years, therefore, has an importance which transcends economic and social considerations. It is at the very heart of the problem of our existence....." [7]

Some authors comfort themselves with the idea that "it has all happened before" - that there was a rapid expansion of population in Europe during the 19th Century[8], and that the problem solved itself. These people are deluding themselves. Today's problem of the under-developed countries is entirely different from that of the European countries a hundred years ago.

(1) First, both the population and population density are incomparably greater in most of the under-developed countries today than they were in Europe before the Industrial Revolution.

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(2) Second, the European birth rate, even before modern birth control methods were known, was well below the present birth rates in under-developed countries.

(3) Third, in Europe the decline in the death rate did not precede economic development but came about partly as a consequence of the improvement in living conditions and kept pace with this development. Moreover, medical techniques and disease control methods, which are now both cheap and efficient, have been imported to countries where they are a century or two ahead of the way of life of the people[9]. The fact is that medical progress now enables men to live longer on average without their standard of living being raised. Medical progress having gained a march on economic progress, it has become possible for more people to live longer under worse conditions.

(4) Fourth, overseas emigration helped European countries during the 19th and early 20th Century to escape some of the economic difficulties to which the rapid growth of their population might otherwise have led, before high birth rates were adjusted to falling death rates. According to one estimate, the population of Europe in 1910 was 88 million less than it would have been if there had been no emigration after 1800 [10]. Today the densely populated under-developed countries have hardly any opportunities to ease their difficulties by means of emigration :

(i) There are no longer any great "open spaces" on earth with plentiful and inexpensive agricultural land such as for example, North and South America, Australia and New Zealand presented in the 19th Century.

(ii) The high cost of present-day migration, of transporting equipping and establishing agricultural settlers in new surroundings which may take large capital sums to prepare and maintain.

(iii) The demand for immigrants in countries of immigration is largely for skilled and semi-skilled workers in industry and trade for which emigrants from the over-populated countries do not qualify.

(iv) Any potential migration, which may be economically feasible, will offer no relief in view of the very large numbers required to have any effect on population trends in densely populated under-developed countries. Just to keep Asia's population stationary would require the emigration of some 25 million people <u>per year</u> - which is, of course, an absurdity under present-day world conditions.

(v) There are severe restrictions on immigrants in most countries both on the right of entry and of the types of employment in which they may engage. The opinion is widely held, and entrenched in legislation, that successful immigration requires that the racial and cultural background of immigrants should be substantially the same as that of the country of settlement.

(5) Finally, population growth in many under-developed countries today exceeds by two or three times the rate of increase in Western Europe in the 19th Century. Amongst others, rapid growth itself offers a severe obstacle to reducing fertility in that it impedes the social and economic changes that tend to reduce the birth rate[11].

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When considering the complex inter-relationships between two sets of factors (demographic trends and economic and social development) it is convenient from an analytical point of view to treat first the influence of one set on the other, and then to deal with influences in the opposite direction. In discussing the relevant facts concerning population and natural and man-made resources obtaining in under-developed countries, the main points relating to the influence of economic and social development on population growth have already been touched on. This inlfuence (of economic growth on demographic trends) must operate through one or more of the three determinants of population growth, i.e. births, deaths and migration. In recent times, the theory of "demographic transition" has been widely accepted as a theoretical frame-work which enables social scientists to come to grips with the complex problem of the inter-relationships between demographic, social and economic variables. This theory, which is partly the outcome of efforts to reason about the future course of population trends in countries which are emerging from a state of economic under-development in the light of the demographic evolution experienced by countries that have become industrialised, and have achieved relatively high levels of living, have been summarised as follows [12].

"The classical economic theory of population growth (primarily associated with Malthus) held that any rise in incomes (particularly among the poorer classes) tended to increase birth rates and (with more certainty and force) to decrease death rates."

"The course of events since Malthus' time, however, has led to the gradual evolution of a theory that postulates a more complicated sequence of birth and death rates as typically associated with economic development. It is sometimes termed the theory of the "demographic transition""...

