Conclusions

The panel concludes from its investigations that the over-all task is to achieve universal acceptance of the desirability of planning and controlling family size. An essential condition for the achievement of this objective is the awareness among people throughout the world that voluntary planning and control of family size can and will provide better opportunities for all children and greater happiness for their parents.

Science and technology must provide knowledge of the nature of the reproductive processes and simple, acceptable techniques for controlling them. Societies must make available to all people techniques that do not interfere with the necessary privacy and fulfillment of marital life.

Implementation of the following recommendations is essential for needed expansion and strengthening of activities in the fields of science that are concerned with population problems.

1 *Support of graduate and postdoctoral training in demography and in social and bio-medical sciences concerned with population problems should be increased.*

Effective basic and applied research on population problems is severely restricted by the scarcity of qualified experts. In demography, for example, the conduct of large-scale statistical operations and the staffing of research programs within the government and in the universities must draw upon a very meager supply of trained demog-

raphers. Despite the fundamental contributions that have already been made by demographers in illuminating the inverse relationship between population growth and economic development, large areas of the problem remain obscure. No great increase in the effective contribution of population research is likely to occur without an increase in the number of good demographers. Fellowship support is needed in order to attract qualified students to graduate work in demography. In addition, funds are needed to help universities establish teaching and research posts, for at the present time graduate training in demography is available at only a few of the many outstanding American universities.

Similar needs exist in the social sciences, to provide competent investigators for motivational and attitudinal studies in the field of family planning. Finally, as indicated in the bio-medical section of this report, there is great need for increased research in a number of areas related to animal and human reproduction. This requires additional personnel. Increased support for existing laboratories and for individual investigators currently concerned with studies of specific aspects of the reproductive process will help to attract graduate students to this field of investigation. Graduate and postdoctoral training fellowships must be provided for qualified candidates. Support for schools of hygiene and public health concerned with the training of personnel in population problems must also be expanded.

2 *Research laboratories for scientific investigation of the bio-medical aspects of human reproduction should be expanded.*

The process of human reproduction is complex, and a thorough understanding of it will require extensive research by many investigators in universities, medical centers, and other research institutions.

There are at present a few laboratories concerned with human reproduction. We recommend that these laboratories expand their facilities and mobilize additional students and mature scholars to work on problems of human fertility. Bringing such scientists together at a few centers would create a highly stimulating atmosphere and bring a new sense of urgency to our appreciation of world population problems. The work of such laboratories would attract public

attention to the importance of research in this area and serve to catalyze additional work in other laboratories on studies in human reproduction. In this connection we welcome the establishment of the National Institute for Child Health and Human Development.

The bio-medical section of this report discusses several promising opportunities for research on methods of fertility regulation. Work done in recent years has opened up enough such opportunities to warrant a concentrated five-to-seven-year effort in applied research directed toward improving and enlarging the present battery of contraceptive methods, thus increasing the effectiveness of voluntary family planning by individuals throughout the world. The scope and urgency of the problems are great enough to justify the launching of large, well-publicized programs. Such programs would surely attract sufficient numbers of qualified personnel to staff the pertinent areas of study and research.

3 *International cooperation in studies concerned with voluntary fertility regulation and family planning is highly desirable, and the United States Government should actively participate in fostering such cooperation, working in coordination with appropriate agencies of the United Nations system whenever possible, and with other inter-governmental and non-governmental organizations whenever appropriate.*

The most important contributions the United States Government can make are support of the search for new knowledge and making this knowledge readily accessible to the international community. Scientific research knows no national boundaries, and it is appropriate that American efforts to improve our knowledge of biological, social, and cultural aspects of voluntary fertility regulation and family planning should be part of an international effort. We should seek to foster the creation of a rich diversity of resources among various countries of the international community, so that countries seeking information on ways and means of dealing with their population problems will be able to obtain from one country or another the particular types of assistance most compatible with their particular economic, social, cultural, and religious circumstances.

One of the major tasks is to provide a social, medical, and economic base for the continued modernization of less-developed countries. This requires measures to improve the application of modern scientific knowledge to public health problems, education, the rationalization of agriculture, development of industries, improvement of vital statistics and national censuses, and to other studies of population trends. The United States aid program and the United Nations and related agencies have a major role to play in all activities that will help to develop the skilled personnel needed for modernization of a society. All these developments are good in their own right and also will contribute positively to the appreciation and solution of population problems throughout the world.

