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*N O T E*

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## FOREWORD

This is the first issue of the *Population Bulletin*, a publication which is to be prepared as occasion arises by the Population Division of the United Nations Department of Social Affairs.

Other publications of the Department of Social Affairs relating to population are issued in a series entitled *Population Studies* (ST/SOA/Series A). Publications in that series present the results of studies carried out by the Population Division on various demographic subjects, for example, the population of territories under United Nations trusteeship, methods of demographic analysis, and population census methods. The *Population Bulletin* differs from the *Population Studies* in that each issue of the *Bulletin* will contain several brief articles relating to population which, by their nature, do not require separate publication.

Material for the *Bulletin* will be selected with a view to the interests and needs of governmental agencies, research institutions, scholars and other individuals engaged in social and economic research, as well as the general international public. Articles of general interest relating to population trends and problems on the international level will therefore be included

together with discussions of technical demographic questions.

It is expected that most of the articles to be published will be prepared by the United Nations staff in pursuance of the programme of work recommended by the Economic and Social Council and the Population Commission. Articles contributed by scientists who are not staff members may also be included. They will be accompanied by an acknowledgment mentioning the name of the contributor and the institution, if any, with which he is associated. Articles not bearing such an acknowledgment have been prepared by the staff of the United Nations. The United Nations does not take any attitude with regard to population problems other than that dictated by the principles of the United Nations Charter or by the decisions of relevant organs of the United Nations. Points of view which contributors may express in their articles should not be considered as reflecting the views of the United Nations.

Subsequent issues of the *Population Bulletin* will be published whenever a sufficient number of pertinent articles of international interest has been assembled.

# The past and future growth of world population— a long-range view

Whether all the world's peoples can have an adequate level of living depends in an important degree on their numbers and rate of increase. Some economists place great emphasis on this aspect of the problem, fearing that if the population continues to grow at the same rate as during the last century, it will outrun the world's capacity to provide sufficient food and other necessities. Others take a more optimistic view and believe that production can be increased to match any growth in the number of consumers which can be expected in the foreseeable future. The latter may agree, however, that it would be prudent to plan the utilization of resources—especially those scarce natural resources which are subject to depletion or exhaustion—with a view to the trend of world population and its implications for future requirements.

The population of the earth in mid-1950, in round numbers, was 2,400 million, or about eighteen men, women, and children for each square kilometre of the land area. Such figures can only be approximate, of course, for many of the countries, including some of the most populous, have no reliable census or vital statistics. Estimates of China's population, for instance may miss the mark by as much as 100 million.<sup>1</sup>

Statements about the size of the population and its rate of increase in the world as a whole during any specified period in the past are subject to more uncertainty than those about present numbers. Comprehensive statistics of births and deaths and periodic censuses of the population are rather recent innovations, even in those countries where these methods of population accounting have reached their greatest development. Historical studies of population trends are therefore handicapped by a shortage of reliable data which grows more serious as the researches are carried farther back into time. Even over the relatively brief span of the last twenty or thirty years, the gaps in available

<sup>1</sup>The official estimate for all China in mid-1948, given in the United Nations *Demographic Yearbook, 1949-50*, p. 77, was 463,493,000. However, a leading Chinese demographer, writing in 1946, stated that the maximum population of the country was 400 million. Chen, Ta, *Population in Modern China*, 1946, pp. 5-6.

information preclude any exact measurement of the increase in world population. When the analysis is extended to a period of two or three centuries, the results inevitably become rather impressionistic. Nevertheless, the findings of careful research in this field can be used to advantage as a background for the examination of recent trends and of their implications for the future.

Population estimates covering the period 1650 to 1950, for the world and its broad geographical divisions, are presented in table I. The figures for the period 1650 to 1900 are based primarily on the careful research of the American demographer, Willcox; those for 1950 were compiled by the United Nations Population Division. These estimates indicate that the number of the earth's inhabitants increased from 470 million in 1650 to 2,406 million in 1950. This is a five-fold gain in 300 years, representing an average annual rate of about 5.6 per thousand.

TABLE I. ESTIMATES OF WORLD POPULATION BY CONTINENTAL DIVISIONS, 1650-1950<sup>a</sup>

Area	Estimated population (millions)				
	1650	1750	1850	1900	1950
World total .....	470	694	1,094	1,550	2,406
Africa .....	100	100	100	120	199
America .....	8	11	59	144	328
North of Rio Grande..	1	1	26	81	166
South of Rio Grande...	7	10	33	63	162
Asia (excl. Asiatic USSR)	257	437	656	857	1,272
Europe & Asiatic USSR.	103	144	274	423	594
Oceania .....	2	2	2	6	13

<sup>a</sup>The principal sources are, for 1650-1900, Willcox, Walter F., *Studies in American Demography*, Ithaca (N. Y.) U.S.A., 1940; for 1950, estimates compiled by the United Nations Population Division, on the basis of official estimates for various countries, with additions and corrections as needed. Willcox's estimates for Europe have been increased and his estimates for Asia reduced, by estimates of the population of the Asiatic part of the USSR, based primarily on Volkhov's *Dinamika nase-leniya SSSR*, Moscow 1930, pp. 33-50, 264. The 1900 estimate for Africa is taken from Carr-Saunders, A.M., *World Population*, Oxford, England, 1936.

In the perspective of the thousands of years of man's previous existence on earth, the modern era must appear as a period of unusually rapid population growth. Anthropologists be-

lieve that the history of *homo sapiens* goes back to 25,000 B.C., or earlier. If the first couple of this species had developed by 25,000 B.C., an average annual rate of increase of 0.7 per thousand would have given the 350 million people that are believed to have been inhabiting the world when Christ was born. The average rate of population growth from 1650 to 1950, therefore, is at least eight times as large as that before the Christian era. The recent period is very unlikely to have been the only period of comparatively rapid increase, for all available evidence points to the conclusion that the peopling of the planet has proceeded at an uneven pace, with spurts of relatively fast growth interspersed with intervals of slow growth or of decline.

It is evident also that the rate of increase has been accelerating during the more recent years of the modern era. Between 1650 and 1850, the estimates indicate an average annual increase of about 4 per thousand; between 1850 and 1900, they show an annual growth of 7 per thousand; and between 1900 and 1950, 9 per thousand. Although these are only rough approximations, they leave little room for doubt that the rate of growth has been substantially higher since 1850 than it was before.

The trends of increase have not been parallel in all parts of the world. During the 1850-1900 period, the population of Europe grew rapidly and that of America prodigiously, while Asia's population increased at a distinctly slower rate and Africa's grew hardly at all. In contrast, since the beginning of the twentieth century, the estimates for Asia and Africa show an acceleration of increase, while those for Europe indicate that the rate of growth has diminished somewhat.

The more detailed information available regarding the world's population since 1920 permits a further subdivision by regions in a discussion of recent growth. From 1920 to 1950, Latin America (i.e., America south of the Rio Grande) appears to have had by far the most rapidly growing population (see table II). High rates of increase are shown also for the remainder of America, Africa, south-central Asia (chiefly India and Pakistan), Japan and Oceania. The increase in eastern Europe and the USSR might have been equally rapid but for the heavy losses of the recent war. Other regions, such as north-west-central Europe and the remainder of the Far East (a large part of which consists of the population of China), have been gaining population at appreciably lower rates than the world average.

TABLE II. POPULATION ESTIMATES FOR REGIONS OF THE WORLD, 1920 AND 1950<sup>a</sup>

Region	Reliability of estimates	Estimated mid-year population (millions)		Average annual rate of growth (per cent)
		1920	1950	
World total.....	—	1,834	2,406	0.9
Africa .....	Poor	136	199	1.3
America .....		207	328	1.5
North of Rio Grande..	Good	115	166	1.3
South of Rio Grande..	Fair	92	162	1.9
Asia (excl. Asiatic)				
USSR) .....		997	1,272	0.8
Near East .....	Poor	55	75	1.0
South-central Asia...	Fair	314	442	1.1
Japan .....	Good	56	84	1.4
Remaining Far East..	Poor	572	670	0.5
Europe and Asiatic				
USSR .....		485	594	0.7
North-west-central				
Europe .....	Good	179	215	0.6
Southern Europe.....	Good	70	92	0.9
Eastern Europe and				
Asiatic USSR .....	Fair	236	287	0.7
Oceania .....	Good	9	13	1.4

<sup>a</sup>The estimates for 1920 have been published previously in the United Nations *Demographic Yearbook, 1949-1950*, p.10. Those for 1950 have been prepared by the methods described in pp.10-13 of that yearbook.

Some idea of the changes in rates of growth during the past fifteen years and of the factors involved may be obtained from estimates of birth and death rates for the world as a whole and eleven regions in particular during the periods 1936-1938 and 1946-1948. Vital statistics for some of the regions are fragmentary and unreliable so that it is desirable to give a range within which the birth and death rates probably lie rather than a single figure. In such cases the rate of natural increase could vary between the extremes obtained by subtracting the lower limit of the death rate from the upper limit of the birth rate and vice versa. Because such extreme combinations are not likely to occur, the range computed in this manner has been reduced by about one-third. The rates in table III show that the world's population probably was growing somewhat faster in the late 1940's than in the late 1930's. The acceleration of growth is explained partly by a decline in mortality, notably in Africa, Latin America, south-central Asia and southern Europe. The birth rate, on the other hand, was higher in the later period in northern America, Japan, north-west-central Europe and Oceania.

TABLE III. ESTIMATED VITAL RATES FOR REGIONS OF THE WORLD,  
1936-1938 AND 1946-1948<sup>a</sup>

Regions	Rate per thousand population					
	1936-1938			1946-1948		
	Births	Deaths	Natural increase	Births	Deaths	Natural increase
World total .....	34-38	24-27	8-13	35-37	22-25	11-14
Africa .....	40-45	30-35	7-13	40-45	25-30	12-18
America						
North of Rio Grande.....	17	11	6	25	10	15
South of Rio Grande.....	40-45	20-25	17-23	40	17	23
Asia (excl. Asiatic USSR)						
Near East .....	40-45	30-35	7-13	40-45	30-35	7-13
South-central Asia .....	40-45	30-35	7-13	40-45	25-30	12-18
Japan .....	28	17	11	31	15	16
Remaining Far East.....	40-45	30-35	7-13	40-45	30-35	7-13
Europe and Asiatic USSR						
North-west-central Europe .....	17	13	4	19	12	7
Southern Europe .....	23	16	7	23	12	11
Eastern Europe and Asiatic USSR...	30-34	17-21	11-15	28	18	10
Oceania .....	20	11	9	28	12	16

<sup>a</sup>Sources: United Nations, *World Population Trends, 1920-1947* (ST/SOA/Series A, Population Studies, No. 3); *Demographic Yearbook, 1949-50*, p. 14.

It is evident from the foregoing discussion and other material that vital rates in various regions of the world are subject to fairly rapid changes, and that any expectation of a constant rate of population growth in the future would be unrealistic. It may be useful, however, as a first step in analysing the implications of recent demographic tendencies, to calculate the population changes that would occur from 1950 to 1980 if the birth and death rates should remain as they were during the period 1946-1948. The results of this computation are presented in table IV. They indicate that if growth should continue at the 1946-1948 rates, the population of the world as a whole and of each of the eleven regions enumerated would increase more rapidly during the next thirty years than during the preceding thirty. The world total by 1980 would be 3,523 millions, or 46 per cent more than the 1950 figure. Latin America would substantially increase its share of the total, and northern America, Oceania, Africa, south-central Asia and Japan would also gain. Europe - particularly north-west-central Europe - the remainder of the Far East and the Near East would have a reduced proportion of the world population. These calculations do not take into account the possibilities of migration, which are most difficult to foresee.

This kind of analysis ignores the fact that the demographic position of some of the regions which now have similar rates of natural increase is actually very different from that of others; the prospects for future population growth are therefore very varied. In general,

TABLE IV. HYPOTHETICAL 1980 POPULATION CALCULATED ON THE ASSUMPTION OF VITAL RATES CONTINUING AT 1946-1948 LEVELS, COMPARED WITH ESTIMATED 1950 POPULATION, FOR REGIONS OF THE WORLD

Region	Population (millions)		Increase 1950-1980 (per cent)	Distribution of population (per cent)	
	1950 (estimated)	1980 (hypothetical)		1950 (estimated)	1980 (hypothetical)
World total ...	2,406	3,523	46	100.0	100.0
Africa .....	199	311	56	8.3	8.8
America .....	328	581	77	13.6	16.5
North of Rio Grande ...	166	260	56	6.9	7.4
South of Rio Grande ...	162	321	98	6.7	9.1
Asia (excl. Asiatic USSR) .....	1,272	1,830	44	52.9	51.9
Near East ..	75	101	35	3.1	2.9
South-central Asia .....	442	691	56	18.4	19.6
Japan .....	84	135	61	3.5	3.8
Remaining Far East.	670	903	35	27.8	25.6
Europe and Asiatic USSR .....	594	780	31	24.7	22.1
North-west-central Europe ..	215	265	23	8.9	7.5
Southern Europe ..	92	128	39	3.8	3.6
Eastern Europe and Asiatic USSR .....	287	387	35	11.9	11.0
Oceania .....	13	21	61	0.5	0.6

those regions which have low death rates also have low birth rates, while birth rates are generally high in regions of high death rates. Thus, low rates of natural increase are found both in regions of high and of low mortality and fertility. For example, north-west-central Europe, with a 1946-1948 birth rate of 19 and death rate of 12 per thousand, has a rate of natural increase not much, if any, lower than that of the Near East, with a birth rate of 40-45 and a death rate of 30-35. Yet the potentialities of growth in the two regions are by no means the same.

Under the conditions which exist at present in regions like the Near East, mortality can be reduced greatly without any radical social changes; certain relatively simple measures of economic development and sanitary reform can lead to a stable death rate much below the present level. The resulting demographic expansion may continue for a long period if economic development keeps pace. There is no certainty that in these areas there will be fundamental social changes which will lead to the limitation of families and a decline in the birth rate as has occurred in much of the western world.

In a region like north-west-central Europe, on the other hand, no great improvement in the death rate can be expected, since it is already very low. The low birth rate is a result of far-reaching earlier changes in popular attitudes regarding family size, and of an increase in the practice of birth control as methods of birth control have become more widely known. The small-family ideal which has evolved in the course of several generations is unlikely to give way in the near future to attitudes that would permit high birth rates. Rapid growth of population is therefore improbable over a long period. There may be short spurts of increase in these regions, however, owing to the fact that couples put off having children during an unfavourable period. Such spurts have occurred after a severe economic depression (e.g., the depression of the 1930's in North America) and after the end of the First and Second World Wars.

In order to make this analysis of future population growth more realistic, it is necessary to use different assumptions regarding future trends of vital rates for regions having different levels of fertility and mortality. So that the discussion will not be unduly complicated, the eleven regions will be combined into three groups. Although this may seem undesirable, because the groups will not be altogether

homogenous demographically, it should be remembered that none of the regions and few—if any—of the countries composing them are homogeneous demographically. A careful examination of these areas would show considerable internal diversity of vital rates.

The general characteristics of the three groups to be utilized are as follows: group I—fertility and mortality have declined to low levels; group II—mortality has declined substantially and fertility in lesser degree; group III—fertility is high, having declined little, if at all, while mortality is high on the whole, although in some of the less populated countries it has fallen considerably in recent times.

Four regions—north-west-central and southern Europe, northern America and Oceania—with about 20 per cent of the world's population, are readily allocated to group I. In the period 1946-1948, the average crude death rate was as low as 10 per thousand in one of these regions (northern America) and only 12 per thousand in the other three. The crude birth rate was considerably higher, ranging from 19 per thousand in north-west-central Europe to 28 per thousand in Oceania; nevertheless, it was distinctly below the world average in spite of the phenomenal increase in births which occurred after the last war in many of the countries in these regions. This increase in births is considered by many observers to be only temporary, resulting from changes in the year of occurrence of marriages and births rather than from an increase in the average size of the family. The crude death rate may already be near its minimum in these regions because of the rising average age of the population. In consequence, it is probable that the crude birth and death rates will move closer together in the future.

The birth and death rates for group I as a whole were, respectively, about 22 and 12 per thousand in the period 1946-1948, giving an annual rate of increase of 10 per thousand. This rate not only is high compared with known rates in the recent past in large parts of these regions, but is higher than the rate to be expected during most of the foreseeable future. Some potentialities for higher rates of growth remain in certain parts of the regions in this group, for example, in parts of southern Europe and North America. But the populations in these parts of the regions do not represent a great proportion of the total group and even in their case birth rates may be expected to fall more rapidly than death rates in coming years.



Group II exhibits a wide variety of demographic situations. In this group are placed regions with such diverse characteristics as eastern Europe (including the Asiatic USSR), Latin America and Japan. These regions are similar in that their death rates have fallen to moderate levels; the rates indicated for the period of 1946-1948 in table III are 15 per thousand for Japan, 17 per thousand for Latin America and 18 per thousand for eastern Europe and the Asiatic USSR. The variation in birth rates is much wider, the 1946-1948 rates ranging from 28 in eastern Europe (including the Asiatic USSR) and 31 in Japan to 40 in America south of the Rio Grande. In the first two of these regions, birth rates have shown definite declines in the recent past. Fertility in most of Latin America remains on a high level, although in some countries of this region appreciable declines have become manifest. Group II includes about 22 per cent of the world population and had an annual rate of growth of about 15 per thousand in the period 1946-1948. Compared with group I, group II had a somewhat higher mortality rate and a substantially higher fertility rate; its average annual rate of growth was greater by 50 per cent.

Some of the countries of eastern Europe and Latin America (for example, Czechoslovakia, Hungary, Argentina and Uruguay) are already approaching the vital rates found in many of the countries of western Europe. Within the next few decades, the vital rates in a number of other group II countries will undoubtedly move nearer to those of group I. In the case of Japan, knowledge gained in the past with regard to methods of reducing birth and death rates, and the incentive supplied by an unfavourable relationship between population and resources in the densely populated islands, may lead to more drastic measures for curtailing population growth. By far the larger proportion of the population of group II, however, still has great potentialities for a rapid increase in numbers, thanks to the wide margins between the present birth and death rates. A large growth is inevitable in the future, even if birth rates decline faster than death rates.

The group as a whole, however, probably is approaching or has already passed its phase of most rapid growth. Some decline in the rate of increase is to be expected during the next thirty years.

The remaining regions of the world—the Near East, south-central Asia, the remaining Far East and Africa—make up group III. In these regions—which have more than half the world's

population—fertility is still high and has shown little, if any, evidence of decline. Considerable progress in controlling mortality has been achieved in many of the less populous countries of these regions (notably in Ceylon, Formosa and French North Africa) and has led to a high rate of population growth in the last few decades. Moderate growth has also occurred in India during recent decades, not so much as a result of marked declines in the usual rates of mortality (which are still high), but because major calamities caused by famines and epidemics, which formerly wiped out millions of human lives in a single year of misfortune, have been averted. Potentials for high rates of population increase are believed to exist in other regions of this group, but have been obscured by recurrent crises caused by the hazards of weather and harvests, by political disturbance and by ravaging diseases, which in the brief interval of one year have nullified the population gains of several prior years. China is an example. In these circumstances, the fluctuating death rate is the chief determinant of population change and the rate of natural increase is erratic. Population growth tends to be slow over long periods in spite of potentialities for a rapid increase in numbers.

The estimated birth rates of group III regions in the period 1946-1948 were in the range of 40-45 per thousand, while the estimated death rates ranged from 25-30 for Africa and south-central Asia to 30-35 for the Near East and the remaining Far East. The estimated vital rates for the period 1946-1948 indicate an average natural increase of 12 per thousand for the group III regions, which is intermediate between the estimated average rates for the other two groups.

The great reductions in mortality which have recently been reported in some areas in group III suggest that economic and social development, together with the increasing application of established techniques for the reduction of mortality, may at some future time lead to a spectacular lowering of the death rate in group III as a whole. If the people of the group III regions are successful in maintaining such improvements over a long period of time, the rate of growth will shoot up and, since the aggregate population of the group is huge, the increase in absolute numbers will be tremendous. In that event many of the group III countries—particularly China, India, Pakistan, the Philippines, Indonesia and other densely populated countries in Asia—will be faced by a grave problem of expanding production fast enough to

support their additional people. However, many observers tend towards the view that in most of the countries in this group, a high rate of increase occasioned by low death rates during some years would be checked by periodic catastrophes such as widespread epidemics, failure of the food supply and internal strife. If this view is correct, the rate of growth over a long period of time may not be very great.

The 1946-1948 rates of increase for the three groups of regions are slightly larger than those shown by the figures for population increase from 1920 to 1950 in table II. Group I was growing by about 10 per thousand per year during the period 1946-1948 and by about 9 per thousand from 1920 to 1950, a difference of only one point. With group II, however, the average annual rate was 15 per thousand for the period 1946-1948 and 11 per thousand for the thirty-year period—a difference of four points. A four-point difference is found also for group III, the rates for the two periods being 12 and 8 per thousand respectively.

No one can see clearly enough into the future to predict with certainty what changes in population will occur during the next three decades in any of these groups of regions, or in any of

their component countries. Such predictions would be impossible even if one could be sure that there would be no great wars or other large-scale catastrophes. It is possible, however, to make assumptions as to the future changes in birth and death rates in the three groups of regions, based on the trends and characteristics described above, which should give a more realistic impression of population potentialities than is conveyed by the hypothetical figures in table IV.

As a basis for the discussion which follows, three sets of assumptions have been formulated for each of the three groups of regions: a "high", a "low" and a "medium". An effort has been made to choose these assumptions in such a way that increases in population exceeding the results of the "high" assumptions or falling short of those of the "low" assumptions will not seem very likely. Calculations corresponding to "medium" assumptions have been made only for convenience; the results are approximately midway between the "high" and the "low" and are not considered as having a greater predictive value than many other intermediate assumptions which could be made.

TABLE V. HYPOTHETICAL 1980 POPULATION AND 1950-1980 RATE OF GROWTH, FOR THE WORLD AND THREE GROUPS OF REGIONS, ACCORDING TO "HIGH", "MEDIUM" AND "LOW" ASSUMPTIONS

Area	Population (millions)			
	1950 (estimated)	1980 (hypothetical) "High" assumption	"Medium" assumption	"Low" assumption
World total	2,406	3,636	3,277	2,976
Group I: (Northern America, north-west-central and southern Europe, Oceania)	486	655	599	548
Group II: (Latin America, Japan, Eastern Europe and Asiatic USSR)	533	938	809	718
Group III: (Africa, Near East, south-central Asia, remaining Far East)	1,387	2,043	1,869	1,710

Area	Average annual rate of growth per thousand				Population distribution (percentage)			
	1920-1950 (estimated)	1950-1980 (hypothetical) "High" assumption	"Medium" assumption	"Low" assumption	1950 (estimated)	1980 (hypothetical) "High" assumption	"Medium" assumption	"Low" assumption
World total					100.0	100.0	100.0	100.0
Group I	9	10	7	4	20.2	18.0	18.3	18.4
Group II	11	19	14	10	22.2	25.8	24.7	24.1
Group III	8	13	10	7	57.6	56.2	57.0	57.5

In drawing up the assumptions for group I, it was borne in mind that the death rates in these regions were already so low that further reductions could be won only very slowly and at increasing cost. In some countries in this group, appreciable improvements in mortality, particularly of infants, appear still feasible. But even if the mortality rates for each age

group continue to fall, the general death rate in some of these countries may not fall much, and may even rise in the future, because of the increasing percentage of old people in the population.

Birth rates in group I countries have been unexpectedly high in recent years, despite their consistent fall in previous decades. In some of

these countries the recent "baby boom" is attributable entirely to post-war readjustments and a tendency to marry at younger ages, but in others an important part is ascribed to a rise in the number of children per family. In most cases, however, opinions differ as to whether or not a real increase has occurred in the actual or desired size of the average family. Although birth rates in these countries are not likely to continue at their present high level for very long, no one knows how soon they will fall, or whether the decline will be to levels as low as those of the depression years in the 1930's, or to levels comparable to those of the "normal" years in the 1920's, or to intermediate levels. Even if age-specific fertility rates were to remain as high as they have been recently, a temporary fall in the crude birth rate would be expected in some countries because the large group of persons now in the reproductive ages will be succeeded by a smaller group, due to the reduced number of births during the depression.

With an appreciable decline in mortality and the maintenance of present high rates of fertility in the reproductive ages, the average rate of growth of 10 per thousand per year observed in group I during the period 1946-1948 may be maintained, but probably not exceeded, during the period 1950-1980. Growth at this rate is therefore taken as the "high" assumption. A slight decline in death rates, combined with a fall in birth rates to a level comparable to the pre-depression period, would result in a growth rate of about 7 per thousand per year; this is the "medium" assumption. If crude death rates cannot be reduced because of the increasing proportion of aged people, and if the downward trend in fertility evidenced from the 1920's to the 1930's asserts itself again, the average annual rate of population increase may be as low as 4 per thousand in the coming thirty years; this is the "low" assumption. These assumptions show the population of the group I countries increasing from 486 million in 1950 to between 548 and 655 million in 1980, with 599 million as a "medium" figure. Although these increases seem quite considerable, they result from rates of growth which are smaller than those for the other two groups. Moreover, only the "high" rate is as large as the actual rates for the periods 1946-1948 or 1920-1950; the "low" is less than half as large. The assumed rates for births, deaths, and natural increase are given in table V and shown graphically in figure 1. The resulting populations appear in table V and figure 2.

It is somewhat more difficult to formulate reasonable assumptions for the regions contained in group II. The spread of more intensive industrialization, commercialization and urbanization may be accompanied by a rapid diffusion of the social customs of the more advanced industrial countries, leading to a speedy adoption of the small-family pattern on a large scale. In this case, age-specific birth rates will fall rapidly—possibly even more rapidly than they did in some western countries half a century earlier. Tending to counter-balance the effect of such a change on the crude birth rate will be the greater survival of infants to parental ages, which will result from the expected declines in infant and child mortality.