"In barest outline the sequence of events, according to the theory of demographic transition, can be summarised as follows: The agrarian low-income economy is characterised by the high birth and death rates - the birth rates relatively stable, and the death rates fluctuating in response to varying fortunes. Then as the economy changes its form to a more interdependent and specialised market-dominated economy, the average death rate declines. It continues to decline under the impact of better organisation and improving medical knowledge and care. Somewhat later the birth rate begins to fall. The two rates pursue a more or less parallel downward course with the decline in the birth rate lagging behind. Finally, as further reductions in the death rate become harder to attain, the birth rate again approaches equality with the death rate and a more gradual rate of growth is re-established with, however, low risks of mortality and small families as the typical pattern. Mortality rates are now relatively stable from year to year and birth rates - now responsive to voluntary decisions rather than to deeply imbedded customs - may fluctuate from year to year. This short description fits the experience of most countries whose economies have undergone the kind of reorganisation we have been calling economic development. The part of the description with the least certain applicability is the characterization of the final stage as a return to a condition of only gradual growth."

"A superficial survey of the demographic situation and apparent prospects in the low-income portions of the world

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gives reason for doubting the applicability of the demographic transition as an exact description of the likely course of events in these areas."

The last paragraph is indeed an understatement. The main reasons for saying this have already been presented in discussing the fundamental differences which exist between the situation in the under-developed countries today, and the demographic situation in Europe and Europe-overseas a hundred to two hundred years ago. The weakness of the theory lies not so much in its description of past events but in its value as an instrument to predict future occurrences. For example, there are clear indications that the repercussions of economic development and a higher per capita income upon the birth rate may not be the same in different cultures. The masses of Asia, Africa and tropical South America may react quite differently to economic development, urbanization and industrialisation, even if we make the rather doubtful assumption that in many places explosive population growth will not prevent a rise in the standard of living. And then the question remains: What types and what degree of change in economic conditions would be required and how much time would have to elapse before birth rates would fall low enough to nearly balance the fast declining death rates? A few examples should suffice to illustrate this point. In Taiwan [13], where death rates declined substantially before and during the last war under Japanese administration, birth rates remained unchanged. In Ceylon, where death rates have declined consistently during the last forty years from about 30 per thousand to around 10 per 1000, there has been no important decline in fertility. In many countries such as Egypt[14] and India [15] there is no differential fertility between country and city (nor on such indices as occupation, possession of land in rural areas, or caste). According to the 1951 census of India, in Travancore-Cochin the number of children ever born to women 45 and over who are still married was 6.6 per 1,000 among the rural population and 6.4 among the urban population. Much the same is true of our own non-white population in this country - Indians, Bantu and even Coloured. In a survey conducted in Alexandra Township, Johannesburg [16], the birth rate was found to be 44.2 per 1000 in this urban group, which corresponds closely to estimates for all Bantu in South Africa. At the same time an infant mortality rate of 131 was established, which reflects the rapidly declining death rates under urban conditions.

One may ask, what about Japan - the only country in Asia which has been able to modernize its economy and go far towards making the demographic transition? As a result of immense effort in the field of industrialisation and urbanisation as well as agriculture, and very drastic measures in birth control (sterilization and abortion for economic reasons) Japan has reduced her birth rate from about 40 per thousand to about 19 per 1000 since 1920. The same processes however, have led to a reduction in her death rate from about 19 to 8 per 1000, which - in spite of well over a million legal abortions per year - still results in an annual growth rate of 1.1 percent p.a. Moreover, "not even the most optimistic view of India's possible economic development during the next thirty years would entail the achievement of a degree of industrialisation or the achievement of levels of income like those prevailing in Japan in the 1920's" [17]. By 1930, nearly 80 percent of Japan's net output (and 50 percent of its labour force) could be credited to the non-agricultural sectors of the economy [18]. In India, 83 percent

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of the population still derive their livelihood from agriculture. In fact, we can conclude this discussion by stating emphatically that it is highly questionable whether the social and economic change likely to take place in the next twenty or thirty years in countries such as India, China, Indonesia, Malaya, Egypt, Pakistan, most parts of Africa and tropical Latin America, will have any great effect on fertility.

We must now look at the other side of the picture: How does population affect economic growth and the standard of living? More precisely, how do demographic trends influence the per capita income of the population in under-developed countries?