In addition, there is specific need for direct assistance in the implementation of policies relating to voluntary fertility control and family planning. It is to be hoped that such assistance will be provided by various interested governments, either bilaterally or through special multilateral arrangements. It should also be provided, at least in part, by private institutions and organizations, by foundations, and even through commercial channels.

4 *Programs in the United States for the training of family-planning administrators should be improved and enlarged.*

The effectiveness of family-planning programs in both highly developed and less-developed areas is limited by the lack of administrators skilled in carrying such programs to the people. In the end, such personnel can best be trained in field situations, for only there can they accumulate the necessary experience. Thus this country can perform a most useful service now by training administrators who will become instructors in their own countries. A few United States schools of public health now provide such training, but more and better programs and facilities are needed to train much larger groups. We see a need for the training of social workers and health educators through practical work in this country under the supervision of appropriate local officials.

Governments and individuals, and particularly underprivileged people in this country and elsewhere, should have the freest and fullest

access possible to the best information on matters of family planning as a basis for making their own decisions. Such information should be appropriate to the particular economic and social milieus of its recipients as well as to their medical and personal requirements. In short, both governmental and individual judgments on this important matter deserve the best available information that modern demography, social science, and bio-medical science can provide.

5 *A committee should be established by the National Academy of Sciences for the purpose of stimulating and coordinating programs directed toward the solution of problems of uncontrolled growth of populations.*

One of the major functions of this committee would be to ensure, by sponsoring special conferences, that the results of basic research being done in various laboratories are made available to appropriate organizations for effective utilization in applied work.

The complex nature of the problem, requiring the participation of many different social institutions (government, private organizations, industry, etc.), requires that some single agency such as this committee take the initiative in seeking ways and means of carrying out the recommendations of this report.

It is appropriate here to call attention to the interdisciplinary nature of population studies, requiring an integration of knowledge from many fields of the natural and social sciences: medicine, biology, economics, demography, sociology, and psychology. It appears to us that the Academy can perform a most valuable service by helping to further this interdisciplinary cooperation.

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The succeeding sections of this report indicate in broad outline the existing world situation in population growth trends. It is the factors determining those trends with which we must concern ourselves in preparing the broadest possible attack on this problem.

World Population Problems

THE GROWTH OF WORLD POPULATION

The population of the world, now somewhat in excess of three billion persons, is growing at about two per cent a year, or faster than at any other period in man's history. While there has been a steady increase of population growth during the past two or three centuries, it has been especially rapid during the past 20 years. To appreciate the pace of population growth we should recall that world population doubled in about 1,700 years from the time of Christ until the middle of the 17th century; it doubled again in about 200 years, doubled again in less than 100, and, if the current *rate* of population increase were to remain constant, would double every 35 years. Moreover, this rate is still increasing.

To be sure, the rate of increase cannot continue to grow much further. Even if the death rate were to fall to zero, at the present level of human reproduction the growth rate would not be much in excess of three and one-half per cent per year, and the time required for world population to double would not fall much below 20 years.

Although the current two per cent a year does not sound like an extraordinary rate of increase, a few simple calculations demonstrate that such a rate of increase in human population could not possibly continue for more than a few hundred years. Had this rate existed from the time of Christ to now, the world population would have increased in this period by a factor of about 7×10^{16}; in other words, there would be about 20 million individuals in place of each

person now alive, or 100 people to each square foot. If the present world population should continue to increase at its present rate of two per cent per year, then, within two centuries, there will be more than 150 billion people. Calculations of this sort demonstrate without question not only that the current continued increase in the rate of population growth must cease but also that this rate must decline again. There can be no doubt concerning this long-term prognosis: *Either the birth rate of the world must come down or the death rate must go back up.*

POPULATION GROWTH IN DIFFERENT PARTS OF THE WORLD

The rates of population growth are not the same, of course, in all parts of the world. Among the industrialized countries, Japan and most of the countries of Europe are now growing relatively slowly—doubling their populations in 50 to 100 years. Another group of industrialized countries—the United States, the Soviet Union, Australia, New Zealand, Canada, and Argentina—are doubling their populations in 30 to 40 years, approximately the world average. The pre-industrial, low-income, and less-developed areas of the world, with two thirds of the world's population—including Asia (except Japan and the Asiatic part of the Soviet Union), the southwestern Pacific islands (principally the Philippines and Indonesia), Africa (with the exception of European minorities), the Caribbean Islands, and Latin America (with the exception of Argentina and Uruguay)—are growing at rates ranging from moderate to very fast. Annual growth rates in all these areas range from one and one-half to three and one-half per cent, doubling in 20 to 40 years.