Rapid decreases in mortality appear probable in group II because of the speed at which the accumulated knowledge of medicine and sanitation may be made available throughout its regions. The rapidity of the fall in crude death rates depends also to some extent on the future behaviour of birth rates; it would be accelerated for a time by a decline in birth rates, for this would reduce the percentage of young children in the population—and very young children have a high death rate. Rapid industrialization, on the other hand, may have in its early stages some adverse social effects, such as the growth of slums, which may temporarily retard the fall in mortality.

In view of these considerations, a rather wide range of possibilities is suggested. The average rate of growth for group II in the coming three decades may be considered "high" if it approaches the remarkable rate of 19 per thousand per year. It may be considered "low" if it is 10 per thousand per year, though that rate would be regarded as high if it should occur in group I. With gradually and consistently declining crude birth and death rates, the annual rate of growth for group II may average about 14 per thousand; this is the "medium" assumption. These suggested future rates compare more favourably with the actual rates of past years than is the case with group I. The "low" is only slightly lower than the average rate for the period 1920-1950, the "medium" is nearly as high as the 1946-1948 figure, while the "high" is 25 per cent above the latter. These rates are shown in table V and figure 1.

Under any of these assumptions, the population of group II would increase rapidly. According to the "high" assumption, it would rise from 533 million in 1950 to 938 million in 1980; that is, it would almost double within little more than one generation. According to the

FIGURE 1. "HIGH," "MEDIUM" AND "LOW" HYPOTHETICAL RATES FOR BIRTHS, DEATHS AND NATURAL INCREASE, FOR THREE GROUPS OF REGIONS, 1950 TO 1980, AND ESTIMATED RATES FOR 1946-48

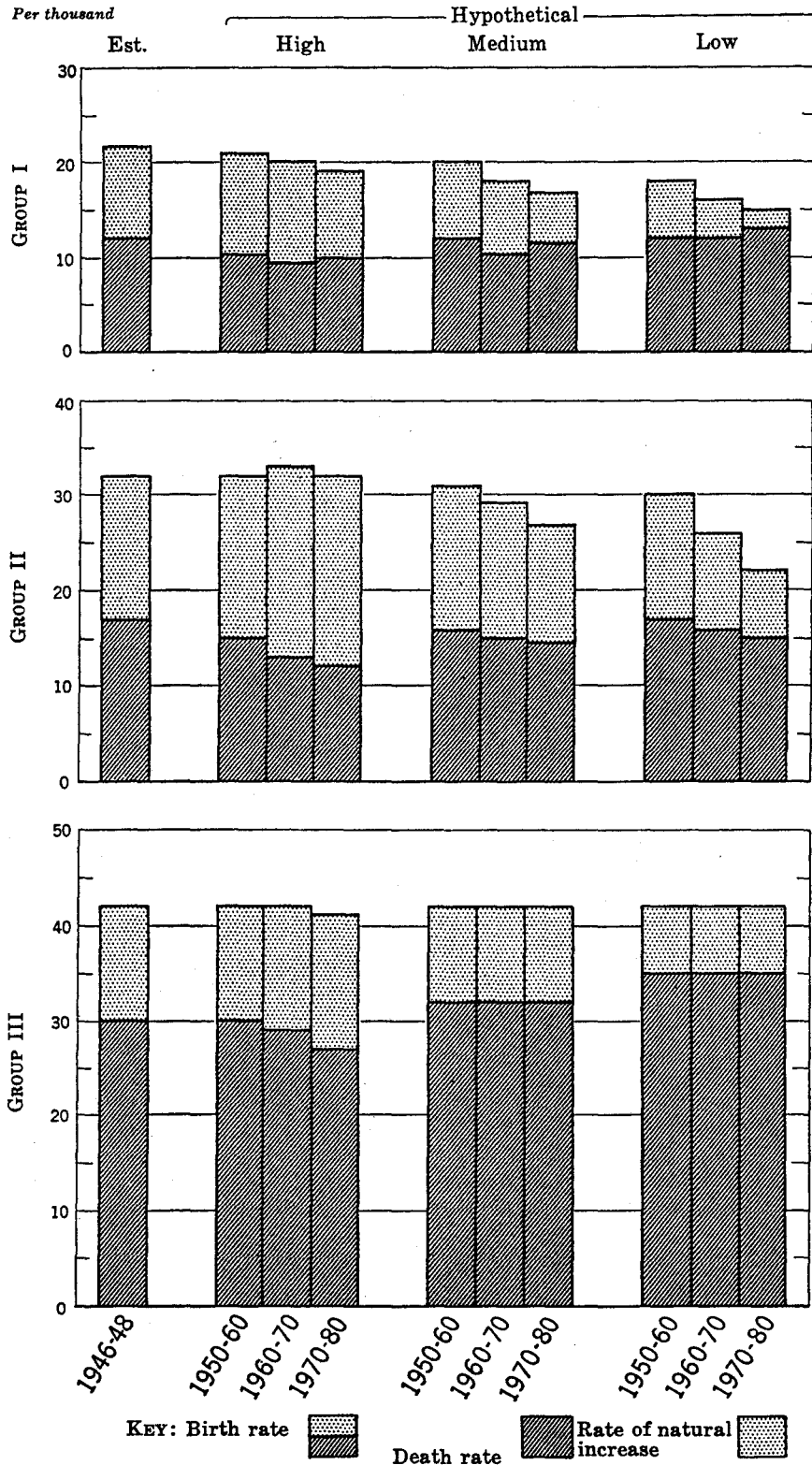
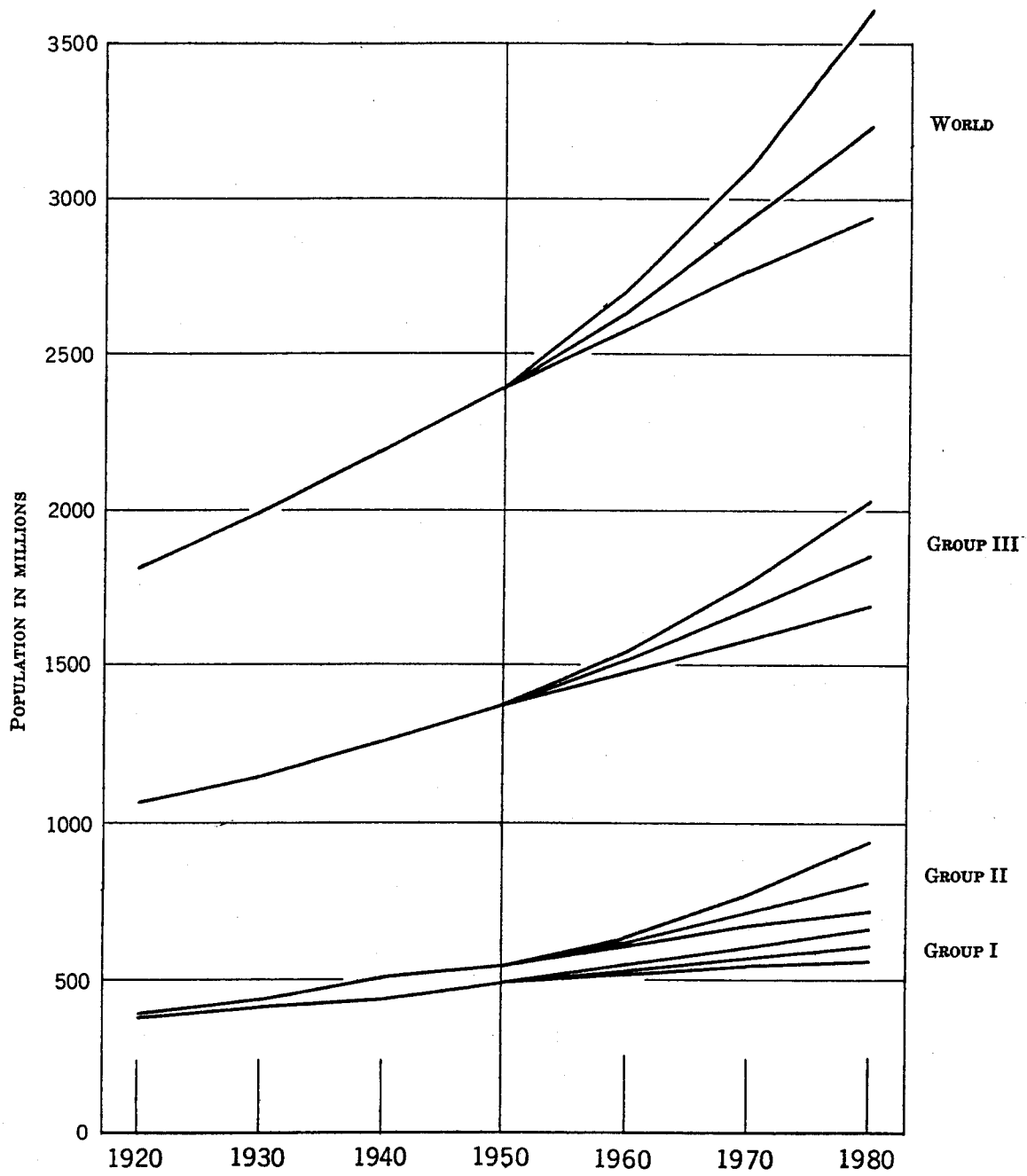


FIGURE 2. POPULATION OF THE WORLD AND OF THREE GROUPS OF REGIONS: ACTUAL, 1920 TO 1950, AND "HIGH", "MEDIUM" AND "LOW" HYPOTHETICAL, 1960 TO 1980



"medium" assumption, the 1980 population would be 809 million, or half as large again as the 1950 total. According to the "low" assumption, the population would increase by one-third, attaining 718 million (see table V and figure 2).

In view of the inadequacy of information about the present birth and death rates in the regions of group III, any hypotheses regarding their future population increase must be especially speculative. An optimistic assumption is that the downward trend of mortality which has been observed recently in several of the less populous countries of this group will spread throughout the group III regions. Such a change may result from the continued extension of modern health and sanitation services, coupled with general success in improving living conditions by rationalization of agricultural and manufacturing processes and development of better transportation and distribution facilities. Even on this assumption, however, it is considered unlikely that very great reductions in the death rates could be achieved quickly in some major countries of group III. Consequently a moderate reduction is the most that can be expected in the average death rate for group III as a whole over the next thirty years. Fertility in some of the group III countries might also decline under the conditions stated, but the decline would be unlikely to have much effect on the average birth rate of the group III regions within the next three decades. The average annual rate of population growth might be as much as 13 per thousand; this is the "high" assumption.

A more conservative assumption is that improvements in social and economic organization during the period 1950-1980 will occur on a sufficient scale in the group III regions to avert those major calamities which have hitherto been responsible for enormous losses of life from time to time in some of the important countries within the group but not to reduce substantially the "normal" mortality level in these countries. On this assumption, the achievement of India in stabilizing the death rate during recent decades would be duplicated in other countries which have hitherto been less fortunate. Elsewhere within the group III regions, progress in bringing down the death rates would continue. The result might be an average death rate for the entire area during the next thirty years somewhere near the level estimated for the period 1946-1948, a period which was favourable in that no major calamities occurred. This is the basis for the "medium" estimate

of 10 per thousand as the average annual rate of growth.

In view of past experience, one should not exclude a more pessimistic view. If adverse circumstances in some group III countries make it impossible to protect the people from the recurrence of death-dealing disasters, the average rate of increase may be as small as 7 per thousand per year; this is the "low" assumption.

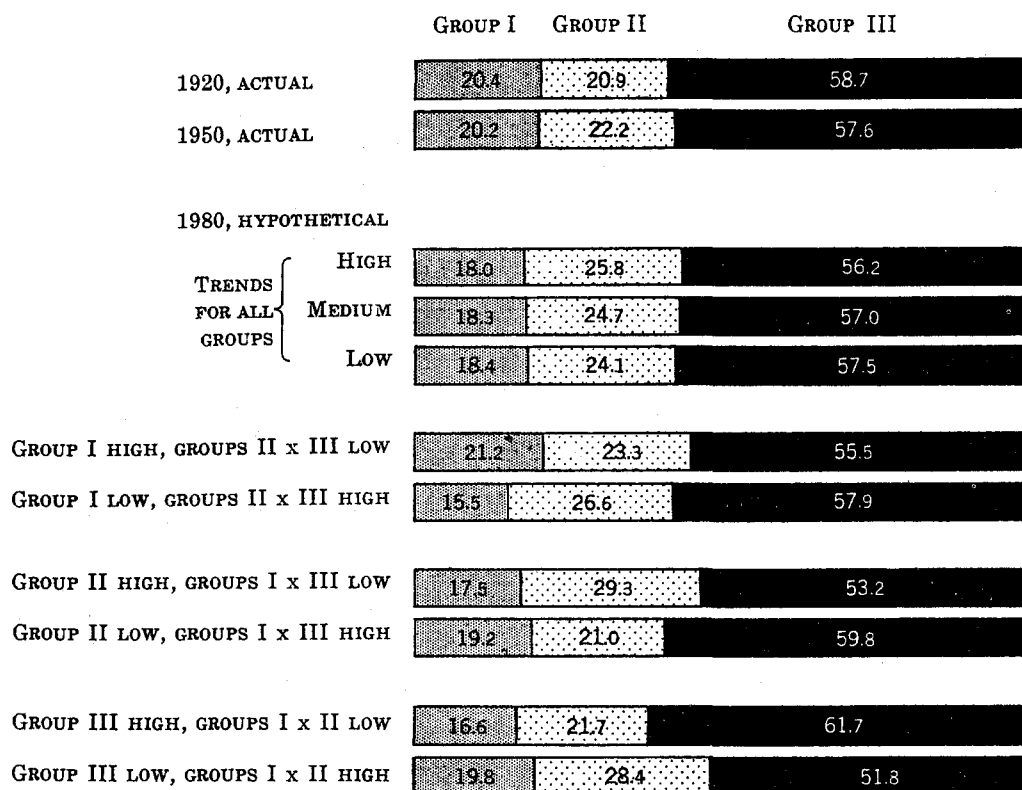
Each of the three assumptions gives a large increase in the absolute numbers of inhabitants of group III. The combined population of these regions, which was estimated at 1,387 million in 1950, would increase by 1980 to 2,043 million on the "high", 1,869 million on the "medium" and 1,710 million on the "low" assumption (see table V and figure 2).

The world population was estimated at 2,406 million in 1950. If all groups of regions should increase according to their respective "high" growth assumptions, the world would have 3,636 million people in 1980. This would represent an increase of over 1,200 million from 1950, or more people than there are now in Africa, the Americas, Europe, the Asiatic USSR and Oceania. It would mean a larger growth in thirty years than occurred in the thousands of years from the first appearance of *homo sapiens* to as recently as 1850. With this rapid growth, the group I regions would contain only 18.0 per cent of the 1980 total instead of the 20.2 per cent which they had in 1950. The share of the group II regions, on the other hand, would rise from 22.2 per cent in 1950 to 25.8 per cent in 1980, while that of the group III regions would diminish slightly, from 57.6 per cent to 56.2 per cent (see table V and figure 3).

Should the "medium" assumptions be followed by all groups of regions, the world population would attain a total of 3,277 million in 1980—an increase of more than 870 million over 1950. This increase would be roughly equal to the present population of China and India, or of Europe and North America; it would mean a slightly larger increase during the next thirty years than during the preceding fifty years. The group I regions would have 18.3 per cent (somewhat less than in 1950), the group II regions 24.7 per cent (somewhat more), and the group III regions 57.0 per cent (about the same) of the world total.

If the "low" rates should describe the growth of all groups of regions, the world population total would still rise to the impressive figure of 2,976 million in 1980. This would mean an increase over 1950 almost equal to the present population of Europe and the Soviet Union.

FIGURE 3. PERCENTAGE DISTRIBUTION OF THE WORLD'S POPULATION BY GROUPS OF REGIONS: ACTUAL, 1920 AND 1950, AND HYPOTHETICAL, 1980



The share of the group I regions would decline to 18.4 per cent, that of the group II regions would rise to 24.1 per cent, and that of the group III regions would be 57.5 per cent—practically the same as now.

Although it is quite possible that a "high" rate of growth in one set of regions will coincide with a "low" rate in other regions, there are some reasons for expecting a correlation in the rates of growth for the different groups. For example, it is probable that failure to maintain world peace will tend to lower rates of population growth in most regions. The recent war caused a large loss of life in many countries; because of developments in aviation and implements of war, it is likely that another major war would involve many more countries and lead to the death of much larger numbers of people. International co-operation, in contrast, is likely to promote prosperity and the well-being of people in all parts of the world. One result should be to accelerate progress in public health and medicine in the regions of group II and III, which for a time should lower death rates more rapidly than birth rates. The

maintenance of prosperity should also tend to support the rate of population growth in the group I regions, but in a different way—by checking or even reversing the decline in the average size of completed families. That the effect of changes in current fertility can be large is shown by many comparisons between the rate of natural increase during the depression years of the 1930's and the rate during the prosperous years of the 1940's.

Because the unexpected may happen, however, it is worth while to note the situation that would develop if the rate of growth of different groups of regions followed divergent assumptions. Twenty-seven combinations of assumptions are possible, but it is sufficient to consider those extreme—and rather unlikely—combinations with which each group would give either a maximum or a minimum proportion of the world population.

The combination of the "high" assumption for group I with the "low" assumptions for groups II and III would give a 1980 population of 655 million for group I, and 3,083 million for the world. This group would then have 21.2 per

cent of the total instead of 20.2 per cent, as in 1950. Under the "low" assumption for group I, combined with "high" assumptions for groups II and III, the world total would be 3,529 million and the proportion in group I would fall to 15.5 per cent—far below the 1950 percentage of 20.2. In similar fashion, the extreme proportions of the 1980 population contained in group II would be 29.3 and 21.0 per cent. The former is much larger, and the latter only slightly smaller, than the actual figure of 22.2 per cent for 1950. The proportion contained in the group III regions would vary between 61.7 and 51.8 per cent of the world's total in 1980; the 1950 figure was 57.6 per cent. These percentages are shown in figure 3. As explained above, however, none of these extreme combinations is likely to occur.

One may conclude that the population of the world is likely to increase during the next thirty years by at least 500 million, barring major wars or other unforeseen calamities. If conditions are favourable for population growth, the increase may be by as much as 1,200 million. The total number of people in 1980 would thus be between 2,976 and 3,636 million, and the number per square kilometre of the earth's land area between 22 and 27 instead of 18 as

at present. The larger figures would mean an increase of 50 per cent in approximately one generation, and the smaller an increase of slightly less than 25 per cent. These may be taken as reasonable upper and lower limits to the amount of expansion in the production of food and other necessities that would be required merely to maintain a constant *per capita* standard of consumption.

Prospective changes in the distribution of world population also have considerable economic significance. The countries of northern America, north-west-central and southern Europe and Oceania, are likely to contain a shrinking percentage of the world's population during the next thirty years, while those of Latin America, eastern Europe, the Asiatic USSR and Japan are likely to have an increasing share. The former countries are, in general, those which enjoy at present the highest standards of living and the most favourable ratios of developed resources to population. The demographic trends may therefore tend to worsen the balance in the distribution of peoples and economic opportunities, unless their effect is offset by migration or by more rapid economic development in the regions of greater population growth than in other regions.



# International migrations in the Far East during recent times

## The countries of emigration

### A. INTRODUCTION

The world's problem of population is centred in the Far East. One-half of the earth's inhabitants are concentrated in that populous region of Asia which extends from Japan and China on the north-east, to India and Pakistan on the south-west, and in the islands off the south-eastern Asiatic coast. The sheer numbers of people who inhabit this region and the magnitude of their economic problems give major importance to all aspects of population change in the Far East. Yet, so far as migration is concerned, much less attention has been paid to studying movements in this region than in the west.

Migratory movements of great social and economic importance, involving tens of millions of migrants, have occurred in the Far East during recent times. These movements have included large migrations from Far Eastern countries to other regions of the world, still larger movements from country to country within the region, and massive movements from area to area within some of the Far Eastern countries. In this report, attention is focused on the international movements.

An era of emigration from the Far East to America, Oceania, and Africa began early in the nineteenth century and drew to a close in the first decades of the twentieth century. It had its origin in the abolition of slavery in the British colonies between 1833 and 1838, which created a demand for new sources of cheap labour supply on the plantations and other colonial enterprises. To meet this demand, gangs of indentured labourers from India were imported into Mauritius and Australia, and later into the British West Indies and Guiana. The practice of importing oriental labourers under various forms of labour contracts spread during the nineteenth century to other colonial areas in the tropical and semi-tropical belts, and to South Africa and the North and South American republics. The Chinese joined the movement on an increasing scale after their ports were opened to foreign trade in 1842 and after old laws prohibiting their emigration were repealed between 1859 and 1860. The Japanese followed suit after the legalization of foreign trade and emigration from Japan in 1866.

Group migration of labourers from India, China, and Japan constituted the bulk of inter-

continental movement from the Far East throughout the remainder of the nineteenth century and during the first two decades of the twentieth.<sup>1</sup> The enactment of laws restricting or prohibiting this type of migration and the erection of legal barriers against orientals generally in many countries of immigration gradually brought the movement of contract labourers to an end, and after the 1920's virtually put a stop to all inter-continental migration from the Far East.

This inter-continental movement, though large in relation to the population of some of the receiving areas, was quite small in relation to the great populations of the Far Eastern countries of origin. It had almost no effect on the rates of population increase in the latter countries. Nevertheless, its blockage during recent decades has given increased importance to intra-regional migration as a possible means of improving the ratio of numbers to resources in the most crowded countries of the Orient.

Movements of population between countries in the Far East have a history that reaches far back into antiquity,<sup>2</sup> but a distinct, new phase of that history commenced about one hun-

<sup>1</sup>There were also small emigrations of Malays to South Africa and the West Indies during the nineteenth century; of Filipino seasonal workers to Hawaii after 1906-1907; of Filipino students, enlisted men in the United States Navy and others from the Philippines to the United States after the First World War; and of Indo-chinese to New Caledonia after 1920. For accounts of these minor migrations, see Mukerjee, *Le migrazioni asiatiche* (1936), pp. 23-25, 119-120; Goodrich, "Indenture" (1932); Lasker, *Filipino immigration to continental United States and to Hawaii* (1931), pp. 21-27, 31; Davie, *World immigration* (1947), p. 338. In addition, there was a sizable emigration of Japanese agricultural settlers, not contract labourers, to South America during the 1920's and 1930's. See the section on Japan below.

For full citations of books and articles mentioned in this article, see the List of Sources on page 29.

<sup>2</sup>There is a long record, for example, of Chinese and Indian movements to the neighbouring countries of Indo-China, Ceylon, Burma, and Thailand as a result of religious missions and cultural contacts, flights from famine, wars etc. From the fifteenth century onward, the Chinese carried on a flourishing trade by junk with the Malay area, Sumatra, Java, Borneo, the Sulu archipelago and the Philippines, and emigration to those areas took place intermittently. Even before that time, Indian migrants and traders in nutmeg, cloves and pepper were prominent in Sumatra, Java and the Malay peninsula. The movement from China was curtailed by laws making emigration from that country illegal after 1713, but in spite of drastic penalties a certain leakage continued. See Chen, *Chinese migrations, with special reference to labor conditions* (1923), p. 4; Mukerjee, *op. cit.*, p. 110; Ceylon yearbook (1949), pp. 182-183; Ferenczi, *International migrations*, Vol. I (1929), pp. 149-150.

dred years ago. Its origin was linked with the same factors that released the streams of emigration overseas: the abolition of slavery and increasing demands for cheap labour in the colonial areas of south-eastern Asia, the opening of the long-closed ports of China and Japan and the removal of ancient prohibitions to emigration from those countries. Burma, Ceylon, Malaya, Thailand, Indochina, the outlying islands of the East Indies and the Philippines emerged as centres of immigration, with China, Japan, and India as the chief suppliers of migrant labour. Later in the nineteenth century the industrialization and imperial expansion of Japan began to give a new stimulus to intra-continental migration, with the developing areas of Formosa, Korea and subsequently Manchuria serving as hosts to Japanese emigrants, and Japan itself ultimately receiving large contingents of migrants from Korea.

The intra-regional migrations since the middle of the nineteenth century have overshadowed the inter-continental movements both by their size and by their economic importance to the countries affected. The part which the immigrants have played in the economic development of Ceylon, Burma, Malaya, Borneo and Manchuria is of the first order of importance, and they have had a considerable effect on the demographic evolution of these territories. The economic influence of immigration to such areas as Thailand and Indochina, the Philippines and Manchuria, and of the Korean migration to Japan, has been far from negligible. So far as the countries of emigration are concerned, the intra-regional movements, like the emigration to other continents, have been insufficient to have much effect on the growth of their populations, but the social and economic repercussions in the homeland have been of considerable importance.

As the volume of inter-continental emigration from the Far East shrank during the first decades of the twentieth century, the numbers of migrants moving between countries in the region continued to increase. The peak was reached probably during the 1920's, but sizable movements occurred during the world-depression decade which followed. It was only during the 1930's and the early 1940's that migration from Korea to Japan, for example, reached its maximum rate. The Second World War, however, eventually brought nearly all international migration in the Far East to a standstill, and since the end of the war the movements have been almost entirely limited to the repatriation of earlier migrants.

The discontinuance of the flow of new migrants since the Second World War offers an occasion to review in somewhat definitive fashion the history of both the inter-continental and the intra-regional movements since the beginning of the modern phase, in the nineteenth century.

This history, of course, has many aspects, only a few of which can be treated here. The purpose of the present report is to summarize available information about the numbers and characteristics of the persons involved in the major migratory streams, the timing of the rise and decline of the various movements, and their demographic importance.

A major obstacle to this undertaking is the inadequacy of the relevant statistical records. Two major types of statistics are available for the study of Far Eastern migrations.

The first consists of data on persons of a given national origin living in a specified area outside the country of origin. Such data may be obtained either in the census of the country of residence, or from consular or other reports compiled by the government of the country of origin. In neither case do the data provide an exact measure of the migration during any given time period, for ordinarily they do not show when the migrants moved<sup>3</sup> or how many migrants died or left the area of immigration between the time of movement and the date of the consular report or census enumeration. These statistics on ethnic groups abroad portray the consequences of past, not current, movements. They are available only for certain countries at certain time periods.