Space does not allow a systematic survey of the treatment of this subject in economic theory since Malthus, for example, the classical school (particularly Adam Smith and David Ricardo), the neo-classical economists (Alfred Marshall), the stagnation theorists (Keynes and his successors) and the work of economists like Schumpeter, Hansen, Harrod and Domar with their varied approaches to the establishment and maintenance of economic growth, taking population characteristics into account[19]. Neither will an attempt be made here to set forth the more recent attempts by demographers and economists to arrive at a more specific definition of the relationship of population variables to other variables in the process of development, (e.g. Spengler, Coale, Leibenstein, Notestein, Belshaw, Sauvy, Stolnitz). We will focus our attention merely on a few illustrative examples of how certain important demographic factors hinder economic development and a rise in per capita income in under-developed countries. (Parenthetically, I may just say that there is a great need for the development of an integrated demographic and economic theory in this field - one which will lead to a more precise statement of the direct and indirect effects of population variables upon other co-existing variables that are collectively the ultimate determinants of economic growth).

Let us first consider the question of <u>population size</u> in relation to per capita income in under-developed countries. We have already referred to the great numbers in most of the under-developed countries and their proportionately small share of natural resources. In particular, these countries suffer from an excessive density of agrarian population in relation to arable land. This difficulty exists not only in grossly over-crowded Asia but also in most countries of Africa and Latin America, where large amounts of unused land are available, but often uninhabited for various reasons[20]. The relative shortage of land in a densely populated agricultural country hampers the achievement of an adequate level of living in two important ways. One, the abundance of labour encourages the use of methods of production which require much labour to produce a small return (the principle of diminishing returns). Secondly, the small size of farms limits the application of advanced techniques which are usually only possible when used on a large scale (economies of scale). Both these forces tend towards reduced per capita income.

The theory of optimum population - which is nothing but an exercise in comparative economic statics - has been criticised for over-emphasizing the role of limited and fixed land as a factor of production and largely ignoring the state of knowledge and skill of the population. Neglecting for a moment the effect

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of a change in other factors of production (notably capital) on the point of diminishing returns, it should be pointed out that in most economically under-developed countries, improving techniques and developing the skills of the people present an even more difficult problem than the relative shortage of land. Most of the poor, densely populated countries are at least as backward socially as they are economically, and in a large population living at a subsistence level education and training, especially if they are to be spread evenly over the population, are slow, costly and difficult. Ignorance, illiteracy, superstition, traditionalism and resistance to social change is extremely hard to overcome in the face of low per capita income and a chronic shortage of capital with land in limited and fixed supply.

A more important aspect of the relationship between population and socio-economic development (completely ignored in optimum population analysis) is the effects over time of changes in the size of population, irrespective of whether the population at any point of time is too small or too large.

We have seen that most of the under-developed countries are characterized by low average income, low levels of education, of literacy, of investment and saving, and of foreign trade. At the same time birth rates are high (40 or more per 1000) and death rates low or falling, resulting in very high growth rates of 2 or 3 percent per year. Perhaps the most significant aspect of the effect of population growth per se on economic development is that the faster the population grows, the more investments are necessary to keep up or improve a given level of per capita production. With a constant population, it is necessary only to replace worn out or obsolete equipment to maintain the level of per capita output. In a fast growing population, a large additional investment is necessary to maintain the same average amount of equipment per worker. Any improvement in equipment which may lead to an increase in average output and ultimately to economic growth, can only be accomplished by further investment, over and above what is required by the growth of population. Moreover, the additional investment required to raise per capita output can more easily be saved in an under-developed country with a slower rate of increase than with a higher growth rate. A large proportion of potential savings in countries of high fertility necessarily goes towards food and other necessities for the increasing number of children. And by no means all of what the people are able to save out of their meagre incomes is actually invested in productive investments.