The rates of population growth of the various countries of the world are, with few exceptions, simply the differences between their birth rates and death rates. International migration is a negligible factor in rates of growth today. Thus, one can understand the varying rates of population growth of different parts of the world by understanding what underlies their respective birth and death rates.

THE REDUCTION OF FERTILITY AND MORTALITY IN WESTERN EUROPE SINCE 1800

A brief, over-simplified history of the course of birth and death rates in western Europe since about 1800 not only provides a frame of reference for understanding the current birth and death rates in Europe, but also casts some light on the present situation and prospects in other parts of the world. A simplified picture of the population history of a typical western European country is shown in

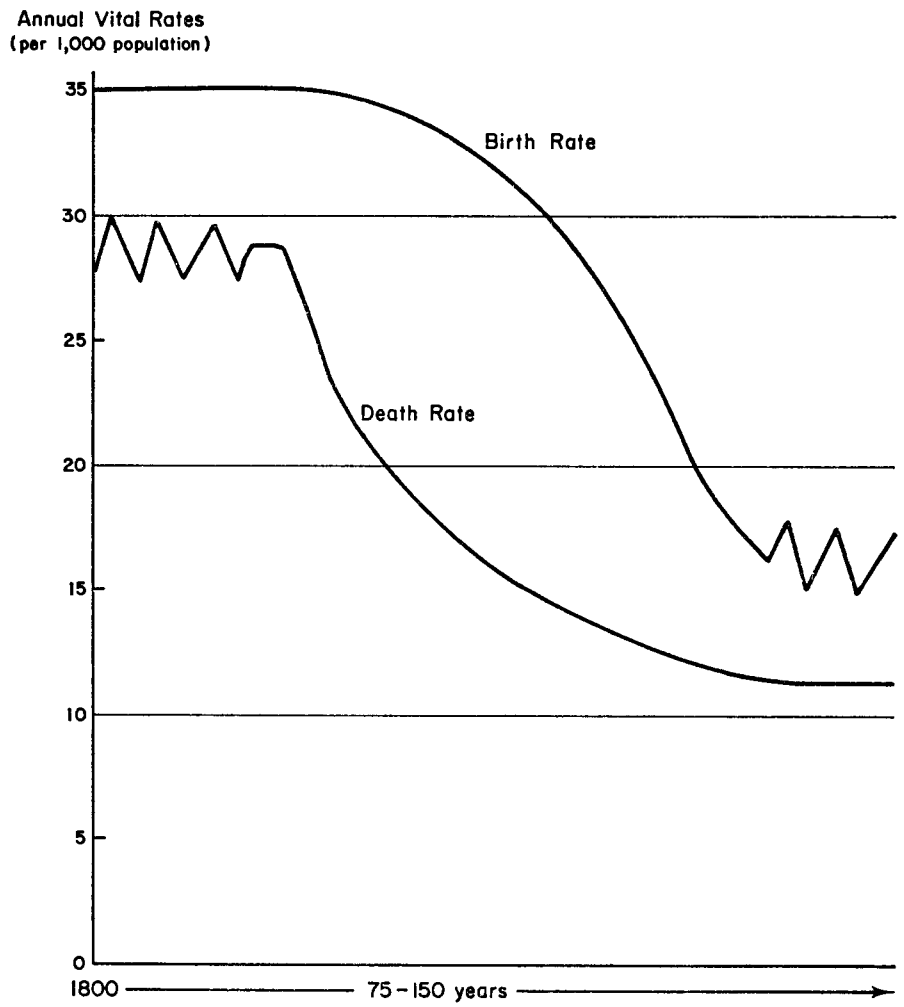

Figure 1. Schematic presentation of birth and death rates in western Europe after 1800. (The time span varies roughly from 75 to 150 years.)