The second type of migration statistics consists of records on certain types of international travellers (such as assisted emigrants, recruited immigrant workers, persons declaring intent to go abroad and, in some cases, all passengers) collected at the time of their movement. These statistics are often grossly incomplete, as in the case of China, or fail to cover important classes of migrants. In the case of Japan, the statistics exclude intra-empire migrants. Indian statistics do not cover movements by land routes and cover only certain categories of movement by water routes. The migrant-receiving countries have generally paid more attention to the collection of statistics than the emigration countries, but their statistics are also quite deficient.<sup>4</sup>

<sup>3</sup>There are a few notable exceptions; the reports of censuses of the former Japanese colonial areas included tabulations of persons born elsewhere by date of last movement into the colony.

<sup>4</sup>Difficulties with migration statistics are not peculiar to the Far Eastern countries. See United Nations, *Problems of migration statistics*, (1949).

In general, the data on earlier migrations are more defective than those on more recent movements. As for the Far Eastern migrations which occurred during the nineteenth century, it seems impossible in many instances to reconstruct measures of their magnitude from the data now available. The statistical analysis is therefore limited chiefly to recent decades and particularly to the inter-war years.

The major countries of emigration in the Far East have been China, India, Pakistan, Japan and Korea. The people who have migrated from Indonesia, Malaya, Indochina, the Philippines or other countries of the Far East are relatively few. In the following passages the assessment of emigration is limited to the five major emigration countries. Assessment even for those countries is quite difficult because of the deficiencies in the basic statistics.

## B. CHINA

### 1. *Inter-continental emigration*

The recruitment of indentured Chinese labourers for work overseas began in the late 1840's, in spite of the prohibitions of emigration from China which had been promulgated repeatedly since 1718.<sup>5</sup> The first streams of emigrants were directed to Latin America. A group of indentured labourers was sent to Cuba in 1847 and subsequent shipments were dispatched to Cuba and Peru.<sup>6</sup> Between 1847 and 1860, about 56,000 emigrants left China for Cuba, but the mortality on the voyage was such that only 48,000 arrived. Chinese migrants from Macao to Cuba between 1860 and 1873 numbered about 48,000, and from Macao to Peru between 1857 and 1873, about 67,000. Deaths and repatriations subsequently reduced these Chinese colonies to about 90,000 in Cuba and 45,000 in Peru during the early 1920's.

The next streams of Chinese emigrants overseas consisted of contract labourers who went to Hawaii from 1852 onwards, and of free labourers who went to the continental United States beginning in 1849 and to Canada beginning in the early 1860's. The emigrants to Hawaii were sugar plantation workers, while those to North America were gold hunters. While many Chinese labourers worked in the mines in areas along the western coast of North America, many others were railway construction workers, farm hands, servants, laundrymen etc.

<sup>5</sup>Chen, *Chinese migrations, with special reference to labor conditions* (1923), pp. 4-5; MacNair, *The Chinese abroad* (1933), p. 209.

<sup>6</sup>Ferenzi, *International migrations* (1929), Vol. I, pp. 155, 157, 928; MacNair, *op. cit.*, p. 210.

The number of Chinese immigrants in Hawaii<sup>7</sup> grew from 300 in 1852 to about 20,000 in 1886. Opposition to the immigration of Chinese labourers was evident by 1875 and culminated in the restriction and exclusion acts of 1885 to 1895. By the Act of 29 April, 1902, the American exclusion laws became applicable to the outlying territories under the jurisdiction of the United States. In consequence, the Chinese population of Hawaii grew only slowly from 1886 onwards. The census of 1900 showed about 26,000 Chinese in Hawaii; the 1940 census about 29,000, of whom all but 5,000 were born in Hawaii.

The stream of Chinese immigrants into California<sup>8</sup> began in 1849, when 900 arrived, and grew rapidly during the next three decades. Some 15,000 arrived in the first half of 1852 alone. From 1855 to 1867, the average annual number of Chinese arrivals in the continental United States was almost 5,000; from 1869 to 1883, the average was over 14,000 per year, with a peak of 40,000 in 1882. After 1884, there was an abrupt decline of Chinese arrivals due to the restrictive laws of 1882 and 1884. In 1894, a convention was adopted barring further immigration of Chinese labourers into the United States. The Chinese population of the United States reached a maximum of about 107,000 in 1890 and declined sharply thereafter because it consisted preponderantly of males. Less than 62,000 remained by 1920, but natural increase brought the total above 77,000 by 1940.

The incentive to Chinese immigration into Canada<sup>9</sup> was supplied by the discoveries of gold in that country, between 1858 and 1864. The placer beds of the shallow gold fields were shortly exhausted, leaving many Chinese workers to be employed on the farms, in the coal mines, in public works and in the salmon-canning industry. By 1881, there were some 4,000 Chinese in the Province of British Columbia, according to the census of that year. During the four fiscal years 1881 to 1884, nearly 16,000 Chinese arrived in that province either from the United States or direct from China. The influx continued at a slower rate until the period of the First World War. From 1886 to 1924, a total of about 90,000 Chinese entered Canada, but the great majority remained there only temporarily, as witnessed by the fact that in 1922 Canada had fewer than 12,000 Chinese resi-

<sup>7</sup>See MacNair, *op. cit.*, pp. 84-86, 220; Burrows, *Hawaiian Americans* (1947), p. 5.

<sup>8</sup>Ferenzi, *op. cit.*, Vol. I, pp. 156, 381-389; MacNair, *op. cit.*, p. 175.

<sup>9</sup>Campbell, *Chinese coolie emigration to countries within the British Empire* (1923), pp. 36-56; Ferenzi, *op. cit.*, Vol. I, p. 155.

dents. The Chinese Immigration Act of 1923, allowing only Chinese merchants and students to enter Canada thenceforth, brought the movement practically to a close.

Chinese migration to Mexico<sup>10</sup> first became important in 1909. About 28,000 Chinese arrivals were recorded between 1909 and 1924. Most of these were transients who used Mexico as a stepping-stone on their way to other countries. In 1922, only 3,000 Chinese remained in Mexico.

Chinese emigration to Australia<sup>11</sup> began as early as the 1850's, but never grew very large. During the 1850's, a steady traffic brought in a small number of contract labourers from China each year for gold mining and other development projects. The number of arrivals reached over 6,000 in 1860, and continued on a modest level through the 1870's. The immigration was chiefly temporary. In 1881 Australia had a Chinese population of less than 29,000, practically all males. In the meantime, immigration legislation became more restrictive. By 1887, laws restricting the immigration of Chinese were in force in all the colonies of Australia. The Commonwealth Immigration Act of 1901 practically ended the immigration of all non-white peoples. The maximum number of Chinese immigrants resident in Australia was recorded in 1891, when there was a Chinese population of about 36,000. The immigration of Chinese to New Zealand was numerically insignificant.<sup>12</sup>

Two other inter-continental movements from China are worth mentioning because of the large numbers of migrants involved, though they were of only very brief duration. One was the shipment of more than 178,000 recruited Chinese contract labourers to the Transvaal, South Africa, between 1904 and 1910, chiefly to work in the gold mines. These labourers were repatriated practically without exception at the completion of the contract.<sup>13</sup> The other was the recruitment of Chinese labourers for war-work in France during the First World War. Nearly 37,000 of them were in the employ of French authorities and about 100,000 served the British armies in France. Practically all the Chinese in France were repatriated at the end of hostilities.<sup>14</sup>

<sup>10</sup>Ferenczi, *op. cit.*, Vol. I, p. 155; MacNair, *op. cit.*, p. 93.

<sup>11</sup>Ferenczi, *op. cit.*, Vol. I, pp. 157-158, 928, 944.

<sup>12</sup>Mukerjee, *Le migrazioni asiatiche* (1936), p. 44; MacNair, *op. cit.*, p. 73.

<sup>13</sup>Chen, *Chinese migrations, with special reference to labor conditions* (1923), p. 131.

<sup>14</sup>*Ibid.*, p. 118.

## 2. Emigration to other countries in the Far East

The principal destinations of Chinese emigrants within the Far Eastern regions, since the middle of the nineteenth century, have been Malaya, Indonesia, Thailand, Indochina and the Philippines. The emigrants to these areas, during the nineteenth century and the first quarter of the twentieth, like the emigrants to other continents, were primarily gangs of contract labourers or peasants, and large numbers of them returned to China after more or less short periods.<sup>15</sup>

In addition to these main streams of intra-regional emigration, some Chinese farmers and a small number of merchants and railroad workers went to Russian Far East during the latter part of the nineteenth century. When the Russian census of 1897 was taken, 50,000 Chinese nationals were enumerated in that area. Most of them became successful farmers. Further Chinese emigration to that area occurred in subsequent years. The Russian census of 1926 showed 92,000 Chinese in the USSR, most of them in the Far Eastern territory. No sizable Chinese immigration to the Soviet Far East seems to have occurred since the 1930's.<sup>16</sup>

The deficiencies in Chinese statistics make it virtually impossible to present a coherent account of the numbers involved in these movements during the period prior to the First World War. Data on the numbers of Chinese living in various countries of the Far East at various dates just before the First World War, however, give some indication of the movements which had occurred prior to that time. There were about 917,000 Chinese in Malaya in 1911, 563,000 in Indonesia in 1905, and some 230,000 in Indochina in 1910.<sup>17</sup> For the Philippines and Thailand, various conflicting estimates of the numbers of Chinese in years prior to the First World War are available. For example, a figure of 40,000 Chinese in the Philippines in 1903 has been mentioned by different authorities, sometimes as the number of Chinese who were

<sup>15</sup>Purcell, *The Chinese in south-east Asia* (1951), pp. 60, 105-106, 209, 305-324, 458-496, 570-571; Ferenczi, *op. cit.* (1929), Vol. I, pp. 140-150.

<sup>16</sup>Mandel, *The Soviet Far East and Central Asia* (1944), p. 26; Lorimer, *The population of the Soviet Union: history and prospects* (1946), p. 64; Kulischer, *Kriegs- und Wanderzüge* (1932), p. 190; Kulischer, *Europe on the move* (1948), pp. 86, 112; Obolensky-Ossinsky, "Emigration from and immigration into Russia", *International Migrations*, Vol. II (1931), pp. 565-580.

<sup>17</sup>British Malaya, *Malayan statistics, 1928*, p. 5; Indonesia, Central Bureau of Statistics, *Statistical pocket book of Indonesia* (1941), p. 5; MacNair, *The Chinese abroad* (1933), p. 49.

employed in "industry" only and sometimes as the total number of Chinese in that country.<sup>18</sup> For Thailand even the lowest estimate of the number of Chinese—700,000 between 1904 and 1909<sup>19</sup>—was far above the census figures for more recent years.

The migrations from China since the First World War are depicted fairly well in the statistics of the countries to which the Chinese went. These data indicate that the flow and ebb of Chinese migrants during the inter-war years generally followed business booms and depressions in the receiving countries. In the 1930's, most of the receiving countries adopted restrictive measures for immigrants. From 1938 to the end of the Second World War, Chinese ports were in Japanese hands. The war years also brought political instability, serious economic disruption and a lack of transportation facilities to the receiving countries. All these conditions at home or abroad reduced the Chinese overseas migratory movements to a negligible number. Post-war movements from China have not been the spontaneous movements of numerous migrants seeking a better economic life abroad. Rather, they have consisted largely of former residents of the receiving countries revisiting their homes or travelling on business. In recent years, practically all the receiving countries of the Far East have imposed restrictive measures on Chinese immigration.<sup>20</sup>

The chief area of destination of emigrants from China in the Far East has been Malaya. Malayan census data and migration statistics indicate that there was an average annual net migration from China to Malaya in the neighbourhood of 50,000 between 1921 and 1931, and of half as many between 1931 and 1941. After

<sup>18</sup>For figures and discussions, see Chen, *op. cit.*, p. 106 ff. and Purcell, *op. cit.*, pp. 571-573.

<sup>19</sup>See Thompson, *Siam: An account of the country and the people* (1910), p. 29, cited in MacNair, *op. cit.*, p. 47.

<sup>20</sup>In post-war Indochina, the entry of Chinese was deferred until the end of 1946, when a new regulation permitted the entry of those Chinese who were either former residents of Indochina but had returned to China in or after 1939, or former residents of Indochina who had returned to China in 1937 for the purpose of war-work and bore certificates to that effect. Immigration to the Soviet Far East is subject to the issuance of a visa. In Thailand, a quota system was established in 1947 for all countries, that for China being 10,000 persons per year. Subsequently this quota was reduced to 400 per year. In post-war Burma, the entry of Chinese has been prohibited with the exception of a quota of 2,000 Chinese repatriates per year. In the Philippines, the entry of Chinese (except teachers, students, business men and travellers) was prohibited before 1941. Since 1941, there has been a quota of 500 Chinese per year. Chinese going to Japan do not require passports, but they do not migrate in any large numbers to that country because of other laws which make it unprofitable for them to do so.

the Second World War there was a small net movement in the opposite direction. Between 1946 and 1949, the number of Chinese moving from Malaya to Hong Kong and China was larger by an annual average of 13,000 than the movement from China to Malaya.<sup>21</sup> The large employment opportunities and attractive wages accompanying the expansion of plantation agriculture and tin mining in Malaya, combined with the free immigration of all races, which lasted through 1929, were strong inducements to the Chinese migrants. These inducements were accentuated by the precarious condition of agriculture and the lack of other economic opportunities in China.<sup>22</sup>

The average migration figures for the decade 1931-1941 mask offsetting currents in different years of the decade. From 1931 to 1933, the number of Chinese returning from Malaya exceeded the number of Chinese migrants moving into Malaya. The surplus of returning migrants was 113,000 in 1931, 98,000 in 1932 and 31,000 in 1933. This return flow was due to widespread unemployment as a result of the world trade depression, which started in 1929 and was felt to such an extent in Malaya from 1930 to 1932 that the Malayan Government repatriated large numbers of Chinese. In the meantime, an Immigration Restriction Ordinance became effective in Malaya in August 1930. Under that ordinance, monthly quotas of immigrant workers, ranging from 500 to 6,000, depending on the economic needs of the country, were set for quarterly or longer periods from 1931 to 1941. On 1 April 1933, the Immigration Restriction Ordinance was replaced by the Aliens Ordinance, under which newly-arrived immigrants were given landing permits. No restriction was placed on the immigration of women and children until 1938.

The gradual improvement in trade in Malaya after late 1933 and the increase in the production of rubber and wage rates in 1937 led to increased quotas for Chinese that ranged from 3,000 or 4,000 to 6,000 per month from July 1934 to the end of 1937. These larger quotas were reflected in migration figures. The net emigration of Chinese to Malaya was 62,000 in 1934, 91,000 in 1935, 76,000 in 1936 and 181,000 in 1937.

<sup>21</sup>Purcell, *op. cit.* (1951), p. 206; Malayan Union, *Annual report on the Malayan Union for 1946; 1947*; Federation of Malaya, *A report on the 1947 census of population, and Annual report on the Federation of Malaya, 1948; 1949.*

<sup>22</sup>Purcell, *op. cit.*, chapters III and IV; Skinner, *The Chinese in south-east Asia.*

Under the Aliens Ordinance of 1933, whereby women were admitted free of quota restrictions until 1938, the net emigration of women to Malaya during the five years 1934-1938 was over 190,000 (deck passengers), or an average of about 40,000 per year. They were mostly Cantonese peasant women, ranging in age from 18 to 40 years. An annual net inflow of this size is comparable to that between 1921 and 1931—the heyday of Chinese emigration to Malaya—when about 50,000 net emigrants per year were recorded.

From 1938 onwards, the Malayan Government followed a policy of progressive reduction of the monthly immigration quota for Chinese. At that time Chinese ports were one after another falling into Japanese hands. Largely because of those developments, the net number of Chinese immigrants to Malaya fell from 53,000 in 1938 to 14,000 in 1939, 3,000 in 1940 and 7,000 in 1941.<sup>23</sup>

The war years (1942 to 1945) in Malaya were marked by political instability, serious economic disruption, food shortage and a lack of transportation facilities. These reduced the overseas movements to a negligible size. Since the end of the Second World War the Malayan policy of progressive restriction of immigration on a selective basis, in which both economic and political considerations play an important part, has been reinstated. The present migration currents between China and Malaya consist largely of former residents in Malaya who are revisiting their homes or travelling on business. This is shown by the fact that although the number of Chinese arrivals in Malaya was 38,000 in 1948 and 96,000 in 1949, the total number of entry permits issued by Malayan authorities to new immigrants of all races was only 7,128 in 1948 and 1,427 in 1949.

Chinese emigration to other Far Eastern countries has been smaller than that to Malaya. The movement of Chinese to Indonesia was reduced from a level of tens of thousands per year prior to the great depression to several thousand per year after 1934, when a quota system was established in that country.

In Thailand, between the censuses of 1919 and 1929, the Chinese immigrant population increased by 185,000, or about 17,000 per year. The increase between 1929 and 1937 amounted to 79,000, or about 10,000 per year. These figures understate, perhaps very greatly, the volume of Chinese emigration to Thailand during the interval, since the resident Chinese popula-

<sup>23</sup>The figure for 1941 covered only the first ten months.

tion was constantly depleted by deaths. From 1937 to 1941, there was a recorded net immigration of 35,000 Chinese at the port of Bangkok, and some Chinese were among a net influx of 66,000 people across the southern border from Malaya. For the period of the Second World War (1941-1945), the data on Chinese immigration are limited to movements through the port of Bangkok, but they indicate that the immigration of Chinese was numerically unimportant. Revival of large-scale Chinese immigration in the post-war years has not occurred because of a severe quota restriction.

In Indochina the net number of Chinese immigrants averaged 25,000 a year between 1926 and 1929, but during the economic depression, between 1930 and 1934, there was an average net departure of over 1,000 Chinese a year. Subsequently, the gradual revival of trade and business conditions, combined with the outbreak of the Sino-Japanese war, produced a net immigration of Chinese which averaged 16,000 annually in the period 1935-1936 and 43,000 between 1937 and 1939. The net departure of nearly 10,000 Chinese a year in the period 1940-1941 reflected the call by the Chinese Government to the Chinese abroad to return for war-work and the moving of the Japanese front to the territory of Indochina.<sup>24</sup> From 1942 to 1945, little migration to or from Indochina was recorded. In the post-war period 1946 to 1948, there was, however, an average net immigration of nearly 20,000 Chinese annually.<sup>25</sup>

Chinese emigration during the recent decades to other countries, such as the Philippines, Burma, British North Borneo and Sarawak, has been much smaller, although the Chinese ethnic groups surviving from earlier migrations to some of these countries constitute considerable proportions of their populations. For instance, the number of Chinese in North Borneo was officially estimated at 70,000 in 1947, representing about 20 per cent of the total population. The number of Chinese in Sarawak was estimated at over 140,000 in 1947, or 26 per cent of the total population.

### 3. Demographic importance of Chinese emigration

The scraps of statistical evidence which have been reviewed here are sufficient to show that the number of Chinese who have emigrated

<sup>24</sup>International Labour Office, *Yearbook of labour statistics, 1945-1946*, p. 238; *1947-1948*, p. 282.

<sup>25</sup>Indochina, Service de la statistique générale, *Annuaire statistique de l'Indochine, 1943-1946*, p. 32; *1947-1948*, pp. 29-30.

since the 1840's runs to many millions. Well over one million must have gone to destinations outside Asia, and many times that number migrated to other countries in the Far East. The net demographic effect of the emigration, however, was much smaller than the number of emigrants might imply, for very many of the migrants were labourers engaged on contracts for specified periods of time, who returned to China after they had served their terms. The sex ratio even among those who remained in the countries of immigration was so extremely unbalanced that they had little opportunity to reproduce. These factors limited the demographic influence of the inter-continental emigrations. Perhaps only 300,000 or 400,000 Chinese are now living in the areas of immigration outside Asia. The number of Chinese in Asiatic countries other than China around 1940 has been estimated at approximately 8.1 millions.<sup>26</sup> This represented less than 2 per cent of China's estimated 460 million population within the country. So far as any effect of emigration on the growth of population in China is concerned, it can be dismissed as negligible.

The economic importance to China of this emigration may well have been disproportionate to its volume. The remittances which the emigrant workers made to their dependents in the homeland while they were abroad were undoubtedly an important item in China's international finances. Nor should the cultural importance of the movement be underemphasized.<sup>27</sup>

## C. INDIA AND PAKISTAN

### 1. *Inter-continental emigration*

The main currents of inter-continental emigration from the present area of India and Pakistan<sup>28</sup> during the nineteenth century were directed to the island of Mauritius in the Indian Ocean, to South Africa, to Fiji, and to Trinidad and British Guiana in America. Smaller numbers of Indians were sent also to Australia,<sup>29</sup> to Jamaica in the West Indies and to the French

colonies of Martinique, Guadeloupe, and Reunion Island.<sup>30</sup> The Indian migrants to all these areas, like the Chinese inter-continental emigrants, were chiefly contract labourers.

Of the major streams of emigrants, the earliest was the one to Mauritius, which began during the 1830's and continued on a large scale through the remainder of the nineteenth and the early twentieth centuries. Indian migration to the British West Indies and Guiana became important in the 1840's, and to South Africa in the 1860's. The first shipment of Indian labourers to Fiji arrived in 1879.

During the whole period when the system of indenture and its variants operated (roughly from 1830 to 1920), some 450,000 Indians went to Mauritius, over 200,000 to British Guiana and about 150,000 to Trinidad. The recorded number of Indian arrivals in Fiji from 1881 to 1923 was nearly 63,000. The movement to South Africa also was large, as indicated by the fact that Natal had a population of about 130,000 Indians in 1910.<sup>31</sup>

The total volume of inter-continental emigration from India throughout the period 1842-1916 fluctuated between 50,000 and 170,000 per five-year period, with the peak between 1857 and 1861. In 1858, 46,000 Indians emigrated to other continents.<sup>32</sup> The volume declined rapidly after 1916 and has been negligible since the early 1920's as a result of the controls set up both by the Indian Government and the governments of the receiving countries.<sup>33</sup> As time went on, the Indian Government became increasingly aware of the exploitation of the Indian indentured labourers abroad. A national policy aiming at the abolition of the system of indenture was followed during the years 1908-1922. During that period, British Guiana, Trinidad, Natal, Mauritius and all other receiving countries abolished the system.<sup>34</sup> In 1922, to protect Indian emigrants, the Indian Government passed an Emigration Act which prohibited the recruitment by foreign agents of unskilled labourers

<sup>26</sup>China, Directorate of Statistics. *Statistical yearbook of China 1943*, pp. 427-429.

<sup>27</sup>A somewhat fuller discussion of these problems is offered in the Population chapters of United Nations *Economic Survey of Asia and the Far East 1948 and 1950*.

<sup>28</sup>For convenience, the area now occupied by Pakistan and the Indian Union is called "India" and its emigrants "Indians" in the following passages where movements prior to the partition are discussed.

<sup>29</sup>The only direct movement of Indian contract labourers to Australia took place in the period 1837-1838. In 1839, there were 1,283 Indian indentured labourers there. After 1839, few Indians entered Australia. See Australia, Commonwealth Bureau of Census and Statistics. *Official yearbook of the Commonwealth of Australia, 1925*, p. 951.

<sup>30</sup>Mukerjee, *op. cit.* (1936), pp. 23-25, 43. In a measure both Fiji and Mauritius have served as way-stations for Indian migration to other countries.

<sup>31</sup>Mukerjee, *op. cit.* pp. 41-44, 104-106, 118-119; Goodrich, "Indenture" (1932); Union of South Africa, *Official yearbook 1938*, p. 1039.

<sup>32</sup>Ferenczi, *op. cit.* (1929), Vol. 1., pp. 904-905.

<sup>33</sup>From 1920 to 1934, Indian inter-continental emigration dropped to less than 1,000 persons per year on the average. Most of these were presumably either former Indian residents abroad re-emigrating from India after a visit there, or persons emigrating to join their family members abroad. Ferenczi, *op. cit.*, p. 905; International Labour Office, *Yearbook of labour statistics, 1938*, pp. 229-230; 1947-48, p. 282.

<sup>34</sup>Mukerjee, *op. cit.*, p. 43.



from India except to countries and under conditions specified by the Governor-General and only after approval by both Chambers of the Legislature. That Act halted the inter-continental movements of unskilled labourers from India.<sup>35</sup>

## 2. Emigration to other countries in the Far East

Even before the First World War, when the inter-continental emigration from India was in full swing, it was surpassed in importance by the migration of Indians to other countries in the Far East. The principal destinations of these continental emigrants were Burma, Ceylon and Malaya. That Indian emigration to those countries had achieved a considerable magnitude by the outbreak of the First World War is indicated by the fact that in 1911 there were 494,000 Indian immigrants living in Burma, 474,000 in Ceylon and 267,000 persons of Indian stock (migrants and their descendants) in Malaya.<sup>36</sup>

Continental emigration continued to increase during the 1920's, after Indian emigration to countries outside Asia had practically ceased. Its magnitude during the period 1921 to 1937 is represented by Davis' estimates, shown in Table I, of the total emigration from India, since the inter-continental movement after 1921 was very small.

TABLE I. MIGRATION TO AND FROM INDIA, 1921-1937<sup>a</sup>  
(in thousands)

Period	Emigrants	Returned migrants	Net emigration (-) or net return migration (+)
1921-1925	2,762	2,216	-547
1926-1930	3,298	2,857	-441
1931-1935	1,940	2,093	+162
1936-1937	815	755	- 59

<sup>a</sup>Figures are estimates presented by Davis in *The population of India and Pakistan* (1951), p. 99.

The net balance of emigration from 1921 to 1937 was somewhat less than one million, for although nearly 9 million emigrants left India, most of them returned. The period of maximum emigration was during the 1920's, especially from 1923 to 1929, when the general prosperity of the export trades in Burma, Malaya and Ceylon vouchsafed a steady, high demand for labour. Improvements in the working and living conditions of the emigrant workers and their families in the receiving countries, as required

<sup>35</sup>India, *Census of India*, 1931, Vol. I, Part 1, pp. 67-70; Shirras, "Indian migration" (1931).