The concept of the "capital-output" of "investment-income" ratio has been devised to illustrate the relationship between population growth and economic development[21]. If the ratio of capital stock to current annual output is 3 to 1, i.e. three units of capital are required to produce one unit of income, then this means that a population growing at 1% p.a. must invest 3% of current output just to maintain its per capita income, and one growing at 3% p.a. must invest 9% of current output. (This is assuming that there is no technical improvement and only capital and labour enters into production). Most of the under-developed countries have a rate of investment well below 9% of production, which means inability to keep up the average equipment per worker. But if income per capita is to be raised, say by 2%, then in a population growing at 3% p.a. no less than 18% of current output must be saved and invested.

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Another illustration of how population growth impedes economic development is the astronomical absolute amounts of investment which would be required to provide the under-developed countries with enough equipment to permit a "satisfactory" level of per capita production under current growth conditions[22]. For example to equip all Asia with an average of about R1,400 worth of machinery and tools per worker would cost an amount equal to three times the national income of the United States. Again, it has been estimated that R360,000,000,000 worth of equipment would be needed to raise the average output per worker in the major part of Asia to the level that Japan had reached before the last war.

I do not have time to discuss the delicate political problems involved in the development of the poor countries and in particular, the difficulties and possibilities of obtaining badly needed capital via foreign aid and through the expansion of international trade[23]. I only want to stress in passing that there is little hope that these sources of capital will suffice to initiate and maintain economic development in backward areas. For example it has been calculated that between 4.4 and 13.2% of the national income of developed countries would have to be transferred annually to the under-developed countries in order to double their per capita income in 35 years[24]. In view of the underlying assumptions about the capital coefficient and prospective rates of population growth, this may be considered a conservative estimate. But let us compare with this the actual proportions of national income invested overseas in recent years by some of the leading countries. Since the last war France has invested in its overseas territories about 1 to 1.5% of its national income; all other developed countries have remained well below this level, including the United States which has spent about 0.5% of its national income on foreign aid[25].

The third factor which enters into an analysis of the effect of population growth on socio-economic development is the age composition of the population. The age distribution of a population is profoundly affected by births and deaths (in a closed population) and the main determining factor is the past course of fertility. High fertility, such as we have in all under-developed countries, means many children per adult. In addition, decreases in mortality have a reinforcing effect on the youthful age structure. The result is that all low-income countries, as a consequence of their high birth rates and declining mortality, have a broadly-based and sharply tapering age pyramid.

The percentage of children under 15 years of age in the under-developed countries of Asia, Africa and Latin America is usually in the order of 40 percent or more of the total population, while the proportion in European countries is only between 20 and 30 percent. This means a heavy burden of dependent children for the working population, which makes it extremely difficult if not impossible for them to accumulate savings, the prerequisite to capital formation and investment. It also complicates the problem of providing the children with the education that is essential for social and economic advancement in the long run. In any case greater expenditures on schooling and child welfare programmes must inevitably reduce the availability of capital for increasing the productivity of labour.

The high childhood mortality rates in under-developed countries cause expenditures on children who, because they die,

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make no contribution at a later time to the economy. So it seems that the falling mortality at younger ages, allowing more children to survive to adulthood, would mean an improvement in the burden of dependency and thus a saving in material resources. This is a delusion. Longer average life spans mean that more males will survive to become fathers and more females will attain or complete their reproductive period. And if the high birth rates remained unchanged, any addition to the adult population implies a proportionate increase in the number of births and of children. If death rates fall, while birth rates remain constant, the size of each successive generation will be larger but the average number of dependent children per adult will be practically unchanged[26].

In fact analysis shows that the increase in the number of children is indeed somewhat greater than the rise in the number of workers[27]. So while it is true that a decrease in childhood mortality will lead to a larger population at the working ages than would otherwise have resulted, it produces an even greater rise in the number of children whom the people of productive age must support. This is the present situation of the under-developed countries generally, and they will continue to suffer the economic handicap of heavy childhood dependency as long as their present high birth rates continue.

Let us conclude this survey of the world population problem by quoting from a recent address by Sir Charles Darwin :

"When we circumvented the Law of the Non-inheritance of Acquired Characters we raised man from being merely the most efficient member of the animal kingdom into being its master. We have got to discover a way of circumventing another natural law, that of the universal tendency of all species to multiply in numbers, if we are to retain the good things of the world in anything like their present form. The difficulties are enormous, and I can only end by expressing the hope that they will be solved" [28].