Figure 1. The jagged interval in the early death rate and the recent birth rate is intended to indicate that all the rates are subject to substantial annual variation. The birth rate in 1800 was about 35 per 1,000 population and the average number of children ever born to women reaching age 45 was about five. The death rate in 1800 averaged 25 to 30 per 1,000 population although, as indicated, it was subject to variation because of episodic plagues, epidemics, and crop failures. The average expectation of life at birth was 35 years or less. The current birth rate in western European countries is 14 to 20 per 1,000 population with an average of two to three children born to a woman by the end of childbearing. The death rate is 7 to 11 per 1,000 population per year, and the expectation of life at birth is about 70 years. The death rate declined, starting in the late 18th or early 19th century, partly because of better transport and communication, wider markets, and greater productivity, but more directly because of the development of sanitation and, later, modern medicine. These developments, part of the changes in the whole complex of modern civilization, involved scientific and technological advances in many areas, specifically in public health, medicine, agriculture, and industry. The immediate cause of the decline in the birth rate was the increased deliberate control of fertility within marriage. The only important exception to this statement relates to Ireland, where the decline in the birth rate was brought about by an increase of several years in the age at marriage combined with an increase of 10 to 15 per cent in the proportion of people remaining single. The average age at marriage rose to 28 and more than a fourth of Irish women remained unmarried at age 45. In other countries, however, such social changes have had either insignificant or favorable effects on the birth rate. In these countries—England, Wales, Scotland, Scandinavia, the Low Countries, Germany, Switzerland, Austria, and France—the birth rate went down because of the practice of contraception among married couples. It is certain that there was no decline in the reproductive capacity; in fact, with improved health, the contrary is likely.

Only a minor fraction of the decline in western European fertility can be ascribed to the invention of modern techniques of contraception. In the first place, very substantial declines in some European countries antedated the invention and mass manufacture of contraceptive devices. Second, we know from surveys that as recently as just

before World War II more than half of the couples in Great Britain practicing birth control were practicing withdrawal, or *coitus interruptus*. There is similar direct evidence for other European countries.

In this instance, the decline in fertility was not the result of technical innovations in contraception, but of the decision of married couples to resort to folk methods known for centuries. Thus we must explain the decline in the western European birth rates in terms of why people were willing to modify their sexual behavior in order to have fewer children. Such changes in attitude were doubtless a part of a whole set of profound social and economic changes that accompanied the industrialization and modernization of western Europe. Among the factors underlying this particular change in attitude was a change in the economic consequences of childbearing. In a preindustrial, agrarian society children start helping with chores at an early age; they do not remain in a dependent status during a long period of education. They provide the principal form of support for the parents in their old age, and, with high mortality, many children must be born to ensure that some will survive to take care of their parents. On the other hand, in an urban, industrialized society, children are less of an economic asset and more of an economic burden.

Among the social factors that might account for the change in attitude is the decline in the importance of the family as an economic unit that has accompanied the industrialization and modernization of Europe. In an industrialized economy, the family is no longer the unit of production and individuals come to be judged by what they do rather than who they are. Children leave home to seek jobs and parents no longer count on support by their children in their old age. As this kind of modernization continues, public education, which is essential to the production of a literate labor force, is extended to women, and thus the traditional subordinate role of women is modified. Since the burden of child care falls primarily on women, their rise in status is probably an important element in the development of an attitude favoring the deliberate limitation of family size. Finally, the social and economic changes characteristic of industrialization and modernization of a country are accompanied by and reinforce a rise of secularism, pragmatism, and rationalism in place of custom and tradition. Since modernization of a nation involves extension of deliberate human control over an increasing range of the environment,

it is not surprising that people living in an economy undergoing industrialization should extend the notion of deliberate and rational control to the question of whether or not birth should result from their sexual activities.

As the simplified representation in Figure 1 indicates, the birth rate in western Europe usually began its descent after the death rate had already fallen substantially. (France is a partial exception. The decline in French births began late in the 18th century and the downward courses of the birth and death rates during the 19th century were more or less parallel.) In general, the death rate appears to be affected more immediately and automatically by industrialization. One may surmise that the birth rate responds more slowly because its reduction requires changes in more deeply seated customs. There is in most societies a consensus in favor of improving health and reducing the incidence of premature death. There is no such consensus for changes in attitudes and behavior needed to reduce the birth rate.

DECLINING FERTILITY AND MORTALITY IN OTHER INDUSTRIALIZED AREAS

The pattern of declining mortality and fertility that we have described for western Europe fits not only the western European countries upon which it is based but also, with suitable adjustment in the initial birth and death rates and in the time scale, eastern and southern Europe (with the exception of Albania), the Soviet Union, Japan, the United States, Australia, Canada, Argentina, and New Zealand. In short, every country that has changed from a predominantly rural agrarian society to a predominantly industrial urban society and has extended public education to near-universality, at least at the primary school level, has had a major reduction in birth and death rates of the sort depicted in Figure 1.