<sup>36</sup>India, *Census of India*, 1911, Vol. I, Part I, p. 98; Vol. IX, Part I, p. 81; British Malaya, *Malayan statistics* (1928), p. 5.

by India's Emigration Act of 1922, also attracted new Indian migrants. Some 80 per cent of those who emigrated between 1921 and 1931 returned to India, most of them after only a short stay abroad, for the out-migration was chiefly for seasonal work. Because the receiving countries were near to India, the demand for Indian labour could be met on a seasonal basis.

During the 1930's, as the world-wide economic recession limited the markets for the raw materials produced in the immigration countries of the Far East, Indian emigration to other parts of the Far East declined. The estimated annual average number of continental emigrants between 1931 and 1937 was slightly over half the average for the preceding decade. During the period 1931-1935, the number of earlier emigrants returning to India slightly exceeded the number of departures; thereafter the return migration dropped to a near balance with the outward flow.

For the years after 1937, no figures comparable with Davis' estimates are available. The Indian emigration statistics do not give a reliable indication of the trend, as evidenced by the fact that the recorded number of Indian nationals emigrating between 1931 and 1937 was hardly more than one-tenth of the total estimated by Davis for that period. The data collected in the countries of immigration suggest, however, that the outward movement continued on a moderate scale during the late 1930's and early 1940's, being offset by a return migration of similar magnitude. During the post-war period, movements from India to the immigration countries in the Far East have been small, with the exception of those to Ceylon. The size of the return flow to India has generally been comparable to that of the outward movement, thus leaving little net emigration from India. As in the case of the post-war movements from China, most of the Indian migrants are former emigrants returning to their homeland or going abroad for a short period. In recent years, all the principal countries receiving Indian immigration have adopted measures restricting its volume.<sup>37</sup>

<sup>37</sup>In July 1941, Indian emigration to Burma was restricted by an agreement between the Governments of India and Burma designed to prevent the Indian immigrants, who could not identify themselves with the interests of Burma, from entering into undue competition with the Burmese. A similar agreement has also been reached in recent years with the Government of Ceylon. In the case of Malaya, the post-war practice is that Indian migrants are required to apply for entry permits, which are granted only if the applicants can produce a guarantee satisfactory to the Controller of Immigration in Malaya that work is available for them in the receiving country.



The migration statistics of Burma indicate that Indian migrants to that country averaged almost 400,000 per year during the 1920's and over 300,000 per year during the 1930's; whereas the average annual number of Indians returning from Burma was over 300,000 in both periods. During the Second World War period, a considerable number of Indians fled from Burma to India. In the post-war years, the movements between India and Burma have been mainly those of war-time displaced persons being repatriated. There have been few new emigrants from India to Burma since the war.

The number of Indians moving to Ceylon from 1932 to 1940 amounted to between 100,000 and 200,000 annually, a number which was generally comparable to that of returning Indian migrants from Ceylon. During the war years of 1941 to 1945, Indian emigration to Ceylon fluctuated between wide margins, ranging from 70,000 to 330,000 per year, while the return flow remained in line with the pre-war volume.<sup>38</sup> In the post-war years, the numbers of Indians moving to Ceylon have been recorded at 296,000 in 1946, 221,000 in 1947 and 206,000 in 1948. The recorded numbers of returning Indians from Ceylon for those three years were 219,000, 203,000 and 187,000 respectively.

Indian migrants to Malaya averaged about 90,000 a year during the 1920's and 60,000 during the 1930's, while the annual averages of migrants returning from Malaya were 60,000 and 70,000 respectively. The figures for the 1930's indicate that the number of returning migrants from Malaya was generally larger than that of the migrants who went there. During the war years, the hostile treatment of Indians in Malaya under Japanese occupation dislodged many Indian settlers. Hence in the following years, from 1946 to 1949, more Indians returned to India from Malaya than arrived. The Malayan statistics show that during those four years 138,000 Indians returned to India and a smaller number of Indians entered Malaya. Indian emigration during recent decades to other countries, such as Thailand, Indochina and Indonesia, has been very small.

The partition of the former territory of India between Pakistan and the Indian Union, which was effected in August 1947, gave rise to a large exchange of minorities between the two new countries. This exchange ranks among the largest international population movements of recent times although it was not a migration

<sup>38</sup>Ceylon, Department of Census and Statistics, *Statistical abstract of Ceylon, 1949*, pp. 4, 50.

in the normal sense. The movement started before partition, for people were moving in anticipation of it. In 1949 and 1950, the greatest part of the movement was from East Bengal (Pakistan area) to the Indian territories. The cause of this exchange of population was both religious and political. Before the decision in favor of partition, religion had not been a cause of large migrations in India. That decision touched off religious agitations which prepared the ground for social unrest and violence. Statistical information on the volume of the population movement is incomplete. Up to November 1949, official Indian and Pakistani sources put the number of partition refugees at 7 million in each country. But the movement from East Bengal has continued up to the present and may go on for some time to come.

This mass movement has involved severe hardship and resulted in heavy loss of life and property, and in great damage to crops and industries. During the past three years, in spite of the large relief expenditures by the governments, resettlement and rehabilitation of the refugees have not been completed.<sup>39</sup>

### 3. Demographic importance and characteristics of Indian emigration

It has been estimated that during the period of more than 100 years from 1834 to 1937, about 30 million Indians emigrated to other countries, and about 24 million returned to India, leaving a net emigration of some 6 million.<sup>40</sup> The demographic effect of this migration, as measured by the number of Indians living abroad at the end of the period, was limited, perhaps even more than in the case of Chinese emigration by the fact that most of the migrants were men who had little opportunity to reproduce in the areas of immigration. The number of Indians living outside India and Pakistan has recently been estimated at about 4 million. These constitute hardly 1 per cent of the present population of India and Pakistan.<sup>41</sup> Clearly the influence of the movement on the demographic development of the homeland has been all but negligible.

Only fragmentary statistics on the characteristics of Indian emigrants are available, covering the period since 1923. A classification by

<sup>39</sup>United Nations, *Official records of the fourth session of the General Assembly, Third Committee*, pp. 144, 146; Schechtman, *Population transfers in Asia (1949)*, p. 19; International Labour Office, "Rehabilitation and Resettlement of displaced persons in the Indian Union" (1950), pp. 411-426.

<sup>40</sup>Davis, *op. cit.* (1951), p. 99.

<sup>41</sup>The Times of India Press, *The Indian and Pakistan Yearbook and Who's Who, 1948*, p. 1091; *The Economist*, London, 22 October 1949, p. 879.

sex is given in the official statistics on continental emigration of Indian nationals from 1923 to 1947, with a further distinction between persons under and over 15 years of age for the years 1928 to 1947. As indicated previously, these data fall far short of covering all Indian emigration during the years to which they refer. However, to the extent that they can be taken as representative of the sex and age composition of the migrants, they confirm the fact that the movement has been very largely one of adult males migrating without families.

During the years 1923 to 1939, the sex ratio among the recorded continental emigrants was on the average, slightly over 500 females per 1,000 males<sup>42</sup> (see Table II).

TABLE II. RECORDED CONTINENTAL EMIGRATION\* OF NATIONALS FROM INDIA BY SEX, 1923-1947<sup>b</sup>

Year	Males	Females	Females per 1000 males
1923-1947	1,086,537	516,214	475
1923-1939	945,051	511,742	541
1923	53,188	25,119	472
1924	93,268	55,562	596
1925	102,000	52,873	518
1926	148,712	66,093	444
1927	143,594	78,379	546
1928	66,066	44,657	676
1929	88,795	47,818	539
1930	55,025	28,592	520
1931	20,407	12,364	606
1932	13,469	7,576	562
1933	7,573	3,666	484
1934	71,846	48,762	679
1935	15,743	8,144	517
1936	6,775	3,302	487
1937	39,900	21,712	544
1938	9,299	4,499	484
1939	9,391	2,624	279
1940-1947	141,486	4,472	32
1940	14,515	414	29
1941	13,300	463	35
1942	11,037	343	31
1943	17,736	629	35
1944	22,978	872	38
1945	20,426	698	34
1946	21,052	603	29
1947	20,442	450	22

\*Including a very small number of inter-continental emigrants.

<sup>b</sup>Sources: Special communications to the United Nations Secretariat from the Government of India; Ferenczi, *op. cit.*, Vol. I, (1929), p. 903.

<sup>42</sup>It is interesting to note that the data do not support the hypothesis that the proportion of men among the emigrants tends to rise in periods of heavy emigration when the demand for labour in the receiving countries is expanding. The average sex ratio showed a larger proportion of females in years when emigration was large than in those when it was small. The average for the heavy-emigration years 1924-1929 and 1934 was 552 females per 1000 males; for the light-emigration years 1931-1933, 1935-1936 and 1938-1939, it was 510. No great importance can be attached to this comparison in view of the limitations of the data.

The data by age groups for the years 1928 to 1939 indicate that approximately one-half of the emigrants were males 15 years old and over, about one-fourth were females 15 years old and over, and one-fourth children under 15 (see Table III). After 1939, the statistics imply that the numbers of women and children emigrating abruptly dropped very low, while emigration of adult males continued at a level roughly comparable to that of the 1930's. This change in the composition of the emigrant groups was not explained in the source of the statistics; it may be only a result of the restricted coverage of the data.

Not only the demographic composition of the Indian emigrants, but also their tendency to form separate communities in the countries of immigration has limited the importance of their movement. Had they been better integrated into the life of the receiving countries, larger numbers of them might have remained permanently abroad, and their influence on the social and economic as well as the demographic development, both of the home country and of the immigration countries, might have been more important.

## D. JAPAN

### 1. Inter-continental emigration

Emigration of Japanese indentured workers to work overseas began after 1885, when Japan legalized the emigration of its nationals. The main streams of Japanese inter-continental migration were two, one to Hawaii, the United States and Canada, the other to Peru and Brazil.

The early Japanese emigrants to Hawaii<sup>43</sup> were indentured labourers going to work on the sugar plantations. Between 1885 and 1894, approximately 30,000 such Japanese workers entered Hawaii. In 1898, 10,000 Japanese went to Hawaii. In the following year this number was more than doubled. However, in 1900 the number fell below 2,000 as a result of the adoption of the United States law forbidding the immigration of indentured workers to Hawaii, which had been annexed to the United States in 1897. The period 1901-1907 witnessed a great influx to Hawaii of non-indentured Japanese workers, as the annual immigration of Japanese frequently reached 10,000 to 20,000.<sup>44</sup> It was in 1907 that Japan voluntarily limited the number of its emigrant labourers, in accord-

<sup>43</sup>Ishii, *Population pressure and economic life in Japan* (1937), p. 194; Ferenczi, *op. cit.* (1929), Vol. I, p. 164.

<sup>44</sup>Japan, Department of Overseas Affairs, "Japanese overseas" (1941), p. 348.

TABLE III. RECORDED CONTINENTAL EMIGRATION<sup>a</sup> OF NATIONALS FROM INDIA BY SEX AND AGE, 1928-1947<sup>b</sup>

Sex and Age	Number			Percentage		
	1928-1947	1928-1939	1940-1947	1928-1947	1928-1939	1940-1947
All ages						
Total	733,963	633,005	145,958	100.0	100.0	100.0
Male	545,775	404,289	141,486	69.6	63.4	96.9
Female	238,188	233,716	4,472	30.4	36.6	3.1
Adults aged 15 and over						
Total	604,547	464,118	140,429	77.1	72.7	96.2
Male	450,368	312,916	137,452	57.4	49.0	94.2
Female	154,179	151,202	2,977	19.7	23.7	2.0
Children aged under 15						
Total	179,416	173,887	5,529	22.9	27.3	3.8
Male	95,407	91,373	4,034	12.2	14.3	2.8
Female	84,009	82,514	1,495	10.7	13.0	1.0

<sup>a</sup>Including a very small number of intercontinental emigrants.

<sup>b</sup>Sources: Special communication to the United Nations Secretariat from the Government of India; Ferenczi, *op. cit.* (1929), Vol. I, p. 903.

ance with the "Gentlemen's Agreement". Most of the indentured Japanese labourers who went to Hawaii returned to Japan upon the expiration of their term. The small number who remained either started their own businesses with their savings or entered other occupations in the free labour market. Some of this group re-migrated from Hawaii to the continental United States. The Japanese population of Hawaii, according to census reports, was 80,000 in 1910, 109,000 in 1920, 140,000 in 1930 and 158,000 in 1940.

Japanese emigration to the continental United States<sup>45</sup> also started after 1885. The Japanese migrants to that country were not indentured workers but common labourers who engaged chiefly in farming in southern California and other areas. Japanese statistics show that the total number of Japanese who left for the United States amounted to nearly 197,000 between 1885 and 1924, while according to United States statistics a total of 271,000 Japanese arrived between 1886 and 1924. The discrepancy between the figures has been attributed to indirect Japanese migration to the United States by way of Hawaii. There was also a considerable return movement to Japan before the "Gentlemen's Agreement" of 1907. But during the period 1908 to 1924, 114,000 Japanese returned from the United States and only 69,000 left for the United States. After

<sup>45</sup>Ichihashi, "International migration of the Japanese" (1931), p. 621; Ferenczi, *op. cit.*, Vol. I, pp. 266-273; Grünfeld, *Die japanische Auswanderung* (1913), p. 46; Japan, Department of Overseas Affairs, "Japanese overseas" (1941), p. 348.

1924, the Immigration Law of 1924 of the United States put an end to the influx of Japanese migrant workers into that country. The Japanese population in the United States, according to the census reports, was 72,000 in 1910, 111,000 in 1920, 139,000 in 1930 and 127,000 in 1940.

Japanese emigration to Canada<sup>46</sup> was much smaller than to Hawaii or the United States, although it started at approximately the same time. According to Japanese statistics, 30,000 Japanese left for Canada between 1891 and 1924. It appears that few of the Japanese in Canada settled permanently; most of them stayed for some time and re-migrated. Between 1919 and 1924, Japanese re-migration from Canada was larger than Japanese immigration. An agreement in 1908 between Canada and Japan provided that from then on no more than 400 Japanese labourers should enter Canada in any one year. The Japanese population in Canada numbered, according to Canadian census reports, 9,000 in 1911, 16,000 in 1921 and 23,000 in 1931 and 1941.

The stream of Japanese emigration to Latin America began later than that to Hawaii and North America, and for many years it amounted to hardly more than a trickle.<sup>47</sup> In

<sup>46</sup>Ichihashi, *op. cit.*, p. 621; Ferenczi, *op. cit.*, Vol I, p. 162.

<sup>47</sup>Norman and Gerbi. *The Japanese in South America: an introductory survey, with special reference to Peru* (1943), pp. 6-9; Ichihashi, *op. cit.*, pp. 621, 630; Japan, Department of Overseas Affairs, "Japanese overseas" (1941), pp. 349-352; Ishii, *Population pressure and economic life in Japan* (1937), p. 194; Foreign Affairs Association of Japan, *The Japanese yearbook* (1930), p. 45.

1899, a shipment of 790 Japanese indentured labourers arrived in Peru for work on the sugar plantations. Other shipments followed, but up to 1924 very few of the migrants had taken up permanent residence in Peru. A total of 21,000 Japanese entered the country from 1897 to 1924, but only 3,000 were living there in 1908, and less than 1,000 in 1924. The migration of Japanese to Brazil during that period was also rather small. It began with the dispatch of 1,000 workers from Japan in 1908 to work on Brazilian coffee plantations. By 1924, some 24,000 Japanese had gone to Brazil.

After the migration of Japanese to Hawaii, the United States and Canada had been cut off by the restriction and exclusion laws, the movement to Latin America increased greatly in volume and changed significantly in character.<sup>48</sup> From 1924 onwards this migration was a project carefully planned and financially supported by the Japanese Government. It consisted chiefly in the movement of workers, together with their families, for permanent settlement. By far the largest number of migrants was directed to Brazil, but considerable numbers went also to Peru.

With this new immigration, the number of Japanese in Peru increased to 17,000 in 1930 and 20,000 in 1936. In the latter year, Peru revised its immigration law, limiting the number of Japanese residents to 16,000. As the actual number already exceeded that limit, further immigration was prohibited.

The number of Japanese who emigrated to Brazil between 1924 and 1937 was nearly 151,000. Most of these arrived before 1935; after that date Japanese emigration to Brazil, and with it all inter-continental emigration from Japan, fell off rapidly as Japan became concerned primarily with its programme of continental expansion in Asia. By 1940, the size of the Japanese population in Brazil had increased to 290,000.

## 2. Emigration to other countries in the Far East

The number of Japanese emigrants to other countries in the Far East was small during the first decades after the legalization of emigration from Japan. The majority of the continental emigrants during the latter part of the nineteenth century were itinerant tradesmen and fishermen going to China and Korea.<sup>49</sup> The continental migration did not become important until the wars with China and Russia gave

<sup>48</sup>Norman and Gerbi, *op. cit.*, pp. 47-49; Ichihashi, *op. cit.*, p. 621.

<sup>49</sup>Ichihashi, *op. cit.*, pp. 618-620.

Japan the beginnings of its Asiatic empire. Formosa was acquired in 1895, and Korea, Karafuto and the leased territory of Kwantung in Manchuria were acquired in 1905. A steady movement of Japanese to those territories, for their administration and development, commenced soon after their acquisition.

Initially that movement was not large. Around 1910 there were about 146,000 Japanese in Korea, 26,000 in Karafuto, 20,000 in Manchuria and 98,000 in Formosa.<sup>50</sup> The migrants were a highly selected group, having a superior social and economic status in the government and industries of the areas of immigration.

From 1920 onwards, the censuses of Japan supplied data on the Japanese in the outlying areas of the empire while Japanese consular reports covered those in Manchuria and other parts of China. The figures for 1920 indicate that during the decade of the First World War, there was an increasing migration of Japanese to what may be called the areas of Japanese hegemony in Asia, including Manchuria and other parts of China as well as the empire territories. The total number of Japanese in those areas rose from about 300,000 around 1910 to 849,000 in 1920. The latter number was distributed as follows: 377,000 in Korea, 103,000 in Karafuto, 150,000 in Manchuria, 55,000 elsewhere in China and 164,000 in Formosa.<sup>51</sup>

The tempo of the movement continued to accelerate during the inter-war period. The number of Japanese in the areas of their hegemony increased by more than 50 per cent during the 1920's, reaching a total of 1,321,000 by 1930.<sup>52</sup> The increase during the next decade was still larger; in 1940, the Japanese civilian population of these areas was 2,799,000—more than twice the 1930 total for both civilian and military personnel. Of the gain during the 1920's, more than four-fifths took place in the empire territories of Korea, Karafuto and Formosa, but the movement to Manchuria became dominant after 1930. The decade 1930-1940, which corresponded roughly to a period of Japanese domination of all Manchuria, including the Province of Jehol, was marked by a rapid

<sup>50</sup>Japan, Bureau of Statistics, *Résumé statistique de l'Empire du Japon, 1911*, pp. 27-29.

<sup>51</sup>Figures for 1920 include military personnel except those for Manchuria and other parts of China. Japan, Cabinet Bureau of Statistics, *Final report on the 1930 census*, pp. 35-36. Figures for Manchuria and other parts of China from special communication of the Japanese Government to the United Nations.

<sup>52</sup>Military personnel are included except for Manchuria and other parts of China.

industrial development and expansion of strategic installations there. Large numbers of Koreans as well as Japanese migrated to Manchuria at that time. After the outbreak of the war with China in 1937, a stream of Japanese, both military and civilian, poured into other parts of China, particularly the northern provinces. In consequence of these developments, the number of Japanese civilians in Manchuria and other parts of China increased nearly five-fold between 1930 and 1940, and reached nearly 1,400,000 in the latter year (see Table IV).

TABLE IV. JAPANESE CIVILIAN RESIDENTS IN CHINA PROPER AND MANCHURIA, 1920-1944\*

Year <sup>b</sup>	China proper	Manchuria <sup>c</sup>	Year <sup>b</sup>	China proper	Manchuria <sup>c</sup>
1920....	54,444	150,465	1933....	55,064	319,715
1921....	57,832	162,280	1934....	56,049	389,497
1922....	59,321	168,811	1935....	56,106	480,219
1923....	48,387	172,690	1936....	59,345	543,090
1924....	45,269	179,484	1937....	59,345	586,510
1925....	47,613	184,529	1938....	105,334	671,452
1926....	48,961	191,656	1939....	216,641	..
1927....	51,698	198,730	1940....	364,476	1,019,916
1928....	55,156	204,429	1941....	447,209	..
1929....	55,708	215,009	1942....	494,788	..
1930....	54,391	227,605	1943....	538,410	..
1931....	53,632	232,753	1944....	515,116	..
1932....	53,374	260,332			

\*Source: Special communication to the United Nations Secretariat from the Government of Japan. These figures omit members of the Japanese armed forces and persons attached thereto.

<sup>b</sup>Figures for 1920-1943 are as of 1 October of each year; figure for 1944 is as of 1 April.

<sup>c</sup>Including the province of Jehol, the former Kwantung leased Territory, and the South Manchuria Railway Zone.

The characteristics of the Japanese immigrants to the various dependencies and other Asiatic areas under Japanese domination were essentially the same. They were predominantly urban residents, and their economic activities were concentrated in commerce, manufacturing, public service and the professions. Of all the former Japanese dependencies, Formosa was the least industrialized; nevertheless the Japanese migrants to that territory were mainly non-agricultural workers. Persons engaged in non-agricultural pursuits such as commerce, public service, the professions and manufacturing occupations made up about three-quarters of all the Japanese arrivals and departures for which gainful occupations were reported in the Formosan statistics. Those engaged in agriculture and fishing represented less than one-tenth of the total. In Korea and Manchuria, where industrial development was more extensive and more rapid, the proportion of Japanese immi-

grants engaged in government service, manufacturing and mining occupations was still higher. Notwithstanding the repeated efforts of the Japanese Government to set up agricultural colonies abroad, the Japanese migrants expected to better their economic fortunes and improve their social status through migration, and they believed, for the most part, that agriculture and manual labour offered little chance for such advancement. Consequently, Japan's external and inter-empire movements have never been "the exodus of poverty-sticken peasants to a life offering only subsistence on an agricultural frontier".<sup>53</sup>

Other currents of Japanese emigration were small. Japanese emigration to the Philippines began in 1903, but the average annual number for the period 1912 to 1941 was below 2,000.<sup>54</sup> The emigrants to the Philippines were unusual in that they were predominantly agriculturists. That country is the only one in Asia where Japanese immigrants have mostly taken up, and remained in, agriculture.

Japanese emigration to the Soviet territory in Asia was not important. Only 19,000 civilian migrants, consisting mostly of itinerant tradesmen and fishermen, went there between 1898 and 1924.<sup>55</sup>

The number of Japanese who went to other Asian countries also was small. The total number living in Indonesia, Malaya, Thailand, Indochina and Burma in 1940 was only about 20,000. The development of the small Japanese settlements in those countries was associated with the growth of Japanese trade in south-east Asia. Most of the Japanese there were engaged in commerce or the retail trade.

The large movements of Japanese military forces in the Far East during the 1930's and 1940's left very substantial numbers of Japanese soldiers abroad at the surrender. During the early post-war period, some 6 million Japanese nationals, both Japanese-born and others, were repatriated to that area of Japan which was under the military occupation of the Supreme Commander of the Allied Powers. The nationals of the former areas of the empire were given the option of repatriation to their countries, and Ryukyu islanders were repatriated

<sup>53</sup>Taeuber, "Migration and the population potential of monsoon Asia (1947), p. 20.

<sup>54</sup>The available data on this emigration refer only to the Philippines and Guam combined. A special communication to the United Nations Secretariat from the Government of Japan gives the following figures on emigration to these islands: 1912-1919, 11,052; 1920-1929, 15,116; 1930-1935, 8,828; 1940-1941, 973.

<sup>55</sup>Ichihashi, *op. cit.* (1931), p. 634.

to Okinawa and other islands. Thus the net result of all the Japanese movements after the restoration of 1868 was to leave practically no Japanese in the Far East region outside Japan.

### 3. Demographic importance and characteristics of Japanese emigration

The post-war repatriations have meant that the ultimate effect of Japanese emigration upon the growth of population in the homeland was very small. However, in assessing the demographic importance of the movement, it is necessary to consider the fact that a substantial number of Japanese lived for considerable periods of time in the empire territories and other Japanese-dominated areas of the Far East. In 1940, according to official reports, more than 3,500,000 Japanese civilians were living outside Japan, most of them in the Far East.<sup>56</sup> This number was equal to about 5 per cent of the population of Japan proper at that time—a much higher percentage than the corresponding figures for China and India. Although it proved to be only temporary, the emigration was large enough to be a factor of some importance in the relationship between population growth and employment opportunities in pre-war Japan.

As a result of the emigration of Japanese civilians from Japan between 1920 and 1940, partly balanced by Japanese migrants returning to Japan, it has been estimated that the number of Japanese of the homeland aged 10 years or over in 1940 was some 1.7 million smaller than it would have been had this migration not occurred.<sup>57</sup> Since the excess of births over deaths among the Japanese population in the homeland during this twenty-year period was about 16 million,<sup>58</sup> it appears that the net loss of those aged 10 or above amounted to about 11 per cent of the natural increase that occurred within the country.

The demographic importance of the movement is made clearer by the available data indicating the sex and age composition of the migrants. Because the Japanese statistics of emigration are incomplete, these indications have to be obtained from census data on the characteristics of the Japanese emigrant stock

<sup>56</sup>Taeuber, "Population increase and manpower utilization in Imperial Japan" (1950), p. 281.

<sup>57</sup>The net loss of persons aged 10 or above by migration during this twenty-year period includes the survivors of the net migrants plus the survivors of children born to migrants between 1920 and 1930. See Taeuber, "Migration and the population potential of monsoon Asia", pp. 19-20.

<sup>58</sup>Taeuber, "Population increase and manpower utilization in Imperial Japan" (1950), p. 281.

in outlying areas of the former Japanese empire. In 1940, the sex ratio among the 820,000 Japanese in Manchuria<sup>59</sup> was 704 females per 1,000 males; among the 395,000 Japanese in Karafuto, it was 758; among the 708,000 Japanese in Korea, 891; and among the 312,000 Japanese in Formosa, 930. The corresponding ratio among the Japanese population in Japan<sup>60</sup> was 1,007. It appears that the migrants were preponderantly males; further, there is evidence that most of them were in the ages of early adulthood.