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1. United Nations. Demographic Yearbook, 1959. New Yor.

2. Ansley J. Coale. "Increases in Expectations of Life and Population Growth" in International Population Conference, Vienna 1959, p.36. Coale says: "In about 6,500 years, if current growth continues, the descendants of the present world population would form a solid sphere of live bodies expanding with a radial velocity that, neglecting relativity, would equal the velocity of light." Whether or not our growth rate is maintained for a few years, or even centuries, ultimately birth rates must fall or death rates go up."

3. Colin Clark, "Population Growth and Living Standards", International Labour Review, Aug. 1953.

4. Cf. United Nations, Population Growth and the Standard of Living in under-developed Countries, New York, 1954.

5. Cf. Roland Pressat, "La Population de la Chine et son Economie", in Population, 1958.

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6. In 1900 there was one European for every two Asians; by the year 2000 there will probably be four Asians for every European and twice as many Latin Americans as Northern Americans.

7. United Nations, Report on the World Social Situation, New York, 1957.

8. It has been estimated that between 1750 and 1900 the population of Europe and its emigrant off-shoots overseas increased nearly four-fold.

9. Cf. A. Sauvy, "The Economic, Social and Political Problems caused by the Increase in World Population", in Humanity and Subsistence, Annales Nestle, 1961, p.31.

10. Cf. United Nations, Population Growth and the Standard of Living in under-developed Countries, p.8, New York, 1954.

11. Cf. Ansley J. Coale and Edgar M. Hoover, Population Growth and Economic Development in Low-Income Countries, Princeton, 1958, pp. 15 - 17.

12. Ibid., pp. 9 - 17.

13. Cf. George W. Barclay, Colonial Development and Population in Taiwan, Princeton, 1954, p.147.

14. Cf. M.A. El-Badry, "Some Aspects of Fertility in Egypt", The Milbank Memorial Fund Quarterly, Vol. XXXIV, No. 1. pp. 22 - 43.

15. Cf. Kingsley Davis, The Population of India and Pakistan, pp. 70-82, and the National Sample Survey, No. 7, Couple Fertility, Govt. of India, 1955.

16. L.T. Badenhorst and B. Unterhalter, "A Survey of Fertility and Infant Mortality in an Urban African Community", Population Studies, Vol. XV, No. 1, 1961.

17. Cf. Ansley J. Coale and Edgar M. Hoover, op.cit p.58.

18. Cf. William W. Lockwood, The Economic Development of Japan, Princeton, 1954, p.103.

19. Cf. Vincent Heath Whitney, "Population in Theories of Economic Development" in International Population Conference, Vienna, 1959, p.149 ff.

20. In many parts of Latin America and Africa there are more than 200 persons dependent on agriculture per square mile of arable land.

21. Cf. Jan Tinbergen: The Design of Development, International Bank for Reconstruction and Development, New York, 1955.

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22. United Nations: Population Growth and the Standard of Living in under-developed Countries, Population Studies, No. 20. New York, 1954. See also United Nations, Analyses and Projections of Economic Development, New York, 1955.

23. Cf. G. Haberler, "Population Pressure and Economic Policy in Developed and Under-developed Countries", in Humanity and Subsistence, Annales Nestle, 1961, pp. 63 - 73.

24. Cf. Leon Tabah, Le Probleme Population - Investissement - Niveau de Vie dans le Pays Sous - Developpes, in Le Tiers Monde by Georges Balandier, Paris, 1956.

25. Cf. W. Brand, "The World Population Problem", in International Population Conference, Vienna, 1959, p.28.

26. For an analysis of the relative effects of mortality and fertility decreases on age composition, see F. Lorimer, "Dynamics of age structure in a Population with Initially High Fertility and Mortality", in United Nations, Population Bulletin, No. 1, pp. 31-41.

27. Cf. A.J. Coale, "The Effect of Declines in Mortality on Age Distribution", in Trends and Differentials in Mortality, Milbank Memorial Fund, New York, 1956, pp. 125 - 132.

28. Cf. "The Future Numbers of Mankind", in Humanity and Subsistence, Annales Nestle, Switzerland, 1961.

Jan Smuts House. August, 1962.