The jagged line describing the variable current birth rate represents in some instances—notably the United States—a major recovery in the birth rate from its low point. It must be remembered, however, that this recovery has not been caused by a reversion to uncontrolled family size. In the United States, for example, one can scarcely imagine that married couples have forgotten how to employ the contraceptive

techniques that reduced the birth rates to a level of mere replacement just before World War II. We know, in fact, that more couples are skilled in the use of contraception today than ever before. (Nevertheless, effective methods of controlling family size are still unknown and unused by many couples even in the United States.) The recent increase in the birth rate has been the result largely of earlier and more nearly universal marriage, the virtual disappearance of childless and one-child families, and a voluntary choice of two, three, or four children by a vast majority of American couples. There has been no general return to the very large family of pre-industrial times, although some segments of our society still produce many unwanted children.

POPULATION TRENDS IN LESS-DEVELOPED COUNTRIES

We turn now to a comparison of the present situation in the less-developed areas with the demographic circumstances in western Europe prior to the industrial revolution. Figure 2 presents the trends of birth and death rates in the less-developed areas in a rough schematic way similar to that employed in Figure 1. There are several important differences between the circumstances in today's less-developed areas and those in pre-industrial Europe. Note first that the birth rate in the less-developed areas is higher than it was in pre-industrial western Europe. This difference results from the fact that in many less-developed countries almost all women at age 35 have married, and at an average age substantially less than in 18th-century Europe. Second, many of the less-developed areas of the world today are much more densely populated than was western Europe at the beginning of the industrial revolution. Moreover, there are few remaining areas comparable to North and South America into which a growing population could move and which could provide rapidly expanding markets. Finally, and most significantly, the death rate in the less-developed areas is dropping very rapidly—a decline that looks almost vertical compared to the gradual decline in western Europe—and without regard to economic change.

The precipitous decline in the death rate that is occurring in the low-income countries of the world is a consequence of the development and application of low-cost public health techniques. Unlike