In 1940, 71 per cent of the male Japanese population in Manchuria (excluding Jehol and Kwantung) was between 15 and 44 years old. The corresponding percentage of the male Japanese population in Japan proper in the same year was 45 per cent (see Table V).

TABLE V. AGE DISTRIBUTION OF JAPANESE MALES IN MANCHURIA AND JAPAN, 1940<sup>a</sup>

Age	Manchuria <sup>b</sup> (percentage)	Japan proper <sup>c</sup> (percentage)
All Ages.....	100.0	100.0
0-4.....	10.8	12.6
5-9.....	6.7	12.3
10-14.....	5.1	11.7
15-19.....	16.8	10.2
20-24.....	11.4	8.2
25-29.....	17.4	7.7
30-34.....	12.6	6.8
35-39.....	7.5	6.2
40-44.....	4.8	5.4
45-49.....	2.9	4.5
50-54.....	1.8	4.0
55-59.....	1.1	3.4
60 and over.....	1.1	7.0

<sup>a</sup>Sources: Manchoukuo, The 1940 census of Manchoukuo (1942), pp. 256-258; United Nations, *Demographic yearbook, 1948*, p. 126.

<sup>b</sup>Excluding Kwantung and Jehol.

<sup>c</sup>Including military.

When the sex and age distribution of the emigrants is considered, it is evident that the movement was more important in relation to the increase in numbers of young men in Japan than in relation to the growth of the total population. The field for employment in the empire territories and other sections of Asia that were coming under Japanese influence was evidently of considerable importance to the young men who came of age in Japan during the inter-war years. By the same token, the closing of that field in the post-war period constitutes an important restriction of employment opportuni-

<sup>59</sup>Excluding Kwantung and Jehol. Manchoukuo, The 1940 census of Manchoukuo (1942), pp. 256-258.

<sup>60</sup>Japan, Cabinet Bureau of Statistics, Census of 1940—selected tables. Microfilm copy, Library of Congress, Washington, D. C.

ties for those who are reaching working age in Japan at present.

The migratory loss of the Japanese population in Japan between 1920 and 1940 was approximately balanced by the immigration of Koreans to Japan, so that the total population of the country was scarcely affected, on the balance, by the migratory movements.<sup>61</sup> The occupational distribution of the Korean immigrants, however, was very different from that of the Japanese emigrants. The Koreans in Japan were employed chiefly as unskilled labourers in agriculture and manufacturing, while the Japanese emigrants, as already indicated, were engaged largely as technicians, administrators and skilled workers in the industries and governmental services of the receiving areas. The social and economic status of the jobs which the Japanese occupied in the empire territories and other parts of their sphere of influence in Asia was far higher than that of the jobs which they relinquished to the Korean immigrants in Japan.

Economically, the importance of the Japanese emigration was out of proportion to the number of emigrants. The emigrants played an important role in organizing and developing the agriculture and industries of the areas that they occupied, including Manchuria. As a result, the capacity of those areas to support population was enhanced as the numbers of their inhabitants were increased. For those areas, the effect of Japanese immigration was similar to that of a great increase in their technical and managerial personnel devoted to economic development, although the development was oriented towards the needs of Japan rather than of the countries themselves. To Japan, the emigration was a means of strengthening its hold on the various parts of its area of hegemony and of increasing their production of the foodstuffs, minerals and other materials which Japan lacked, as well as a means of finding employment for its growing labour resources.

## E. KOREA

### 1. Continental emigration

In modern times there has been little inter-continental emigration from Korea.<sup>62</sup> The movements from Korea have been almost exclusively continental. There have been three major con-

<sup>61</sup>Taeuber, "Migration and the population potential of monsoon Asia" (1947), p. 20.

<sup>62</sup>Immediately before Korea came under Japanese power, about 7,000 Koreans fled to Hawaii; other inter-continental movements from Korea have been very small. Kim, "The Koreans in Hawaii" (1934), p. 410.

tinental movements of Koreans: one across the north-eastern border into the Russian Far East, a second across the Yalu river into Manchuria, and a third across the Japan Sea to Japan. The first two began as early as the 1860's; they were initially brought about by pressures due to famines and calamities in Korea. The movement to Japan took place chiefly after the First World War.

Information as to the size of Korean emigration to the Russian Far East and Manchuria during any time in the latter part of the nineteenth century is not available. In 1906-07, the Korean agricultural labourers residing in the Russian Ussuri district numbered some 50,000. In 1915, 90,000 Koreans were reported to have gone there. According to the Soviet census of 1926, there were 172,000 Koreans in the USSR, most of them living in the Far Eastern territory. About one-half of them had adopted Soviet citizenship. According to the Soviet census of 1939, there were 180,000 Koreans in the USSR. Until 1937, most of them had lived in the Far Eastern Territory, but in that year almost the whole colony was transplanted to Siberia and central Asia.<sup>63</sup>

The number of Koreans in Manchuria prior to the First World War may have been nearly as many as half a million,<sup>64</sup> but the number in Japan was under 1,000.<sup>65</sup> The movements of Koreans to both Manchuria and Japan were growing during the 1920's and increasing very rapidly during the 1930's. These movements apparently reached their peak around 1940. According to available data, there were about 600,000 Koreans in Manchuria in the late 1920's. In 1940, the number of Koreans had increased to 1.4 million, of whom 616,000 were in Chientao Province and 500,000 in the neighbouring provinces of Kirin, Fentien, Mutanking, and Tung-hua.<sup>66</sup> A major portion of the Koreans in Chientao Province and the settled Koreans in the other rural regions were engaged in agriculture. They concentrated on the cultivation of rice, but they also took up livestock breeding, poultry farming and straw weaving. After the Man-

<sup>63</sup>Great Britain, Naval Intelligence Division, *A handbook on Siberia and Arctic Russia* (1920), Vol. I, p. 212; Lorimer, *The population of the Soviet Union: history and prospects* (1946), p. 64; Lasker, *Asia on the move* (1945), pp. 95, 114; Yarmolinsky, *Jews and other minor nationalities under the Soviets* (1928), p. 147; Kulischer, *Europe on the move* (1948), p. 86.

<sup>64</sup>Chen, *Japanese emigration to China* (1915-1916?), p. 13.

<sup>65</sup>Japan, Bureau of Statistics, *Résumé statistique de l'Empire du Japon, 1911*, No. 25, p. 37.

<sup>66</sup>Manchoukuo, *The 1940 census of Manchoukuo* (1942), pp. 256-258.



churian "incident" in 1931, the Korean immigrants were offered various facilities for obtaining employment in manufacture and commerce. As a consequence, small strata of relatively wealthy Korean farmers, merchants and industrial employees developed. The Koreans as a group enjoyed an economic and social status somewhere between the Chinese, who were on a lower plane, and the Japanese, who were on a higher plane.

The stream of Koreans moving into Japan equalled that going to Manchuria after 1930. The number of Koreans in Japan was 41,000 in 1920, 419,000 in 1930 and 1.2 million in 1940.<sup>67</sup> The Koreans involved in this movement came predominantly from southern Korea. They were principally of agricultural origin, and many served as unskilled manual workers in the industrial and urban regions of Japan. They were a convenient supplement to the Japanese labour force during the period when industrial requirements in Japan were increasing while the needs for military manpower abroad were expanding.

During the period, 1940-1945, the number of Koreans in Japan appears to have remained at about the pre-war level (1.2 million). On the numbers in Manchuria at that time there is no statistical information. However, from the partial statistics on Korean repatriates in the post-war years, it appears that there were some shifts of Koreans either from Manchuria or through that area to north China, and less substantial movements within the former area of the Japanese empire.

The available repatriation statistics<sup>68</sup> for the post-war period are almost exclusively those referring to the territory under the Republic of Korea. The statistics compiled by the Government of the Republic show that total arrivals of Koreans amounted to 2 million<sup>69</sup> by the end of January 1950, and that 1.4 million of these came from Japan. The reports of the Supreme Commander for the Allied Powers, on the other hand, indicate that the numbers of Koreans repatriated to South Korea under military auspices was only one million.<sup>70</sup> Their distribution according to the areas from which they were repatriated was as follows: 588,000 from Japan, 317,000 from Manchuria, 73,000 from China and 33,000 from other Pacific areas.

<sup>67</sup>Japan, Cabinet Bureau of Statistics, *Census of Japan, 1920; 1930; 1940*.

<sup>68</sup>Covering the period 1 October 1945 to 31 January 1950.

<sup>69</sup>Republic of Korea, *Statistical Summation* (1950), No. 13, p. 10.

<sup>70</sup>Taeuber and Barclay, "Korea and the Koreans in the north-eastern Asian region" (1950), p. 290.

The difference between the 1.4 million arrivals of Koreans in Korea compiled by the government and the 588,000 Korean evacuees from Japan to South Korea shown in the reports of the Supreme Commander for the Allied Powers<sup>71</sup> appears to be due to the fact that the Korean Government counted all Koreans who entered the country, whereas the Supreme Commander did not include voluntary movements or expulsions for illegal entry or other reasons. There is evidence that in the post-war years there has been considerable clandestine out-movement of Koreans to Japan. This movement is attributable to the crippled economic conditions in Korea resulting from post-war dislocations of industry.

## 2. *Demographic importance and characteristics of emigration from Korea*

Emigration has been far more important as a factor in the demographic development of Korea than of any other country in the Far East, even though much of the Korean emigration, like the Japanese, was nullified by repatriations after the Second World War. In 1940, the number of persons of Korean stock living abroad was about 2.8 million, representing nearly 12 per cent of the total population of Korea in the same year.<sup>72</sup> Taeuber has estimated that during the ten years between 1925 and 1935, almost half a million Koreans emigrated, and during the five-year period 1935-1940, over 900,000 left Korea. The effect of this emigration on the population of Korea was assessed by Taeuber as follows:

"Between 1925 and 1940 the Korean population of Korea increased 4.5 million. If there had been no migration of Koreans to or from the country, the increase would have been over 6 million. Migration removed one-fourth of the population increase that would otherwise have occurred in Korea. The contributions of this out-movement to the achievement of a manpower-employment balance within Korea were larger than these over-all figures indicate, for the Korean migrants were predominantly men in working ages. In the absence of migration the number of Korean men aged 15 to 59 would have increased from 5.3 million in 1925 to almost 7 million in 1940, an increase of 30 per cent within a fifteen-year period. The actual increase was 16 per cent. Forty-five per cent of the expected in-

<sup>71</sup>Taeuber and Barclay, *op. cit.*, pp. 289-290.

<sup>72</sup>Japan, Cabinet Bureau of Statistics, *Census of 1940*—selected tables; Manchoukuo, *The 1940 census of Manchoukuo* (1942), pp. 256-258; Kim, "The Koreans in Hawaii" (1934), p. 410; Lorimer, *The population of the Soviet Union: history and prospects* (1946), p. 64.



crease in mature manpower had been removed by migration.<sup>73</sup>

While it is true that the Korean emigrants were predominantly males and largely in the ages of young adulthood, the proportion of emigrants of this description appears to have been less, at least in the case of Korean emigrants to Manchuria, than in the case of emigrants from Japan, China and India. The sex ratio among the 1,450,000 Koreans in Manchuria (excluding Jehol and Kwantung) in 1940 was 837 females per thousand males, whereas it was 1006 per thousand among the Koreans in Korea.<sup>74</sup> Of the male Koreans in Manchuria, 35 per cent were under 15 and 50 per cent were 15 to 44 years old. The corresponding figures for Korea itself were 44 and 39 per cent respectively (see Table VI). These comparisons imply that a substantial number of the Korean emigrants to Manchuria, at least, were accompanied by wives and children.

TABLE VI. AGE DISTRIBUTION OF KOREAN MALES IN MANCHURIA (EXCLUDING JEHOLO AND KWANTUNG) 1940, AND IN KOREA, 1944\*

Age (Years)	Manchuria, 1940 (Percentage)	Korea 1944 (Percentage)
All ages.....	100.0	100.0
0-4.....	13.5	17.2
5-9.....	11.2	14.5
10-14.....	10.2	12.3
15-19.....	10.5	9.4
20-24.....	10.7	7.1
25-29.....	10.0	6.5
30-34.....	7.9	6.1
35-39.....	6.0	5.4
40-44.....	5.2	4.6
45-49.....	4.2	4.4
50-54.....	3.4	3.6
55-59.....	2.6	2.9
60 and over.....	4.6	5.9

\*Sources: Manchoukuo, The 1940 census of Manchoukuo (1942), pp. 256-258. United Nations, *Demographic Yearbook, 1948*, pp. 127-128.

The large emigration no doubt eased appreciably the pressure on the land in the rural areas of Korea, where the high birth rates and falling death rates of the period 1925-1940 were rapidly raising the density of the agricultural population. They also reduced competition for industrial jobs in Korea during the decade 1930-1940, when substantial economic development was under way. The repatriation of a million or more Korean emigrants after the Second World War, and the blockage of further emigra-

<sup>73</sup>Taeuber and Barclay, "Korea and the Koreans in the north-east Asian region" (1950), pp. 285-286.

<sup>74</sup>Manchoukuo, The 1940 census of Manchoukuo (1942), pp. 256-258. United Nations, *Demographic yearbook, 1949-1950*, p. 129.

tion from south Korea to Japan (except for the clandestine movements mentioned above), have added to the problems of food supply and imbalance of population and resources in Korea. So far as south Korea is concerned, internal movements of population within Korea seem to have further complicated these problems since 1945, and the ravages of the Korean war since the middle of 1950 has greatly exacerbated them. The demographic situation is one of the major problems which will call for a solution in the eventual reconstruction of Korea.

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# Dynamics of age structure in a population with initially high fertility and mortality

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Age structure is a matter of major importance in demographic studies, both because of its immediate economic and social consequences and because of its influence on trends of births, deaths, and natural increase. The systematic investigation of conditions determining age structure was necessarily first directed to the determination of the structure resulting from constant vital rates, if continued indefinitely in a population not affected by migration. This led to the development of the theory of "stable populations" which provides a system of mathematical relations that is useful in the analysis of transient phenomena.<sup>1</sup>

Much attention has been given in recent years to the effects of changing birth rates and death rates on the age composition of nations characterized by relatively low rates of fertility and mortality. Possible future trends in age structure have been shown, in projections of population on a cohort basis, in relation to alternative hypotheses regarding future trends of fertility and of mortality. A typical "transitional" structure, with an "abnormally" high proportion of young adults, had been defined as a temporary characteristic of the recent demographic development of many western nations—with the possibility of reversed transitional effects, including an "abnormally" high proportion of aged persons, during a later phase of their development.<sup>2</sup>

On the other hand, there has been little systematic investigation of the possible effects of changes in vital rates on the age composition of populations with initially high fertility and mortality. The present study is a limited contribution to this neglected topic. It shows expected changes in age structure over a thirty-year period in one model population on two hypotheses: (A) a specified decline of mortality with fertility remaining constant; (B) concomitant declines of fertility and mortality. Only limited conclusions

can be drawn from such an investigation. The experiment, however, does suggest important implications and emphasizes the necessity of much extensive study of this subject.

Before considering this specific problem, it is desirable to compare age structures resulting from various combinations of constant vital rates. The conditions resulting in the formation of a stable population may be defined in several ways.

1. A constant set of age-specific death rates and a constant rate of natural increase, if continued indefinitely in a situation not affected by migration, would produce a population with fixed proportions in different age classes.<sup>3</sup> These conditions can be made more specific by taking account of age-specific death rates for each sex and the sex ratio of births. Any combination of such conditions (constant specific death rates and constant rate of natural increase) implies a general birth rate and a general death rate (analogous to the crude birth and death rates of an actual population). These implicit birth and death rates can be derived through the calculation of the corresponding stable population.<sup>4</sup> These conditions do not define any fixed distribution of births by ages of mothers or fathers.

2. A stable population, defined with greater specificity, would result from constant age-specific death rates for each sex, a constant sex ratio at birth, and a constant schedule of age-specific maternity rates or age-specific paternity rates. The resultant stable population would have fixed general rates of natural increase, births and deaths.

Stable populations as defined in the preceding paragraph are hypothetical because the vital rates of actual populations are never absolutely constant. The characteristics of the stable population that would result from the observed vital rates of a particular population at a given time,

<sup>1</sup>For a systematic exposition of this theory, see Lotka, A., *Théorie analytique des associations biologiques. Deuxième partie: Analyse démographique avec application particulière à l'espèce humaine*. Paris (1939).

<sup>2</sup>For a description of such transitional phenomena, see Notestein, F. W., and others, *The future population of Europe and the Soviet Union*. League of Nations, Geneva (1944), pp. 108-116.

<sup>3</sup>A theoretical population of this type can be computed separately for persons of either sex, or for both sexes.

<sup>4</sup>The birth rate (i.e., ratio of births to total population) is determined by the method described by Lotka for determining the proportion of a total stable population in any age class. Stable populations defined by the conditions already stated, with derived birth and death rates, are shown in Table I.

TABLE I. STABLE POPULATION WITH SELECTED SCHEDULES OF MORTALITY AND SELECTED CONSTANT RATES OF INCREASE: INTRINSIC BIRTH AND DEATH RATES, AND AGE DISTRIBUTION<sup>a</sup>

Mortality level	Rate of natural increase (per thousand)	Implicit vital rates (per thousand)		Percentage of total population at specified ages, in years						
		Birth rate	Death rate	0-14	15-64	15-19	20-49	50-59	60-64	65 or more
New Zealand, 1931-1938.....	-5	12.35	17.35	18.4	65.4	6.4	33.8	13.1	6.1	16.2
	<i>0</i>	<i>14.94</i>	<i>14.94</i>	<i>21.4</i>	<i>65.0</i>	<i>7.0</i>	<i>40.5</i>	<i>12.1</i>	<i>5.4</i>	<i>13.6</i>
	5	17.87	12.87	24.7	64.1	7.7	40.7	10.9	4.7	11.2
	10	21.08	11.08	28.1	62.7	8.3	40.5	9.8	4.1	9.2
	20	28.52	8.52	35.3	58.8	3.4	38.9	7.6	2.9	5.9
Japan, 1926-1930.....	-5	18.50	23.50	22.9	66.7	7.5	42.0	12.1	5.1	10.4
	<i>0</i>	<i>21.90</i>	<i>21.90</i>	<i>26.1</i>	<i>65.3</i>	<i>8.2</i>	<i>41.9</i>	<i>10.9</i>	<i>4.4</i>	<i>8.6</i>
	5	25.65	20.65	29.5	63.6	8.8	41.3	9.7	3.8	7.0
	10	29.70	19.70	32.9	61.5	9.3	40.4	8.5	3.2	5.6
	20	38.83	18.83	40.1	56.4	10.2	37.7	6.4	2.2	3.5
India, 1921-1931.....	-5	32.73	37.73	31.6	64.3	9.6	44.1	7.9	2.7	4.1
	<i>0</i>	<i>37.40</i>	<i>37.40</i>	<i>34.8</i>	<i>61.9</i>	<i>10.1</i>	<i>42.7</i>	<i>6.9</i>	<i>2.3</i>	<i>3.3</i>
	5	42.39	37.39	38.1	59.3	10.4	41.0	5.9	1.9	2.6
	10	47.64	37.64	41.4	56.6	10.8	39.2	5.1	1.6	2.0
	20	59.12	39.12	47.9	50.8	11.2	35.1	3.6	1.0	1.2

<sup>a</sup>The characteristics of stationary population are printed in *italics*. Values are for persons of both sexes, combined on assumption of 105 male births per 100 female births. See text for statement of other conditions.

if continued indefinitely, are said to be the "intrinsic" characteristics of this population. It has been shown recently that "accidental" characteristics of a particular population at a given time may, and frequently do, impair the logical validity as well as the predictive value of this concept.<sup>5</sup> These difficulties, however, do not seriously affect the use of stable populations to show types of age distribution that tend to result from various combinations of constant vital rates. Moreover, the age structure and crude rates of birth, death and natural increase of an actual population not appreciably affected by migration, whose vital rates have been fairly constant over a long period, may be quite similar to those of the corresponding (hypothetical) stable population.<sup>6</sup>

Summary information on a series of stable populations is given in table I,<sup>7</sup> and, in more summary form, in chart I. Three broad age classes are used here: 1. Persons under 15 years of age (children, generally dependent on others for support and having special needs, as regards

<sup>5</sup>Karmel, P. H., "The relations between male and female nuptiality in stable population", *Population Studies* (London), Vol. I, No. 4, March 1948, pp. 352-387; "Reproduction rates adjusted for age, parity, fecundity and marriage", *Journal of the American Statistical Association*, Vol. 41, No. 4, Dec. 1946, pp. 501-516.

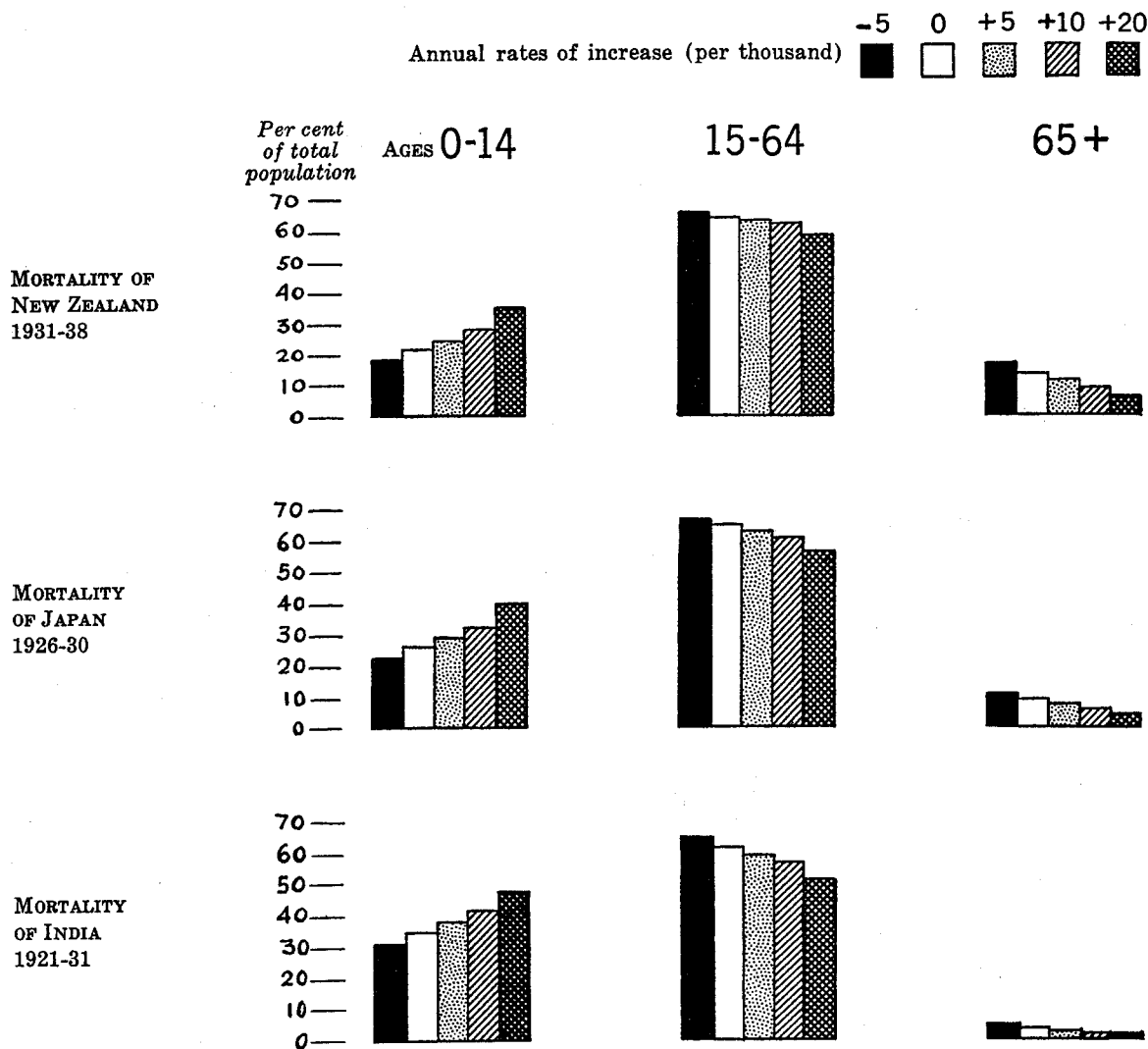
<sup>6</sup>This is illustrated in the case of India in 1931 by information presented below.

<sup>7</sup>The series is similar to one presented by Lotka, *op. cit.*, p. 26. It is extended to cover a wide range of vital rates, and the presentation is modified to show other characteristics.

nurture and education, which are of critical importance for the future welfare of a nation); 2. Persons 15 to 65 years of age (the central age group from which economically productive workers are mainly drawn); 3. Persons 65 years of age and over (aged persons, largely dependent on others, or on accumulated assets, for support). These divisions are necessarily arbitrary; they have a somewhat different functional significance in different situations, and they are variously defined by different writers. Trends within the broad central group may move differently in its lower and upper ranges. There is also special interest from the demographic standpoint in the age group 15 to 49 years of age. So, in order to permit different combinations and comparisons, information is given separately for the following age classes within the central age group: 15 to 19, 20 to 49, 50 to 59 and 60 to 64 years of age.

Interpretation of the functional significance of information on broad age groups involves many complex problems. A very high proportion of children in countries where many children are engaged in economic tasks may lower the average *per capita* production or consumption as much as in countries where most children remain in school. At least this would seem to be the long-run effect because of the difficulties, aggravated by a high ratio of children to adults, in making adequate provision for education and thus raising the productivity of workers. Similarly, persons over 15 years of age who are still

CHART I. AGE DISTRIBUTIONS OF STABLE POPULATIONS WITH SELECTED SCHEDULES OF MORTALITY AND SELECTED CONSTANT RATES OF INCREASE



in school may be contributing indirectly to national production through the acquisition of superior skills. At the other extreme of life, a small proportion of persons over 65 years of age, which is usually associated with a high proportion of children, may be deceptive as regards its effect on the labour resources of a nation—to the extent that this is due to differences in mortality and associated physical conditions. It is true that superior health conditions probably do extend the interval between the onset of incapacity for effective economic production and death. But in situations where death rates at ages 15 to 65 years of age are high, these deaths are commonly preceded by periods of incapacity, similar in economic effect

to the incapacity characteristic of persons at more advanced ages where conditions are favourable to longevity.