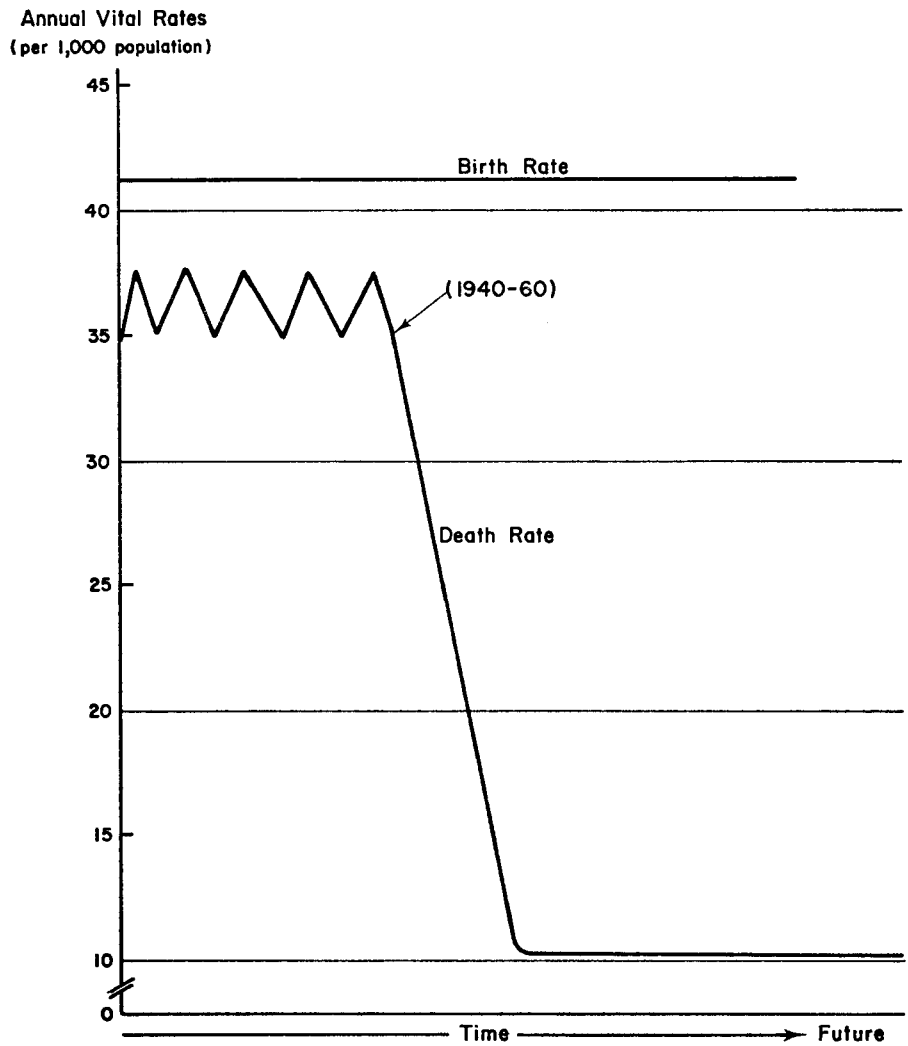

Figure 2. Schematic presentation of birth and death rates in less-developed countries, mid-20th century. (The steep drop in the death rate from approximately 35 per thousand began at times varying roughly between 1940 and 1960 from country to country.)

the countries of western Europe, the less-developed areas have not had to wait for the slow gradual development of medical science, nor have they had to await the possibly more rapid but still difficult process of constructing major sanitary engineering works and the build-up of a large inventory of expensive hospitals, public health

services, and highly trained doctors. Instead, the less-developed areas have been able to import low-cost measures of controlling disease, measures developed for the most part in the highly industrialized countries. The use of residual insecticides to provide effective protection against malaria at a cost of no more than 25 cents per capita per annum is an outstanding example. Other innovations include antibiotics and chemotherapy, and low-cost ways of providing safe water supplies and adequate environmental sanitation in villages that in most other ways remain relatively untouched by modernization. The death rate in Ceylon was cut in half in less than a decade, and declines approaching this in rapidity are almost commonplace.

The result of a precipitous decline in mortality while the birth rate remains essentially unchanged is, of course, a very rapid acceleration in population growth, reaching rates of three to three and one-half per cent. Mexico's population, for example, has grown in recent years at a rate of approximately three and one-half per cent a year. This extreme rate is undoubtedly due to temporary factors and would stabilize at not more than three per cent. But even at three per cent per year, two centuries would see the population of Mexico grow to about 13.5 billion people. Two centuries is a long time, however. Might we not expect that long before 200 years had passed the population of Mexico would have responded to modernization, as did the populations of western Europe, by reducing the birth rate? A positive answer might suggest that organized educational efforts to reduce the birth rate are not necessary. But there is a more immediate problem demanding solution in much less than two centuries: Is the current demographic situation in the less-developed countries impeding the process of modernization itself? If so, a course of action that would directly accelerate the decline in fertility becomes an important part of the whole development effort which is directed toward improving the quality of each individual's life.

POPULATION TRENDS AND THE ECONOMIC DEVELOPMENT OF PRE-INDUSTRIAL COUNTRIES

The combination of high birth rates and low or rapidly declining death rates now found in the less-developed countries implies two different characteristics of the population that have important impli-

cations for the pace of their economic development. One important characteristic is rapid growth, which is the immediate consequence of the large and often growing difference between birth and death rates; the other is the heavy burden of child dependency which results from a high birth rate whether death rates are high or low. A reduced death rate has only a slight effect on the proportion of children in the population, and this effect is in a rather surprising direction. The kinds of mortality reduction that have actually occurred in the world have the effect, if fertility remains unchanged, of reducing rather than increasing the average age of the population.

Mortality reduction produces this effect because the largest increases occur in the survival of infants; thus, although the reduction in mortality increases the number of old persons, it increases the number of children even more. The result is that the high fertility found in low-income countries produces a proportion of children under fifteen of 40 to 45 per cent of the total population, compared to 25 per cent or less in most of the industrialized countries.

What do these characteristics of rapid growth and very large proportions of children imply about the capacity to achieve rapid industrialization? It must be noted that it is probably technically possible in every less-developed area to increase national output at rates even more rapid than the very rapid rates of population increase we have discussed, at least for a few years. The reason at least slight increases in per capita income appear feasible is that the low-income countries can import industrial and agricultural technology as well as medical technology. Briefly, the realistic question in the short run does not seem to be whether some increases in per capita income are possible while the population grows rapidly, but rather whether rapid population growth is a major deterrent to a *rapid* and *continuing* increase in per capita income.