In general, the proportion of the population in the broad central age group, 15 to 65 years, is assumed to give a crude index of the "economic efficiency" of an age structure. It must be emphasized, however, that this crude index may obscure other more complex, and often more important, economic and social aspects of age structure. The proportion of aged persons 65 years old and over indicates one part of the population that, though consuming goods and services, is generally non-productive or less productive than persons in the central age classes. Moreover, a high percentage of aged

persons is generally associated with a high proportion of relatively older persons within the broad central age group, thus indicating a general predominance of older adults as compared with youthful adults. Also, due to the greater longevity of females, the ratio of women to men is generally higher among older adults than among younger adults, especially in countries with low mortality. These relations have complex economic and social implications which involve serious public problems. On the other hand, a very high ratio of children to persons in the broad central age group creates serious social problems, especially in countries where the advancement of educational levels is recognized as a major need. It would seem that a certain "balance" among age classes is socially most desirable, though it is impossible to define such an "optimum age distribution", and it would presumably differ in different situations.

Three levels of mortality, covering a wide range of experience, are represented in the specific death rates used in constructing the stable populations shown in table I. The rates are those of the official life tables for the following populations, with the following expectations of life at birth:<sup>8</sup>

Population	Expectation of life at birth (in years)	
	Males	Females
New Zealand, 1934-1938.....	65.46	68.45
Japan, 1926-1930.....	44.82	46.54
India, 1921-1931.....	26.91	26.56

The reader is cautioned that the results obtained are affected by the particular patterns of mortality at different ages of the populations used in these computations.<sup>9</sup> Somewhat different results would be obtained by using schedules of mortality from other countries representing a similar range of mortality levels. It is unlikely, however, that the apparent significance of the observations made here would be radically changed by the substitution of other schedules representing similar mortality levels under fairly normal conditions.

With a fixed set of specific death rates, the rate of natural increase of a stable population is obviously a direct function of its fertility. It is apparent from an examination of table I that, at any given level of mortality, variations in fertility, by causing variations in rates of natural increase, exert a powerful influence on age distribution.

A high rate of natural increase, as compared with any lower rate, raises proportions at

<sup>8</sup>United Nations, *Demographic Yearbook*, 1948. Table 34.

<sup>9</sup>A comparison of differences between age-specific mortality rates from Indian and Japanese life tables is shown in Table II.

younger ages and lowers proportions at older ages. This is a result of the fact that, in a growing stable population, older persons are the survivors of infants born when the population, and therefore the number of births, was relatively small. Variations in mortality have different force at different ages. In contrast, a difference in rates of natural increase exerts a regular, progressive influence on the proportion of the total population in each successive age interval. However, since this constant influence is relative, it has different absolute effects in relation to other demographic conditions.

At any given level of mortality, the proportions of children and of aged persons are very different in stable populations with different rates of natural increase, due to differences in fertility. At the New Zealand level of mortality, the proportion of children under 15 years of age in stable populations ranges from 18.4 per cent in a population decreasing at 5 per thousand per year, and 21.4 per cent in a stationary population, to 35.3 per cent when the rate of natural increase is 20 per thousand. Similarly, at this mortality level, persons aged 65 years or more are about 16 per cent of the total in a population decreasing at 5 per thousand per year, 14 per cent in a stationary population, but only 6 per cent when the rate of natural increase is 20 per thousand. Within the range of low rates of natural increase (or decrease) shown in this table, these changes at extreme ages tend to offset each other, leaving the broad central age group, 15 to 64 years, fairly constant, in the vicinity of 65 per cent. But the proportion in this central group drops with high rates of natural increase, due to the large increase in the proportion of children. With natural increase at 20 per thousand (implying, at this level of mortality, a general birth rate of 28.5 per thousand), the proportion aged 15 to 64 years falls to 58.8 per cent. These variations in age structure resulting from differences in fertility cause marked variations in the general death rate, even though the age-specific death rates remain unchanged.

At the level of Japanese mortality (1926-1930), variations in the proportion of children among stable populations at different rates of natural increase outweigh variations in the proportion of aged persons, as regards their net effect on the broad central age groups throughout the range of values shown in table I. The proportion of children under 15 years of age is 26.1 per cent in the stationary population (birth rate:21.9 per thousand); it is 40.1 per cent in

the population increasing at a rate of 20 per thousand (birth rate: 38.8 per thousand). The proportion aged 15 to 64 years is 65.3 per cent in the stationary population, but only 56.4 per cent in the population increasing at a rate of 20 per thousand. In the former case (the stationary population), there are 2.5 adults aged 15 to 64 years for each child under 15 years; in the latter case (the rapidly increasing population), there are only 1.4 such adults for each child.

At the mortality level of India (1921-1931), the proportion of children under 15 years is high even in the stationary population. The high proportion of children is, of course, related to the high birth rate (37.4 per thousand) required to maintain a stationary population with a short average length of life. Nevertheless, the proportion in the broad age group, 15 to 64 years, in this stationary population is moderately high (about 62 per cent). At higher levels of fertility, the proportion of children becomes larger and the proportion in the central age group declines to 57 per cent when the rate of natural increase is 10 per thousand, and to 51 per cent with a hypothetical increase of 20 per thousand per year. (The last of these hypothetical conditions could hardly be realized in view of the extraordinary fertility, with 59 per thousand as the birth rate, that would be required to maintain such a rate of increase at such a level of mortality.)

In general, low fertility gives a relatively small proportion of children and relatively large proportions of adults both in the central age group and at advanced ages, as compared with populations characterized by high fertility. This is true in situations where a low birth rate, in the vicinity of 15 per thousand, is sufficient to maintain a stationary population (e.g., in a stationary population at the New Zealand level of mortality). A somewhat similar effect, except perhaps with respect to aged persons, might be expected from a combination of equally low fertility with high mortality rates in a rapidly decreasing population. (In view of the fact that such a combination is rarely observed, these hypothetical conditions have not been included in the series presented in table I.)

Moderately high fertility, at a level sufficient to yield rapid natural increase with low death rates or to maintain a stationary population with high death rates, leads to such a large proportion of children in a stable population as to reduce somewhat the proportion of adults in the broad central age group. Very high fertility, sufficient to cause a substantial constant in-

crease in spite of high death rates, causes a still greater increase in the proportion of children, and in the ratio of children to adults in the central age classes. Thus fertility appears as the major determinant of age structure in populations not affected by migration and characterized by constant vital rates.

The material presented in table I does not permit any precise inferences concerning the effect on the age structure of stable populations of differences in mortality at given levels of fertility. We can only make certain inconclusive observations.

A birth rate of 21.9 per thousand in combination with the specific death rates of Japan (1926-1930), gives a stationary population, distributed by broad classes as follows: 26.1 per cent under 15 years of age; 65.3 per cent aged 15 to 64 years; 8.6 per cent aged 65 years or more. A general birth rate is not an accurate index of fertility if combined with different levels of mortality (though it is less sensitive to variations in age structure than a general death rate), and in any case there is no other stable population shown here with a birth rate of exactly 21.9 per thousand.

We may, however, infer from values in this vicinity that this birth rate (21.9 per thousand), in combination with New Zealand specific death rates, would yield a stable population increasing at about 11 per thousand per year. In such a population the distribution by broad age classes would be approximately as follows: 29 per cent under 15 years of age; 62 per cent aged 15 to 64 years; slightly less than 9 per cent aged 65 years or more.

A comparison of these two age distributions suggests that, with fertility approximately unchanged, a shift to a lower level of mortality tends to reduce somewhat the proportion of a stable population within the age group 15 to 64 years. This is theoretically quite possible. The proportion of aged persons might be held relatively constant by two conflicting tendencies: on the one hand the influence of a higher rate of natural increase, tending to reduce this proportion, and on the other, increased longevity, tending to raise this proportion. At the same time, the proportion of children in the population might rise (mortality among children and young adults being highly concentrated near the threshold of life) with the rise in the rate of natural increase.

A similar comparison yields similar results. A birth rate of 37.4 per thousand, in combination with Indian mortality (1921-1931), defines a stationary population with the following age

groups: 34.8 per cent under 15 years of age; 61.9 per cent aged 15 to 64 years; 3.3 per cent aged 65 years or more. The same birth rate in combination with Japanese mortality (1926-1930), yields a stable population increasing at somewhat over 18 per thousand per year. The broad age groups are: about 39 per cent under 15 years; about 57 per cent aged 15 to 64 years; somewhat less than 4 per cent aged 65 years or more. Again, with approximately the same fertility, the shift to a lower constant level of mortality increases the proportion of children, increases somewhat the proportion of aged persons, and decreases the proportion of adults in the central age groups. Thus, on the arbitrary definition given above, a lower constant level of mortality, without a corresponding difference in the birth rate, appears in some cases to bring about an economically "less efficient" age structure—though this effect would undoubtedly be far out-weighted by an increase of productivity due to the better health of the people. This tentative observation is suggested as a hypothesis for further investigation. The information at our disposal does not warrant any definite generalization.

The effect of concomitant differences in constant levels of mortality and fertility, such that the rate of natural increase remains unchanged, is shown by comparisons between corresponding lines in table I. Among stationary populations (lines in *italics*), proportions in the broad central age group do not differ widely but are somewhat lower with Indian mortality and its required level of fertility (about 62 per cent aged 15 to 64 years) than with either Japanese or New Zealand mortality and corresponding fertility levels (about 65 per cent aged 15 to 64 years in both cases). The proportion of aged persons 65 years and more in stationary populations rises with concomitant shifts of mortality and fertility to lower constant levels, from 3.3 per cent (Indian levels) to 8.6 per cent (Japanese levels) and 13.6 per cent (New Zealand levels). The corresponding decrease in the proportions of children under 15 years of age is from 35 per cent (Indian levels) to 26 per cent (Japanese levels) and 21 per cent (New Zealand levels)—all referring to stationary populations.

It is apparent that, at constant vital rates, the joint effect of high fertility in association with high mortality is to produce an age structure that is relatively "inefficient" in several important economic and social aspects. How might this structure be modified in the course of several decades by possible changes in mortality and in fertility?

This problem can be treated by experimenting with a "model" or hypothetical population, conforming to specified conditions and subject to specified changes. We begin with a stable population like those presented in Table I, on the assumption of 105 males per 100 females at birth. This stable population is assumed to be that resulting from the mortality rates in the Indian life tables (1921-1931), and a constant natural increase of 10 per thousand per year.

The characteristics of this hypothetical population are quite similar to those of the actual population of India in 1931—rather surprisingly so in view of previous fluctuations, especially in mortality, in the actual population. This is shown in the following comparisons:

	<i>Model population</i>	<i>Census population, India, 1931</i>
Males per 100 females in total population.....	105.4	106.4
Percentage increase per 10 years (expected in stable population; reported 1921- 1931, in census population) ..	16.0	16.1
Percentage at specified ages:		
0 to 14 years.....	41.4	40.0
15 to 64 years.....	56.6	57.8
65 or over.....	2.0	2.2
Median age in years.....	19.0	20.5

It is necessary to take account of fertility rates, e.g., maternal frequencies, at particular ages. These are not known for the total population of India, but precise information for a particular population is not required for present purposes. We therefore arbitrarily assume a series of relative maternal frequencies that conform roughly to probable conditions in India and are similar to observed relations in some other countries with very high fertility. The series by five-year age classes, from 15 to 19 up to and including 45 to 49 years of age (ignoring births to younger or older women), runs in the following proportions: 7, 11, 12, 11, 8, 5, 1. The absolute values, conforming to these proportions, are those required to give the assumed rate of natural increase (10 per thousand) at the assumed age-specific death rates. The corresponding annual maternal frequencies, daughters only, per thousand women are as follows: 77.9, 122.4, 133.6, 122.4, 89.1, 55.7, 11.1. These give 3.061 as the gross reproduction ratio.<sup>10</sup> The net reproduction ratio, per generation, is 1.318.

It is arbitrarily assumed that the model population has one million females at the beginning of the experiment—giving a total population of about 2,054,000 persons. This population is then

<sup>10</sup>The functions described here as gross and net reproduction "ratios" are frequently referred to as gross and net reproduction "rates". The terms used here are considered by the writer to be more appropriate.



projected over a thirty-year period on two alternative hypotheses.

*Hypothesis A.* Age-specific fertility rates remain constant. Death rates (by five-year age classes) decline (in straight lines) to give, at the end of thirty years, the age-specific death rates of the Japanese life tables, 1926-1930.

*Hypothesis B.* Mortality declines as in hypothesis A. Fertility rates also decline in straight lines to give the same female net reproduction ratio at the end of the thirty-year period as at the start. The required reduction gives fertility rates at the end of the period that are, on average, slightly less than two-thirds as high as at the start.

In reducing the age-specific fertility rates to give the required general level, it is assumed, in the light of experience in other countries, that the decline is least rapid at ages 25 to 29 years and most rapid at ages 15 to 19 years and at ages over 40 years. At the end of the thirty-year period, the maternal frequencies, daughters only, per thousand women by five-year age classes, are as follows: 21.6, 89.3, 109.5, 89.3, 56.9, 25.5, 3.1. These give 1.976 as a gross reproduction ratio and, in combination with the reduced mortality, the same net reproduction ratio, 1.318, as at the start. The assumed relative frequencies at the end, like those of the initial population, are arbitrary; their general level is that required by the hypothesis.

The nature of the hypothetical decline in mortality is indicated by a comparison, by particular ages of death rates in the Japanese life tables (1926-1930), and death rates in the Indian life tables (1921-1931) (see table II and chart II).

The hypothetical changes in mortality and in fertility are, it is believed, not unreasonable as possibilities in the Indian situation or in other countries with similar present mortality, fertility, and age structure. There is no assumption, however, that such changes will actually take place. Declines in mortality or fertility may be much more or much less rapid; in the case of mortality, there could be a catastrophic increase. It is quite unlikely that changes in any country will conform precisely to the hypothetical conditions defined above. The specific hypotheses merely represent possible general tendencies. The experiment is limited to a thirty-year period, in part because a longer projection would involve even more arbitrary hypotheses, and in part because present planning of human affairs rarely takes a more distant future seriously into account. It should be noted, however, that either

TABLE II. SPECIFIC DEATH RATES (LIFE TABLE  $q_x$  VALUES): INDIA, 1921-1931; JAPAN, 1926-1930

Exact age in years (x)	Males			Females		
	India 1921-1931 A	Japan 1926-1930 B	Ratio B/A	India 1921-1931 A	Japan 1926-1930 B	Ratio B/A
0.....	248.7	140.1	.56	232.3	124.1	.53
1.....	91.8	43.1	.47	86.5	42.1	.49
2.....	56.4	22.4	.40	50.6	22.7	.45
3.....	39.2	15.0	.38	34.0	15.6	.46
4.....	27.4	9.8	.36	23.3	10.6	.45
5.....	19.3	6.4	.33	16.5	7.1	.43
10.....	7.9	2.6	.33	8.1	3.0	.37
15.....	9.8	5.0	.51	11.5	7.3	.63
20.....	12.7	9.8	.77	17.6	10.6	.60
25.....	15.3	8.6	.56	21.6	9.6	.44
30.....	19.3	7.4	.38	25.1	8.9	.35
35.....	24.1	7.7	.32	29.3	9.3	.32
40.....	29.4	9.6	.33	34.5	10.1	.29
45.....	34.9	12.7	.36	39.0	10.2	.26
50.....	41.0	17.5	.43	43.1	12.6	.29
55.....	48.1	25.0	.52	47.5	16.9	.36
60.....	57.9	36.7	.63	54.3	24.2	.45
65.....	72.7	54.9	.76	66.6	37.1	.56
70.....	97.6	80.4	.82	88.8	57.7	.65
75.....	142.7	117.5	.82	130.1	88.9	.68
80.....	218.0	170.2	.78	206.6	138.5	.67

the continuance of these trends or their stabilization would produce changes in age structure.<sup>11</sup>

The effects of these alternative hypotheses on the age structure and other characteristics of the model population over a thirty-year period are shown in table III. The total population, as would be expected, increases more rapidly on hypothesis A (declining mortality, constant fertility) than on hypothesis B. It may, however, appear surprising that the rate of increase also rises during this period on hypothesis B, although fertility is reduced so as to keep the net reproduction ratio constant.<sup>12</sup> The moderate rise on hypothesis B and the more rapid rise on hypothesis A result chiefly from the conspicuous decline of the death rate. On hypothesis B, the absolute number of births remains practically constant throughout the series, while the birth rate falls in the growing population.

The rapid decline in the death rate, here indicated, must be attributed in part to the fact that the population is initially "young", with a very small percentage of aged persons, and remains "young" on either hypothesis in spite of marked improvement in mortality. The decline of the death rate (tending to raise the rate of natural

<sup>11</sup>The characteristics of a stable population with the vital rates in effect at the end of the thirty-year period on hypothesis A are described below.

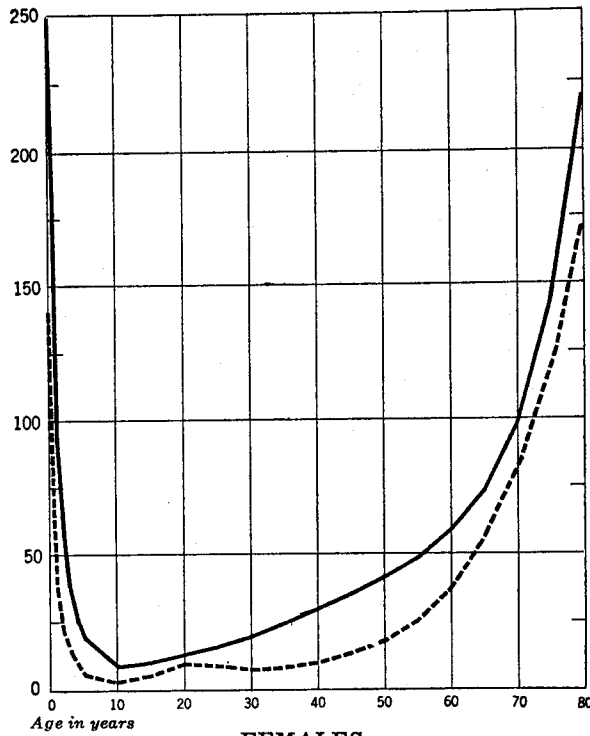
<sup>12</sup>This statement needs minor qualification. There is some variation in the net reproduction ratio at intervening intervals, because mortality trends and fertility trends are treated independently. There is precise equality between the ratios only at the beginning and at the end of the period.

CHART II. SPECIFIC MORTALITY RATES FOR JAPAN (1926-30) AND INDIA (1921-31)

MALES

Death rates  
per 1,000 persons  
of specified age

Indian rates —————  
Japanese rates - - - - -



FEMALES

Death rates  
per 1,000 persons  
of specified age

Indian rates —————  
Japanese rates - - - - -

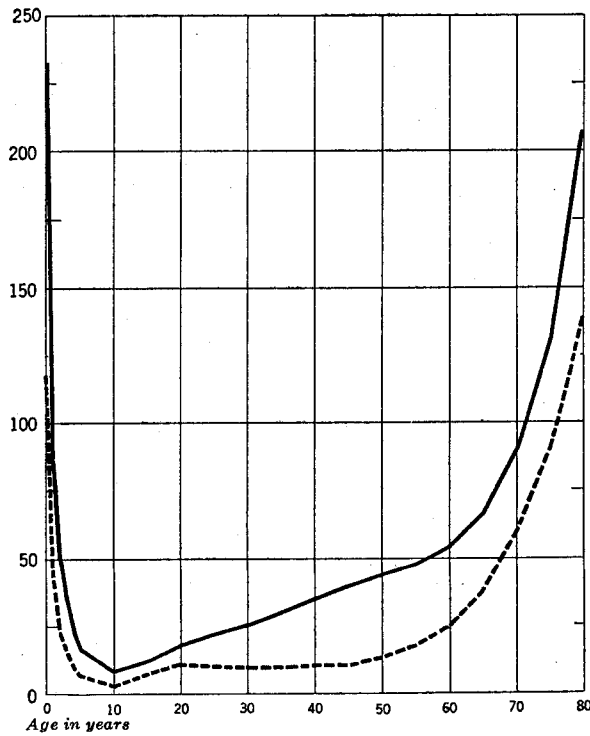


TABLE III. PROJECTIONS OF A MODEL POPULATION, FROM STABLE POPULATION WITH INDIAN MORTALITY (1921-1931) AND WITH INITIAL INCREASE 1 PER CENT PER ANNUM

*Hypothesis A. Specified decline in mortality; fertility constant.*  
*Hypothesis B. Same decline in mortality, with comparable decline in fertility.*

	Hypothesis	Time in years						
		0	5	10	15	20	25	30
Total population (thousands) ..	A	2,054	2,176	2,341	2,552	2,820	3,153	3,569
	B	2,054	2,165	2,295	2,446	2,619	2,814	3,034
Males per 100 females .....	A	105.4	105.3	105.1	104.8	104.4	104.1	103.7
	B	105.4	105.3	105.1	104.9	104.6	104.2	103.8
Median age in years .....	A	19.0	19.0	18.9	18.7	18.5	18.3	18.2
	B	19.0	19.1	19.4	19.7	20.3	21.0	21.3
<i>Age classes</i> (percentage of total)								
0 to 14 .....	A	41.4	41.5	41.8	42.3	42.8	43.2	43.5
	B	41.4	41.2	40.7	39.8	38.8	37.6	36.5
15 to 64 .....	A	56.6	56.5	56.1	55.6	55.0	54.5	54.1
	B	56.6	56.7	57.2	58.0	58.8	59.8	60.6
15 to 19 .....	A	10.8	10.7	10.5	10.3	10.3	10.3	10.3
	B	10.8	10.7	10.7	10.8	10.7	10.5	10.3
20 to 49 .....	A	39.2	39.1	38.8	38.3	37.7	37.0	36.3
	B	39.2	39.3	39.6	40.0	40.6	41.1	41.6
50 to 59 .....	A	5.1	5.1	5.2	5.3	5.4	5.5	5.7
	B	5.1	5.1	5.3	5.5	5.8	6.2	6.7
60 to 64 .....	A	1.6	1.6	1.6	1.6	1.7	1.7	1.8
	B	1.6	1.6	1.6	1.7	1.8	1.9	2.1
65 or over .....	A	2.0	2.0	2.1	2.1	2.2	2.3	2.4
	B	2.0	2.1	2.1	2.2	2.4	2.6	2.9
Birth rate (per 1,000) .....	A	47.6	47.5	47.1	46.4	45.6	44.9	44.3
	B	47.6	44.9	42.3	39.7	37.2	34.7	32.5
Death rate (per 1,000) .....	A	37.6	34.5	31.0	27.9	24.4	21.6	18.2
	B	37.6	33.8	29.9	26.6	23.0	20.3	16.9
Natural increase (per 1,000) ....	A	10.0	13.0	16.1	18.5	21.2	23.3	26.1
	B	10.0	11.1	12.4	13.1	14.2	14.4	15.6

increase) is somewhat accelerated on hypothesis B, due to a decrease in the proportion of infants and young children, whereas the distribution of the adult population with respect to relative numbers of young, middle-aged and aged persons is not radically changed during this thirty-year period.

The stable population that would eventually result from the age-specific death rates and fertility rates in effect on hypothesis A at the end of the thirty-year period, if these rates then remained fixed indefinitely, has also been computed. The intrinsic rate of natural increase used in this computation is 25 per thousand per year.<sup>13</sup> The intrinsic birth rate of this stable population is 43.78 per thousand; its intrinsic death rate is 18.78. Crude rates similar to these intrinsic rates have been observed in some populations which have experienced rapid decline in mortality while traditionally high fertility re-

<sup>13</sup>The precise value obtained by combining the hypothetical schedule of Indian fertility described above with Japanese life table values (1926-1930) was 25.52 per thousand. The approximate figure, 25 per thousand, was used to facilitate comparison with other stable populations shown in table I.

mains in effect. The age composition of this stable population would be as follows:

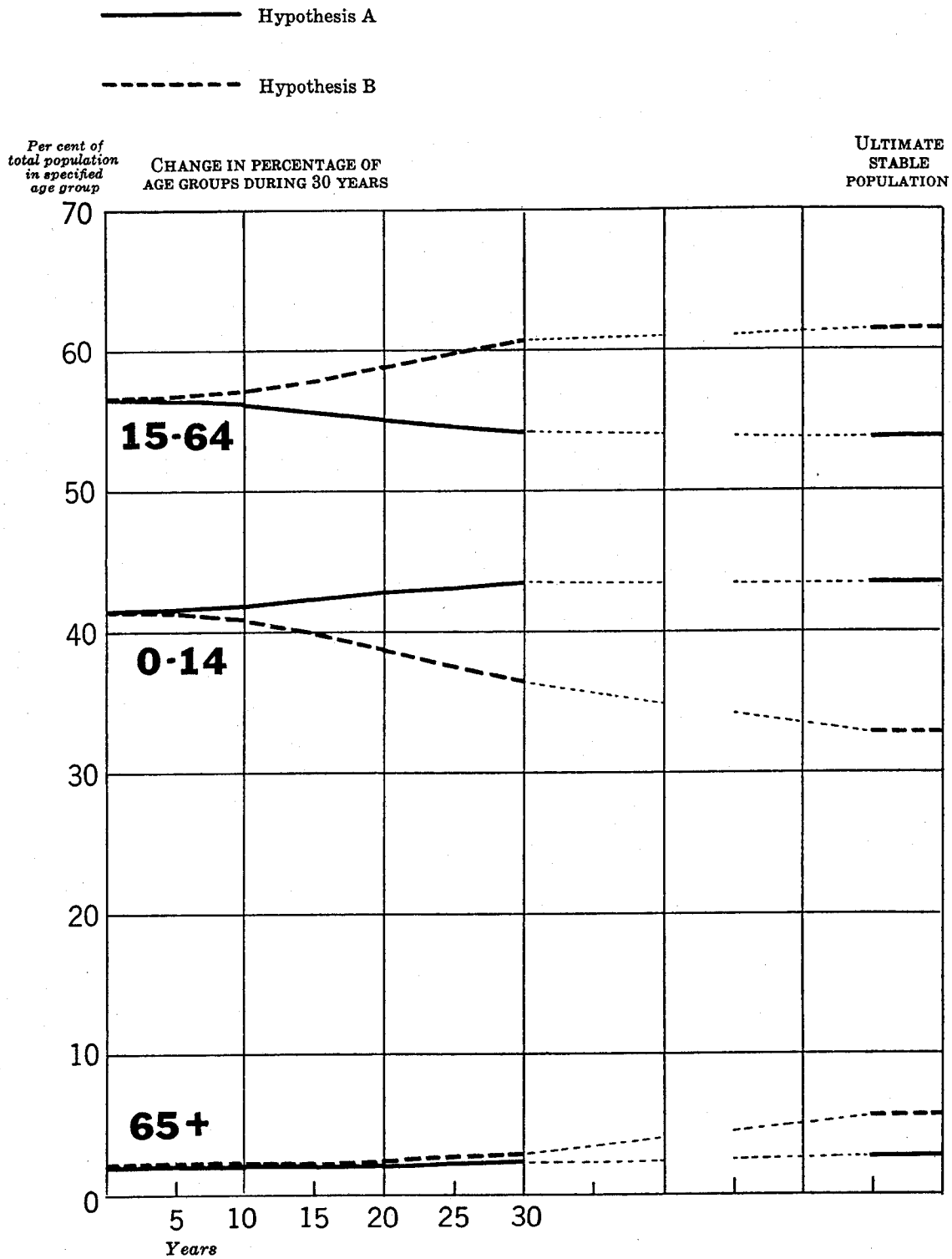
Age class (years)	Percentage of total population
0 to 14 .....	43.6
15 to 64 .....	53.7
15 to 19 .....	10.5
20 to 49 .....	35.9
50 to 59 .....	5.4
60 to 64 .....	1.8
65 or more .....	2.7

It will be noted that this population has both a somewhat larger proportion of children under 15 years and a somewhat larger proportion of aged persons 65 years or more than the initial model population. The proportion in the central age group, 15 to 64 years, is therefore smaller (53.7 per cent as compared with 56.6 per cent).

The stable population that would result from the specific fertility and mortality rates in effect at the end of the period on hypothesis B has already been shown in table I; i.e., a stable population with Japanese mortality (1926-1930) and natural increase at 10 per thousand per year.

The most significant result of the experiment

CHART III. CHANGES IN AGE COMPOSITION UNDER TWO HYPOTHESES



with a model population, on the conditions described above, is that age structure changes very slightly on hypothesis A (declining mortality, constant fertility); it changes only moderately on hypothesis B during the period of the experiment. Improvement in mortality in accordance with the age-specific changes assumed here does not tend immediately to increase the proportion of adults in the population, because reduction of very high mortality in the first few years of life tends (like a rise in fertility) to increase the proportion of children. This effect is offset on hypothesis B by the decline in fertility, but the changes are less pronounced than might have been expected.

The proportion of children under 15 years rises from 41.4 per cent to 43.5 per cent with declining mortality and constant fertility (hypothesis A). On hypothesis B, the proportion of children declines over the thirty-year period from 41.4 per cent to 36.5 per cent. It is then only slightly above the proportion (33 per cent) in a stable population with Japanese mortality (1926-1930) with a constant increase of 10 per thousand per year.

The proportion of persons aged 65 years or over rises on either hypothesis, changing during the thirty years from 2.0 per cent to 2.4 per cent (hypothesis A), or 2.9 per cent (hypothesis B). In the stable populations which would eventually result from the specific rates assumed to be in

effect at the end of the thirty-year period (if those rates should be continued indefinitely thereafter), the proportion would rise only to 2.7 per cent on hypothesis A, but on hypothesis B it would rise to about 5.6 per cent.

The proportion in the central age group, 15 to 64 years, declines slightly with declining mortality and constant fertility (hypothesis A) from 56.6 per cent to 54.1 per cent. It rises gradually with concomitant declines in mortality and fertility (hypothesis B) from 56.6 per cent to 60.6 per cent.

In conclusion, it is necessary to emphasize the arbitrary character of the assumptions made in this analysis and its limitation to one hypothetical population. The study suggests that the "inefficient" age structure of a population with high mortality and high fertility is not necessarily improved and may be slightly aggravated by a decline in mortality without a concomitant decline in fertility. It indicates quite definitely that the effects of a decline in mortality, without a decline in fertility, in accelerating the rate of population growth, may be reinforced over several decades by the persistence of a youthful age structure. Under such conditions a considerable decline in fertility, though modifying the rate of increase that would otherwise result from a decline in mortality, may allow a continuation or even an acceleration of the initial rate of natural increase.

# Some quantitative aspects of the aging of western populations

*(Paper read at the Second International Gerontological Congress, St. Louis (Mo.), United States of America, 10 September 1951)*

## A. DEFINITION OF OLD AGE

It is important to preserve a certain sense of proportion in studying the chronological aging of the population in western countries. At the present time, the demographer can only define old age in chronological terms, considering as "aged" such persons as have attained a certain number of years. This chronological definition imposes considerable restrictions on the interpretation of the findings. Old age cannot be regarded as consisting merely in the number of years which have passed since birth. This fact alone would not make old age a problem.

It is said that in the Orient, or in the tropics, people age rapidly. Biological impairment, physical handicaps, and possibly also a certain social isolation appear already at less advanced ages. An average Indian at the age of 50 may perhaps have to be regarded as "old" in the sense in which the average westerner may be considered "old" when attaining age 70 or 75. Unfortunately, demographic data regarding the incidence of disability at various ages hardly exist. Such data would be required in order to express the quality pertaining to certain ages. Thus, while relatively few persons in India attain ages of 65 years or over, the social burden of old age may be considerably greater than it is in other parts of the world, in view of the greater impairment of persons at less advanced ages. Therefore, while considering trends of chronological aging, which are quantitative only, it must be borne in mind that a qualitative definition, bearing on the frequency and degree of disability, is of at least equal importance.

A further qualification obtains from the fact that old age often implies a certain social verdict. Prejudices, conventions, traditions, as well as legislation, tend to brand persons above certain ages as "old". The age limit which society sets for this class of persons is, of course, variable. It is found in many western countries that employment practices have changed in such a way as to lower the age limit at which persons are no longer considered employable. Thus larger numbers of individuals whose physical handicaps are relatively slight, or even non-existing, have been added to those whom society regards as old. It appears that a sociological definition of old age is required.

It is often said that one is really as old as one feels. Those who can preserve good health up to a very advanced age and, at the same time, have the opportunity of taking an active part in social life, may refuse to consider themselves old. Under unfavourable conditions, when poor health sets in at an earlier stage in life, and when old people cannot find a dignified place in society, it is very likely that aging people will lose interest in life and turn prematurely senile. It follows that a definition of old age in psychological terms is also required.

Thus it appears that four distinct definitions are necessary for an adequate study of the problem of the aged. Apart from old age as defined by the number of years lived, we require also a physiological, a sociological and a psychological definition. Of course, there is a high correlation among all these criteria, but changes in the number of aged people may occur in different ways under any of them.

The situation in certain western countries may be described as one in which chronological old age is increasing, the degree of impairment at particular ages is probably diminishing, the sociological age limit tends to fall, while the trend of psychological aging may be in doubt. Better health, on the one hand, makes aged people feel younger, while restricted opportunities for employment and social isolation may tend to make them feel older.

For the sake of convenience, 65 years is selected, for the discussion which follows, as the chronological lower limit of old age. This choice of an age limit is arbitrary and does not imply any judgment on the physiological, sociological, or psychological conditions of persons above the stated age.

## B. THE DEMOGRAPHIC TRANSITION

Chronological aging is a characteristic of the peoples of Europe, northern America and the British Dominions in Oceania. In Asia, Africa and Latin America, there is only a small proportion of aged persons in the population. This small proportion, moreover, has shown no tendency to rise. Recent censuses have shown that in the Philippines only one person in thirty, in Brazil only one person in forty, and in India only one person in almost fifty, were 65 years old or

more. In France, on the other hand, the census of 1946 showed one person in nine as of such an age. The reason for these wide differences must be found in the demographic history of the various parts of the world.

There was a time when birth rates and death rates were both very high in all parts of the world. However, in the late eighteenth century, improvements in sanitation, medical knowledge, and conditions of living initiated a decline in mortality in certain countries. This decline has since been followed in other countries at various times. In some parts of the world it is only now beginning, while in large parts of the world there is still no evidence of an improvement in mortality.

The decline in mortality was later followed by a decline in fertility, due to social changes leading to the acceptance of the pattern of small families. The decline in fertility began in different countries at different times and has proceeded at varying rates. In large parts of the world, however, fertility is still as high as it has ever been.

These changes, which some demographers call the "demographic transition", have resulted in a great diversity of conditions in various parts of the world. In areas where mortality and fertility are still high, the proportion of the aged is small and remains small. These areas include most of Asia and Africa. In areas where mortality has been declining rather recently and where fertility has declined very little if at all, the total population increases rapidly, and the number of births grows larger every year. Consequently the number of aged persons, though perhaps increasing absolutely, continues to make up only a small fraction of the total. Areas of this type include most of Latin America, Japan and probably also the Soviet Union. There are, finally, those parts of the world in which mortality has been declining for a long time, and in which fertility also has declined very considerably. It is in these areas that the proportion of the aged has increased and still is increasing rapidly. These areas include most of Europe, the United States, Canada, Australia and New Zealand.

### C. DEMOGRAPHIC HISTORY OF CERTAIN COUNTRIES<sup>1</sup>

The demographic transition in western countries has by no means been uniform. Variations in its progress are shown in figure 1, which de-

<sup>1</sup>For sources of data used in this and the following sections, see appendix III.

picts the history of birth rates, death rates and infant mortality rates of six countries during the past hundred years. Birth and death rates are simple but rather crude measurements of the tendencies which underlie population change. Both of these rates are computed per thousand of the total population. Changes in these rates, of course, alter the age structure of the population. A changing age structure, on the other hand, also has some influence on these rates. For example, if a larger fraction of the population falls into those ages at which the risk of death is ordinarily low, this change will tend to lower the death rate. Similarly, if there is an increase in the proportion of the population in the range of ages at which they may become parents, this change will tend to raise the birth rate.

#### *England and Wales*

England and Wales offer a classical example of the demographic transition. Here, death rates were already fairly low in the 1850's, and continued to decline regularly until the 1920's. Because of the rapid aging of the population, however, no further appreciable fall in the death rate has been possible in recent decades, although the mortality rates in individual age groups have continued to drop lower.

The birth rate, which was high in the 1850's, rose to a maximum in the 1870's. A possible reason may have been that, with the decline in mortality, large numbers of children could survive to reproductive ages and, in their turn, give birth to an increased number of children. After the 1870's, and until the great economic crisis of the 1930's, the birth rate fell sharply and consistently, until only a narrow margin was left between the frequency of births and the frequency of deaths. In recent years, however, the birth rate has recovered to some extent.

More remarkable than the fall in either the birth or the death rate was the fall in the infant mortality rate. It is doubtful whether registration of infant deaths was complete in the earliest part of the period. It is, however, certain that there was a time when at least 150 infants died in the first year of life per thousand born, while only about forty-five infant deaths occurred per thousand births in the most recent decade.

#### *France*

The demographic transition in France presents a rather different picture. Both birth and death rates had been declining very gradually over a considerable time in the past, and were at low levels by the middle of the nineteenth

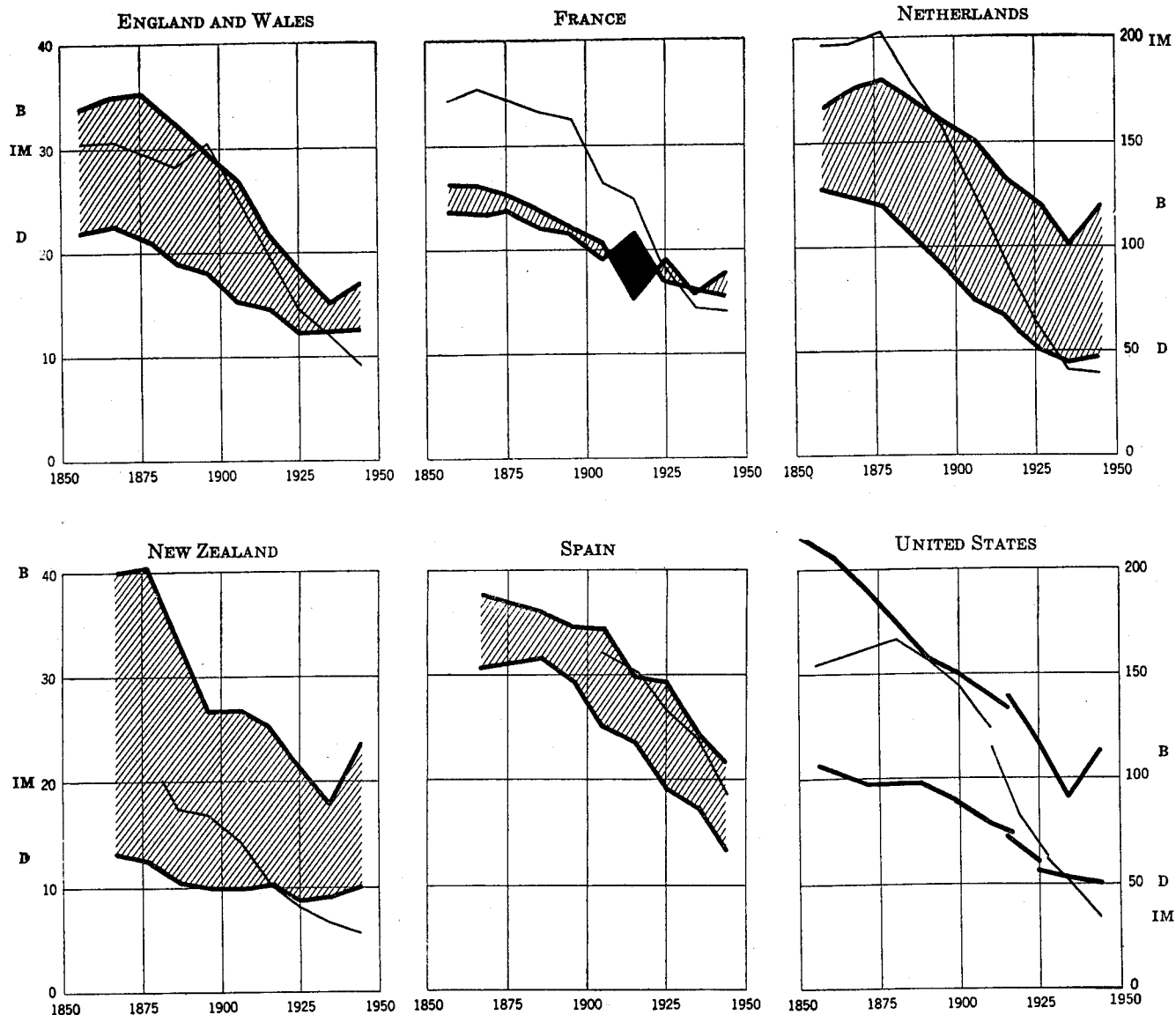
**FIGURE 1. BIRTH RATES, DEATH RATES, AND INFANT MORTALITY RATES IN SIX WESTERN COUNTRIES, 1850-1950**

Heavy lines: B=Birth rates; D=Death rates.

Light line: IM=Infant mortality rates.

*Birth and death rates (per 1,000 pop.)*

*Infant mortality rate (per 1,000 live births)*



century. The low birth rate gave a rather small margin of natural increase. This decline in birth and death rates continued, very gradually, until recent times. In the decade which included the First World War, there was an unusually high mortality combined with an unusually low fertility, resulting in an excess of deaths over births. During the depression of the 1930's, the birth rate once more fell somewhat below the death rate. A recovery of the birth rate has, however, been noted in recent years.

*Netherlands*

The demographic history of the Netherlands affords yet another contrast to the British pattern. There the death rate started higher and fell lower than in England and Wales. The fall in the birth rate, though considerable, was less drastic and fertility is still at a relatively high level. As a result, the margin of natural increase has been widening, and the population has been growing at an accelerated rate. A great drop has been registered in the infant mortality rate.



Around the middle of the last century, about one in five Dutch infants died in the first year of life; only one in forty died in 1949.

#### *New Zealand*

The history of New Zealand is unusual. In the middle of the last century, the population was very small and consisted only of recent immigrants. Until the beginning of the present century, most of the population increase was directly due to immigration. However, as the population grew larger, an increasing part of its growth was derived from the excess of births over deaths among the local population. The originally very high birth rates were those of a population made up in a large part of persons in parental ages. Similarly, the very low death rates at the beginning were due to the fact that a population consisting mostly of young adults is generally subject to low risks of death. In recent years, however, the population trends have approximated those of other western countries. The birth rate has fallen to a fairly low level, while the death rate has actually been rising. Infant mortality in New Zealand has fallen to record low levels.

#### *Spain*

Spain is a country where the demographic transition started in more recent times. The transition, however, has become more rapid than in countries where it began earlier. The fall in birth rates and death rates since the turn of the century has been very steep.

#### *United States*

Some reservation must be made with regard to the data for the United States. Complete registration of births and deaths has been achieved only in rather recent times. The data shown in figure 1 are largely estimates and relate to the white population only, since information on non-whites has been particularly defective until very recent years. In spite of these imperfections in the data, a consistent picture has been obtained. The population of the United States has grown rapidly, partly by natural increase of the population and partly by heavy immigration. The changes in vital rates in the United States are, therefore, intermediate between those found in England and Wales and those found in New Zealand. A constant flow of immigrants has maintained the birth rate at a somewhat higher level and the death rate at a somewhat lower level than the rates of England and Wales at corresponding periods of time. As a result, natural increase, although slowing down, has been fairly rapid.

### D. EFFECTS OF DEMOGRAPHIC TRANSITION ON AGE STRUCTURE

Some of the effects of the vital changes which have just been described are illustrated in figure 2.

For the present purpose, the population can be divided into three major age groups. Persons at ages between 20 and 65 may be regarded as the active persons; they carry the responsibility for the care of children and of the aged. The choice of age limits is arbitrary and does not have any precise meaning. Nevertheless, some age limit has to be selected in order to make valid comparisons. Persons at ages below 20 and above 65 can then be taken as parts of the population whose care is the responsibility of persons at intermediate ages.

The age composition of the population as shown by various national censuses has been examined and the following ratios have been computed: the numbers of persons at ages 65 and over per hundred persons aged 20 to 65; the numbers of persons aged less than 20 per hundred persons aged 20 to 65; and the sum of the two ratios as an indication of the total burden of dependency.

#### *England and Wales*

In England and Wales, the ratio of the aged to the active population remained at almost constant values—between 9 and 10 per cent—until about 1920; for a time, it even seemed to diminish somewhat. Since 1920, it has been increasing rapidly, to reach 17.9 in 1950. The ratio of children and adolescents to the active population, which rose somewhat around 1870, declined very sharply until about 1940, and has been nearly constant in recent years. The total dependency burden, which consisted until fairly recently mostly of children and adolescents, has become more and more an old-age burden. For a long time it decreased, but recently it seems to have shown a tendency to increase once more, as a result of the rapid increase in the proportion of older people.

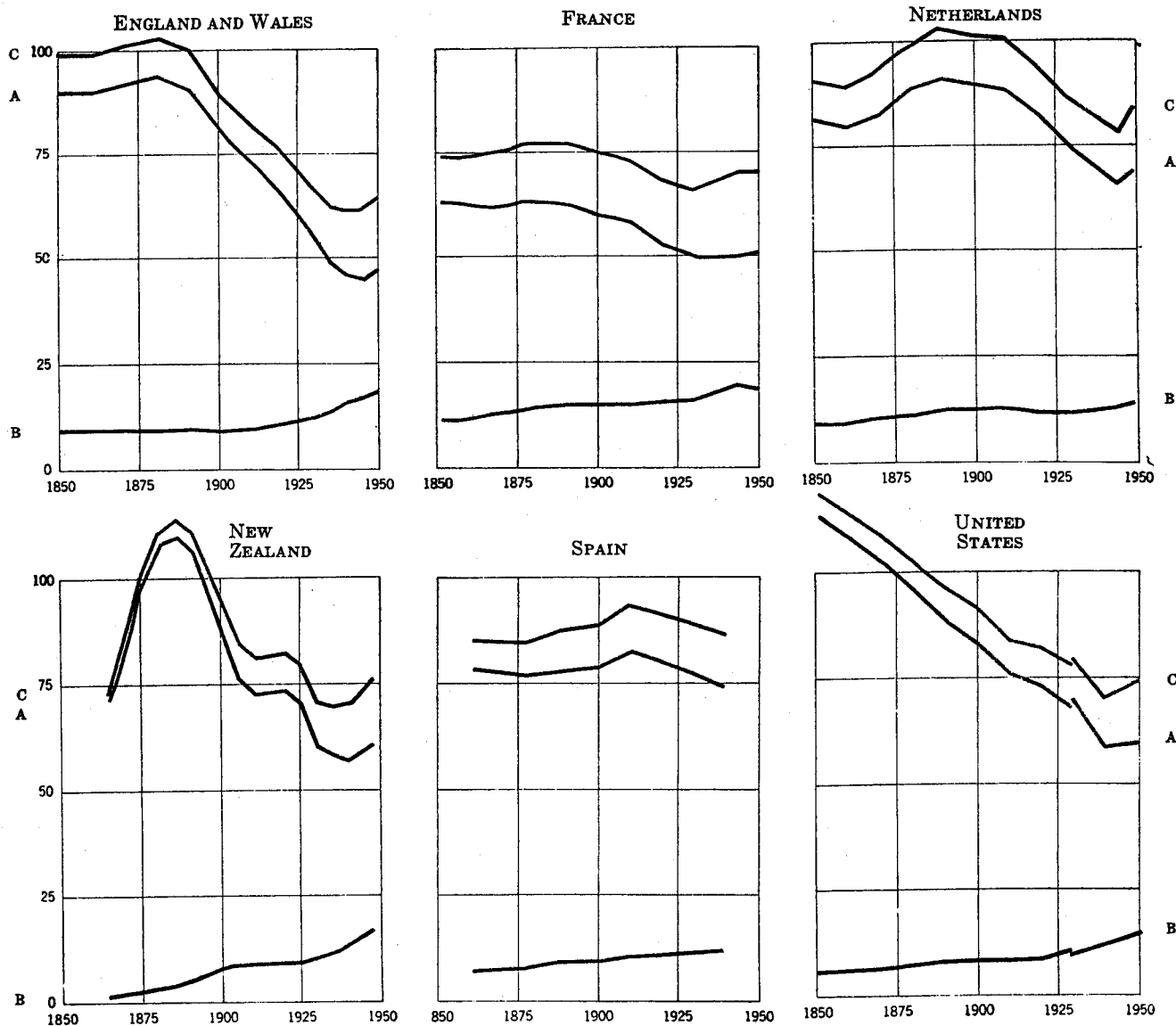
#### *France*

In France, where demographic changes have been rather slow, child dependency has been light for a long time and has diminished further, but not very sharply. Old-age dependency, on the other hand, was already high in the second half of the nineteenth century, and has become an increasing part of total dependency. Although the rise in the ratio of the aged has been very gradual, it attained 19.2 in 1950.

FIGURE 2. OBSERVED CHANGES IN AGE STRUCTURE IN SIX WESTERN COUNTRIES, 1850-1950

A=Number of persons aged under 15 per 100 persons aged 15-64  
 B=Number of persons aged 65 and over per 100 persons aged 15-64  
 c=Total dependency ratio (sum of A and B)

Number per  
 100 aged  
 15-64



*Netherlands*

In the Netherlands, where a rapid natural increase has been maintained until the present, the ratio of the aged rose very gradually and only in recent times has shown a tendency to rise faster. In 1949, it was estimated to have attained 14.0 per hundred persons of working ages. The decline in infant mortality raised the ratio of children and adolescents, which remained very

high until rather recently. The fall in childhood dependency in recent years has not been very rapid.

*New Zealand*

Changes in the age structure of New Zealand have been exceptional, because most of the population increase before the turn of the century was a result of immigration. At first, the age

structure of the New Zealand population resembled the age composition of the immigrant stream. Very few of the immigrants were at advanced ages; immigrant families, as a rule, were not exceedingly large. The young adult immigrants, however, quickly produced children, and the child population grew rapidly, while it was only very gradually that increasing numbers of individuals attained old age. During the twentieth century, immigration has fallen off, resulting at first in a decline in child dependency, and recently in a very rapid increase in the proportion of persons at advanced ages.

#### *Spain*

In Spain the figures show low, but gradually increasing, ratios of aged to active persons, and a rather recent decline in child dependency. There will probably be further declines in child dependency in the future, followed by an accelerated increase in the ratio of the aged.

#### *United States*

In the United States, child dependency, which was originally very high, has declined greatly. The ratio of the aged, which was at first very low, has increased gradually; this increase was, for a time, held in check by the influx of large numbers of immigrants, but has become rapid in recent years.

### E. HYPOTHETICAL EXPERIMENTS

#### 1. *The effect of declines in mortality*

In order to assess the probable rates of aging in the future, it is necessary to study separately the influence of changes in mortality, fertility and rates of migration. For this reason, a few experiments have been made with hypothetical population age structures.<sup>2</sup>

It is commonly thought that the increasing proportion of old people in the populations of western countries is due to the lengthening expectation of life, i.e., to declines in mortality. This supposition is examined in the first two experiments.

The first experiment deals with the effect of a reduction in mortality at ages 5 and over, such as has occurred in France during the last hundred years. Mortality conditions prior to the reduction are represented by the French life table for the years centring on 1850, computed by Bertillon, Sr.