A specific example will clarify this point. If the birth rate in India is not reduced, its population will probably double in the next 25 or 30 years, increasing from about 450 million to about 900 million. Agricultural experts consider it feasible within achievable limits of capital investment to accomplish a doubling of Indian agricultural output within the next 20 to 25 years. In the same period the output of the non-agricultural part of the Indian economy probably would be slightly more than doubled if the birth rate remained unchanged.

For a generation at least, then, India's economic output probably can stay ahead of its maximum rate of population increase. This bare excess over the increase in population, however, is scarcely a satisfactory outcome of India's struggle to achieve economic betterment. The real question is: Could India and the other less-developed areas of the world do substantially better if their birth rates and thus their population growth rates were reduced? Economic analysis clearly indicates that the answer is yes. Any growth of population adds to the rate of increase of national output that must be achieved in order to increase per capita output by any given amount.

To double per capita output in 30 years requires an annual increase in per capita output of 2.3 per cent; if population growth is three per cent a year, then the annual increase in national output must be raised to 5.3 per cent to achieve the desired level of economic growth. In either instance an economy, to grow, must divert effort and resources from producing for current consumption to the enhancement of future productivity. In other words, to grow faster an economy must raise its level of net investment. Net investment is investment in factories, roads, irrigation networks, and fertilizer plants, and also in education and training. The low-income countries find it difficult to mobilize resources for these purposes for three reasons: The pressure to use all available resources for current consumption is great; rapid population growth adds very substantially to the investment targets that must be met to achieve any given rate of increase in material well-being; and the very high proportions of children that result from high fertility demand that a larger portion of national output must be used to support a very large number of non-earning dependents. These dependents create pressure to produce for immediate consumption only. In individual terms, the family with a large number of children finds it more difficult to save, and a government that tries to finance development expenditures out of taxes can expect less support from a population with many children. Moreover, rapid population growth and a heavy burden of child dependency divert investment funds to less productive uses—that is, less productive in the long run. To achieve a given level of literacy in a population much more must be spent on schools. In an expanding population of large families, construction effort must go into housing rather than into factories or power plants.

Thus the combination of continued high fertility and greatly reduced mortality in the less-developed countries raises the levels of investment required while impairing the capacity of the economy to achieve high levels of investment. Economists have estimated that a gradual reduction in the rate of childbearing, totaling 50 per cent in 30 years, would add about 40 per cent to the income per consumer that could be achieved by the end of that time.

To recapitulate, a short-term increase in per capita income may be possible in most less-developed areas, even if the fertility rate is not reduced. Nevertheless, even in the short run, progress will be much faster and more certain if the birth rate falls. In the longer run, economic progress will eventually be stopped and reversed unless the birth rate declines or the death rate increases. Economic progress will be slower and more doubtful if less-developed areas wait for the supposedly inevitable impact of modernization on the birth rate. They run the risk that rapid population growth and adverse age distribution would themselves prevent the achievement of the very modernization they count on to bring the birth rate down.

Social Factors

Birth rates can be lowered by any one of a variety of practices: by late marriage and not marrying, as in Ireland; by induced abortion, as in Japan and the eastern European countries; or by contraception, as in all the western countries. An increase of five years in age of marriage in India would result in a decline of about 20 per cent in the birth rate; a decrease of 15 per cent in the proportion of people married would result in a corresponding decrease in the birth rate. But the marriage practices of a society are closely bound up with its social and cultural institutions and hence are not easily or quickly changed. Such shifts probably have to come as part of those long-term and basic changes in the very fabric of a society that accompany the transition from traditional to modern status.

Induced abortion is widely and legally practiced in some countries, and it is quite widely but illegally, and badly, practiced in many others. It is, however, unacceptable to most societies on religious or moral grounds. Indeed, the very fact of widespread abortion is itself an important argument for voluntary fertility regulation. (It is estimated that there are over six million induced abortions a year in the world, and quite possibly double that number.)

The most accessible means of fertility regulation, then, appears to be contraception. Currently available methods of contraception and their bio-medical characteristics are discussed in the next section of this report. Here we are concerned only with the social aspects of their acceptance and use—with attitudes about family size and family limitation and the bases thereof, spread of information about repro-