Mortality in France at that time was lower than in most other countries of Europe, though

still high by the present-day standards of western nations. Mortality after the reduction is represented by the official French life table of 1933-1938. The amount of the difference is very roughly indicated by the fact that the death rate in France in about 1850 was around 24 per thousand, and that the average death rate for the 1930's was slightly under 16 per thousand. In calculating the effect of such a change, it is assumed that the whole reduction in mortality, which required some eighty or ninety years to be realized in France, has been telescoped in a period of thirty years. This assumption is made because, as has been shown above, recent progress in cutting down high death rates in some other countries—in Spain, for instance—has been faster than it was in France. The experiment, then, consists in calculating the age distribution which the French population would have assumed if the mortality rates of 1850 had continued unchanged, and in comparing this with the age distribution that would have been produced by a decline in these rates to the recent levels within thirty years. After thirty years, it is assumed that the mortality rates decline no more, so that the eventual consequences of the decline up to that time can be calculated. In order to isolate the influence of the mortality changes, all other factors have to be held constant; this is done by assuming that the fertility rates for various age groups remain constant at the levels which were required to replace the population under the 1850 mortality rate, and that there is no immigration or emigration.

It is desirable to distinguish between the effects of a decrease in early childhood mortality, and in mortality at ages over 5. Initially, therefore, mortality is assumed to decline only at ages 5 and over, the death rate in the age class under 5 being held constant at the high level of 1850. According to the life table, the infant mortality rate at that time was 167 per thousand births, and even that high figure may be an underestimate of the losses in the first year of life in France one hundred years ago.

The effect of the assumed trend, which is illustrated in figure 3 (I), is eventually to raise the ratio of persons over 65 to persons 20 to 64 from 15.3 per cent (the figure corresponding to the continued high mortality at all ages) to only 16.5 per cent. Evidently, the effect on aging of a decline in mortality at ages over 5, such as occurred in France, is not very important. The numbers of survivors at all ages are increased without much effect on the ratio of the older to the younger ones.

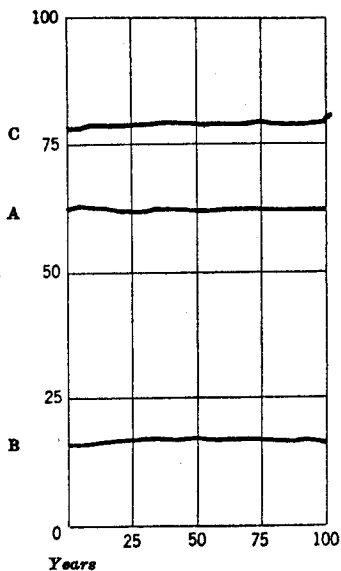
If the assumptions are changed so as to allow

<sup>2</sup>For a brief description of the methods used in these experiments, the reader is referred to appendix I.

**FIGURE 3. HYPOTHETICAL CHANGES IN AGE STRUCTURE OF STATIONARY POPULATIONS UNDER VARIOUS ASSUMPTIONS**

A=Number of persons aged under 15 per 100 aged 15-64  
 B=Number of persons aged 65 and over per 100 aged 15-64  
 C=Total dependency ratio (sum of A and B)

Number per 100 aged 15-64



**Assumption II. Decline in mortality at all ages**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60 and increases to about 75. Line B (y-axis 0-25) starts at approximately 15 and increases to about 20. Line C (y-axis 0-100) starts at approximately 75 and increases significantly to about 90.

**Assumption III. Simultaneous decline in mortality and fertility**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60 and decreases to about 50. Line B (y-axis 0-25) starts at approximately 15 and increases slightly to about 20. Line C (y-axis 0-100) starts at approximately 75 and remains relatively stable around 75.

**Assumption IV. Decline in mortality followed by decline in fertility**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60, peaks at about 75 around year 40, and then declines to about 50. Line B (y-axis 0-25) starts at approximately 15, peaks at about 20 around year 40, and then declines to about 15. Line C (y-axis 0-100) starts at approximately 75, peaks at about 90 around year 40, and then declines to about 70.

**Assumption V. War losses**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60 and fluctuates between 50 and 75. Line B (y-axis 0-25) starts at approximately 15 and remains relatively stable. Line C (y-axis 0-100) starts at approximately 75 and fluctuates between 70 and 80.

**Assumption VI. Effects of emigration**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60 and fluctuates between 55 and 65. Line B (y-axis 0-25) starts at approximately 15 and fluctuates between 20 and 30. Line C (y-axis 0-100) starts at approximately 75 and shows a slight upward trend to about 80.

**Assumption VII. Effects of immigration**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 60 and fluctuates between 55 and 65. Line B (y-axis 0-25) starts at approximately 15 and fluctuates between 20 and 30. Line C (y-axis 0-100) starts at approximately 75 and remains relatively stable around 75.

**Assumption VIII. Immigrant population only**

This graph shows three lines representing A, B, and C over a 100-year period. Line A (y-axis 0-100) starts at approximately 40 and increases to about 60. Line B (y-axis 0-25) starts at approximately 5 and increases to about 20. Line C (y-axis 0-100) starts at approximately 75 and increases to about 80.

mortality of children under 5, as well as of persons over that age, to decline, the effect is as shown in figure 3 (II). At first, a slight increase occurs in the ratio of the aged to the active population. After thirty years, however, this trend is reversed, so that there are finally only 13.0 aged per hundred active persons, instead of the original 15.3. The relative number of children and adolescents, on the other hand, increases rapidly, from an original 62.8 to an eventual 76.2 per cent of the active population.

The reason for this change is that, with a reduction in infant and child mortality there is much more frequent survival to early adult ages. The reduction in mortality at other ages also results in more frequent survival to old age, but the latter effect is not as important as the former. As the population grows, the proportion of children and adolescents increases most rapidly, that of adults less rapidly, and that of the aged least rapidly. The new proportions in each age group then become permanent.

The reduction in infant mortality results in more frequent survival to reproductive ages and consequently a constantly increasing number of births. This effect is more important, at least in the present example, than the effect on survival to old age. Although changes in mortality may occur in different ways, with more important decreases in mortality at advanced ages than at earlier ages, the observation made from the French life tables may be regarded as typical for western countries in recent times.

It must be concluded that the fall in infant mortality is important in keeping the population young. This conclusion is of some interest. In certain countries, particularly in Latin America, mortality is falling, while fertility remains high. It is probable that very rapid declines in infant mortality are taking place and will continue to take place in the near future. While child dependency is increasing rapidly, old-age dependency may even be decreasing. The decline in infant mortality, therefore, has an effect which is similar to that of an increase in fertility.

This effect has occurred in some western countries. In the Netherlands, for example, while child dependency rose considerably for a time, old-age dependency remained almost constant. This situation may bring about a shift in social attitudes, with greater concentration on responsibilities towards children, and relative neglect of the aged, who form only a small part of the total dependency burden. When, at some later time, trends in age structure lead to in-

creased old-age dependency, social attitudes may not be well prepared to meet the new demands.

## 2. *The effect of declines in fertility and mortality*

A third experiment assumes a simultaneous decline in mortality and fertility. Mortality at all ages declines, as before, for thirty years, while fertility declines during the same period to a level which will be sufficient, in the long run, to replace the population at the new low rates of mortality. The effects of these assumed changes upon the age distribution of the population are similar to those which occurred in France during the course of a century—a marked decline in child dependency at an early time, and a gradual increase in old-age dependency, as illustrated in figure 3 (III). The effect of declining fertility upon the number of children is immediate, whereas it takes a much longer time for the effect of declining mortality to become apparent in the age group above 65. Eventually, the total burden of dependency rises owing to the increase in the aged population. In such a population, an adjustment to this situation may not give rise to very acute problems. The increase in aged persons is sufficiently slow to allow for a reorientation of social attitudes.

In most of the other western countries, however, the decline in mortality preceded the decline in fertility. It is therefore realistic to change the assumptions once more and to assume that mortality declines for the first thirty years, while fertility declines in the following thirty years. The effect on age structure in this case is remarkably different, as seen in figure 3 (IV). There is, at first a period of heavy child dependency, due to the rapid fall in infant mortality; following this period, an unusually large number of survivors are drawn into adult ages, the persons who were born when fertility was still high and mortality was low. While these persons are in middle adult ages, the ratio of persons over 65 to persons aged 20 to 65 tends to be lowered. Eventually, however, this large group also enters old age, while the numbers of persons in middle adult ages are no longer increasing because of the declines in fertility in the second thirty-year period. The result, in the later stages, is a very rapid rise in the ratio of aged persons to the active population.

The experience of England and Wales has actually been quite similar to this. In the last quarter of the nineteenth century, the old-age dependency ratio was actually declining, although only slightly, while aging in the most

recent quarter-century has been very rapid. It is in this situation that a great flexibility of social attitudes is required. Attitudes may continue to be influenced by child dependency which was high in a not-too-distant past, and not be properly adjusted to meet the requirements of a rapidly increasing aged population.

### 3. *War hypothesis*

In some European countries, the two world wars have had severe demographic effects. The immediate effect of a war was a loss of males of military ages combined, in some cases, with an even heavier deficit in births. In the long run, these effects have brought about additional changes in age structure.

In order to isolate the effect of a major war, an example has been worked out, assuming the low mortality of the recent French life table (1933-1938) with a fertility sufficient for population replacement. No changes in mortality and fertility are assumed to occur. Further assumptions are made, involving heavy military losses and a large birth deficit in the first five years, similar in effect to the losses suffered by the population of France in the First World War (see figure 3 (V)).

As an immediate result of the birth deficit, the child dependency ratio declines. However, as adolescents who were not exposed to military casualty reach the ages of parenthood, child dependency rises again. It decreases once more as the depleted numbers of war-time babies move into the ages of parenthood. Also as an immediate result of the war, the old-age dependency ratio rises, for persons at advanced ages were not exposed to military casualty and the numbers in young adult ages were reduced. Some years after the war, old-age dependency declines, since persons at ages which were affected by casualties are reaching old age. As persons in active ages are not adequately replaced because of the war-time birth deficit, the ratio of the aged rises again until, some sixty-five years after the war, the war-born babies enter old age.

The First World War undoubtedly contributed to the recent aging of the French population. However, since over thirty years have passed, these war-time effects on aging are ebbing away. Meanwhile, as a result of the Second World War, a second cycle of aging has begun. Since, however, that war did not bring about a heavy birth deficit in France, it is likely that, after two or three decades, the effects on aging will diminish.

### 4. *Migration*

Using again a population of low fertility and low mortality, as in the last example, three different assumptions are made with regard to migration. In each case it is assumed that a migratory movement will continue for a period of thirty years and then suddenly discontinue. Furthermore, it is assumed that the age composition of the migrant population will be the same as that of emigrants from Norway in the year 1900, consisting mostly of young adults, many of whom had young children with them; emigrants of advanced ages were rare. The annual number of migrants is assumed to be 1 per cent of the original population, which implies a very heavy rate of migration.

In the first example, as depicted in figure 3 (VI), the effect of emigration is considered. While the number of adults under 65 is greatly reduced, the number of aged persons remains almost the same, resulting in a greatly increased old-age dependency ratio. When emigration discontinues, after thirty years, it takes another thirty years for old-age dependency to return to its initial level. Such heavy emigration has not been experienced in any western country, except perhaps in Ireland in the last century. Nevertheless, it may be inferred that the cessation of large-scale migration from certain European countries after the First World War has somewhat counteracted the trend towards an aging population.

In the second example, the effect of immigration is examined and shown in figure 3 (VII). About ten years after the onset of immigration, child dependency rises as young immigrants begin to have families. This rise continues until immigration is ended. Old-age dependency, on the other hand, declines, since the population is replenished by the inflow of young people. After the discontinuance of immigration, old-age dependency rises again, since former immigrants are also reaching old age. A high peak of aging is obtained some thirty to forty years after the cessation of immigration. This example helps to explain the trends in the United States. Since large-scale immigration to the United States tapered off following the First World War, it is likely that aging in the United States in recent years has been more rapid than it would have been had large-scale immigration continued.

In the final example, which is illustrated in figure 3 (VIII), it is assumed that a country had no population at the beginning and that its population has been built up over a period of

thirty years by immigration and the subsequent natural increase of the immigrants. As immigration begins, the age distribution of the population is the same as that of the migrants. With continued immigration, further young immigrants are added each year to the aging former immigrants. As young immigrants begin to set up new families, child dependency rises. As immigration discontinues, child dependency falls off again. Old-age dependency is very slight at first and rises only very slowly. However, as immigration discontinues, old-age dependency rises very rapidly. A similar situation exists in New Zealand, where until rather recently only a small number of persons were in the advanced ages, but where in recent time the population has been aging very rapidly.

#### F. CONCLUSIONS

Future prospects of an aging population may be evaluated in terms of the results of these experiments. Infant mortality rates in some western countries have already reached such low levels that further reduction cannot be very spectacular. With the increasing control of degenerative diseases, such as cancer, future improvements can be expected to occur mainly at the ages of from 40 upwards. In such an event, future reductions in mortality will result in further chronological aging, but an increasing proportion of the aged will continue to enjoy good health.

The future of fertility is difficult to predict. We have witnessed in recent years a marked revival of birth rates in most western countries. However, the opinions of experts differ as to how long this revival of fertility can be sustained. It is possible that fertility in the future will be somewhat higher than it was in the 1930's, when there was a severe economic crisis. However, it may not continue at quite as high a level as has been experienced in recent years. Even though fertility has risen, it will be a long time before its effects on aging are felt. In the coming decade, it is the small generation born in the 1930's which will be moving into adult ages; relatively small numbers of adults, consequently, will have to provide both for the increased numbers of aged persons and for the recently increased numbers of children and adolescents. Not until about fifteen or twenty years from now will the numerous recent births enter the adult ages and thereby tend to lessen the burden of old-age dependency. Therefore fur-

ther increases in old-age dependency, at least for another fifteen years, must be anticipated. Following that time, there may be some decline in the ratio of the aged to the active population, but only if birth rates remain fairly high.

In many European countries, the two world wars will continue to have effects on aging. In Germany, for example, young adults, who were not very numerous as a result of the birth deficit of the First World War, have been further depleted as a result of the heavy casualties of the Second World War. In this case, the two world wars have reinforced each other with regard to their effects on aging. Not until thirty to thirty-five years from now, when these adults themselves have reached old age, is there likely to be much reduction in old-age dependency.

It is not very probable that large-scale migrations will take place in the near future. This has been partly prevented by the depletion of the number of young adults in European countries through the combined effect of wars and low fertility in the inter-war years. Young adults have become particularly indispensable in these top-heavy age structures and may not be spared in large numbers in the future. The slackening of immigration in America and Oceania, on the other hand, has resulted in a rapid aging of the populations of the newly settled continents. The climax of the effect of this factor may already have been reached, for it has been some thirty to forty years since mass migration was discontinued. It is true that Australia and New Zealand have experienced a marked pick-up in immigration in recent years which, if continued over a long period, may halt the increase in the proportion of aged persons.

In Latin America, the Soviet Union and Japan, where mortality is declining rapidly and fertility has begun its downward trend, the populations are at present rather young, and the proportions of the aged are small. However, if fertility falls off rapidly, as it has in recent decades in Spain, there may be very rapid aging some decades hence.

Further increases in the number of aged persons are inevitable for most western countries. Attention must therefore be directed towards improving the quality of life in old age. Good health, opportunities for useful activity and a wholesome attitude on the part of younger persons are likely to make life at advanced ages more meaningful and remove from it some of the penalties which, often unjustly, are associated with it at the present time.

## APPENDIX I

### Methodological notes on projections of hypothetical populations

The starting point for the first four projections was the French life table (by Bertillon, Sr.) for the years centring on 1850. The numbers of survivors to various ages from a constant number of births, as given by the life table, were taken as the model of an initially stationary population, being the result of constant mortality conditions such as those in France *circa* 1850, combined with a constant birth rate sufficient for exact replacement of the population. The number of births per thousand persons aged 20 to 45 (i.e., in reproductive ages) was found to be 70.69, giving a birth rate of 25.0 per thousand of the total population.

A similar stationary population was constructed on the basis of the French life table for 1933-1938. The birth rate per thousand persons aged 20 to 45 necessary for exact replacement of a population with 1933-1938 rates of mortality was found to be 48.24, or 17.0 per thousand of the total population. Five-year survival ratios were computed from both life tables. On all the first four assumptions, survival ratios were estimated by straight-line interpolations for six successive five-year periods, beginning with the values of the 1850 life table and ending with those of the 1933-1938 life table. After the thirty years represented by these six intervals, survival ratios were held constant at the 1933-1938 levels. By means of these ratios, the initially stationary population was "aged", in successive intervals, in a manner to represent declining mortality. In the first two assumptions, births in each interval were computed on the basis of a constant birth rate per thousand persons aged 20 to 45 (70.69).

On the first assumption, a further modification was applied to survival ratios. Survival from birth to ages 0 to 4 was held constant throughout at the 1850 level. The survival ratio from ages 0 to 4 to ages 5 to 9 was also computed on the assumption of 1850 levels of mortality at ages under 5 combined with 1933-1938 rates of mortality at ages 5 to 9. Survival ratios for these ages were then interpolated for the first thirty years, beginning with that of 1850 mortality at all ages (ages 0 to 4 as well as 5 to 9), and ending with the computed "hybrid" ratio; the "hybrid" ratio was then held constant for the remaining periods.

The computations for the second assumption differ from those of the first in that the original interpolations of survival ratios apply to all ages.

On the third assumption, survival ratios were as on the second assumption, but births were computed by interpolating the birth rate per thousand persons aged 20 to 45 from 70.69 at

the beginning of the period to 48.24 at the close of the thirty-year period, and holding the rate thenceforth at 48.24.

On the fourth assumption, survival ratios were as on the second and third assumptions; the birth rate per thousand persons aged 20 to 45 was held constant at 70.69 for the first thirty years, then interpolated to reach 48.24 in the ensuing thirty years, after which it was held constant at the latter level.

For the fifth to the seventh projections, the French life table of 1933-1938 was taken as the starting point. Mortality and fertility at the level sufficient for replacement (48.24 births per thousand persons aged 20 to 45) were held constant.

In the fifth projection, it was assumed that, during the first five years, there was a birth deficit of 50 per cent below the number of births which would normally have been expected. Military casualties amounting to 3.5 per cent of persons aged 15 to 19, 15 per cent of persons aged 20 to 24, 20 per cent of persons aged 25 to 29, 15 per cent of persons aged 30 to 34, 10 per cent of persons aged 35 to 39, 4 per cent of persons aged 40 to 44, and 2 per cent of persons aged 45 to 49 were assumed. (This age distribution of military deaths is similar to that of German military deaths in the First World War, taking into account the aging during the five-year interval.) After the first five-year interval, the population was "aged" with mortality and fertility rates held constant at the level of those of the initial population.

In the sixth projection, it was assumed that emigration took place at an initial rate of 1 per cent of the total population per annum. The age distribution of the initial migrants was assumed to be that of emigrants from Norway in the year 1900. From this, the "age-specific propensities to emigrate" were computed and were combined with life-table survival rates to give age-specific percentages of persons remaining alive within the country during five-year periods. The population was then "aged" by means of these percentages for the first thirty years. After thirty years, emigration was assumed to have discontinued, and the initial life-table survival values were applied.

In the seventh projection, the initial age-specific mortality and fertility rates were held constant, and to the resulting population was added an annual number of immigrants (age distribution of emigrants from Norway in 1900) amounting to 1 per cent of the total population. The number of immigrants added increased as the total population grew by immi-



gration. The immigrants were "aged" after their arrival on the assumption of mortality and fertility rates like those of the initial population. It was assumed that, after thirty years, the immigration was discontinued, but that survivors and offspring of previous immigrants, projected

on the basis of constant mortality and fertility rates, continued to be added to the population.

In the eighth projection, the initial population was taken as zero, and immigrants and their offspring were treated as in the seventh projection.

## APPENDIX II

### Tables

TABLE 1 A. NUMBER OF LIVE BIRTHS PER THOUSAND POPULATION FOR SELECTED COUNTRIES, 1850-1950<sup>a</sup>

Period	England and Wales	France	Netherlands	New Zealand	Spain	United States (white population)
1851-1860....	34.1	26.3	33.5	—	—	43.3 <sup>c</sup>
1861-1870....	35.2	26.3	35.3	40.2	37.9	41.4 <sup>c</sup>
1871-1880....	35.4	25.4	36.3	40.6	—	38.3 <sup>c</sup>
1881-1890....	32.5	23.9	34.2	33.8	36.2	35.2 <sup>c</sup>
1891-1900....	29.9	22.2	32.6	26.7	34.8	31.5 <sup>c</sup>
1901-1910....	27.2	20.6	30.6	26.8	34.5	30.1 <sup>c</sup> 26.8 <sup>d</sup>
1911-1920....	21.8	15.2	26.9	25.1	30.0	28.2 <sup>e</sup>
1921-1930....	18.3	18.8	24.5	21.0	29.4	23.6 <sup>e</sup>
1931-1940....	14.9	15.5	20.8	17.7	24.5	18.2 <sup>e</sup>
1941-1950....	16.9	17.7	24.1	23.6	21.5	22.6 <sup>e</sup>

<sup>a</sup>Rates represent annual averages for each decennial period.

<sup>b</sup>Estimated rates.

<sup>c</sup>Estimates for the years 1850, 1860, 1870, 1880, 1890 and 1900 respectively derived from census statistics.

<sup>d</sup>Average of estimates derived from census statistics for 1910 and 1920.

<sup>e</sup>Estimated rates derived from birth statistics, allowing for under-registration of births.

TABLE 1 B. NUMBER OF DEATHS PER THOUSAND POPULATION FOR SELECTED COUNTRIES, 1850-1950<sup>a</sup>

Period	England and Wales	France	Netherlands	New Zealand	Spain	United States
1851-1860....	22.2	23.9	25.7	—	—	21.4 <sup>b</sup>
1861-1870....	22.5	23.6	25.0	13.0	30.8	19.5 <sup>c</sup>
1871-1880....	21.4	23.7	24.3	12.3	—	19.6 <sup>d</sup>
1881-1890....	19.1	22.1	21.0	10.4	31.8	19.6 <sup>d</sup>
1891-1900....	18.2	21.5	18.4	9.8	29.5	18.2 <sup>d</sup>
1901-1910....	15.3	19.4	15.2	9.8	25.2	16.2 <sup>d</sup>
1911-1920....	14.4	21.8	13.4	10.0	23.5	14.6 <sup>d</sup> 14.6 <sup>e</sup>
1921-1930....	12.1	17.0	10.2	8.6	19.1	12.2 <sup>e</sup> 11.2 <sup>f</sup>
1931-1940....	12.3	15.8	8.9	8.7	17.3	10.6 <sup>f</sup>
1941-1950....	12.4	15.5	9.6	9.7	13.0	10.0 <sup>f</sup>

<sup>a</sup>Rates represent annual averages for each decennial period.

<sup>b</sup>Massachusetts rate in 1855.

<sup>c</sup>Massachusetts rate for 1868-1872.

<sup>d</sup>Massachusetts rates for 1873-1882, 1883-1892, 1893-1902, 1903-1912 and 1913-1922 respectively.

<sup>e</sup>Rates in original registration States (whose population was predominantly white.)

<sup>f</sup>White death rates in entire registration area.

TABLE 1 C. NUMBER OF INFANT DEATHS PER THOUSAND LIVE BIRTHS FOR SELECTED COUNTRIES, 1850-1950<sup>a</sup>

Period	England and Wales	France	Netherlands	New Zealand	Spain	United States (white population)
1851-1860....	154	173	198	—	—	155 <sup>b</sup>
1861-1870....	154	178	199	—	—	—
1871-1880....	149	172	204	101 <sup>c</sup>	—	167 <sup>b</sup>
1881-1890....	142	167	178	87	—	158 <sup>b</sup>
1891-1900....	153	164	158	84	—	145 <sup>b</sup>
1901-1910....	128	133	124	72	161	125 <sup>b</sup> 115 <sup>d</sup>
1911-1920....	100	125	94	51	151	83 <sup>d</sup>
1921-1930....	72	92	63	40	134	63 <sup>d</sup> 67 <sup>e</sup>
1931-1940....	59	72	41	32	121	51 <sup>e</sup>
1941-1950....	45	70	40	27	93	34 <sup>e</sup>

<sup>a</sup>Rates represent annual averages for each decennial period.

<sup>b</sup>Life-table death rates under 1 year in Massachusetts in 1855, 1878-1882, 1890, 1900-1902 and 1909-1911 respectively.

<sup>c</sup>1875-1880 only.

<sup>d</sup>Original registration States, 1909-1911, 1919-1920 and 1929 respectively.

<sup>e</sup>Rates in entire registration area.

TABLE 2. NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64 FOR SELECTED COUNTRIES, 1850-1950

Country and year	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
<b>England and Wales</b>			
1851.....	90.3	9.2	99.5
1861.....	90.4	9.3	99.7
1871.....	92.2	9.5	101.7
1881.....	94.1	9.3	103.4
1891.....	90.5	9.5	100.0
1901.....	80.1	8.8	88.9
1911.....	72.6	9.5	82.1
1921.....	64.9	10.6	75.5
1931.....	53.9	12.3	66.2
1936.....	48.9	13.5	62.4
1941.....	45.6	15.5	61.1
1946.....	44.5	16.8	61.3
1950.....	46.4	17.9	64.3
<b>France</b>			
1851.....	62.9	11.3	74.2
1856.....	62.6	11.1	73.7
1861.....	62.3	11.6	73.9
1866.....	61.9	12.6	74.5
1872.....	62.2	13.0	75.2

TABLE 2. NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64 FOR SELECTED COUNTRIES, 1850-1950 (cont.)

Country and year	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
<b>France (cont.)</b>			
1876.....	63.1	13.5	76.6
1881.....	62.7	14.3	77.0
1886.....	62.7	14.2	76.9
1891.....	62.0	14.7	76.7
1896.....	61.1	14.7	75.8
1901.....	59.7	14.6	74.3
1906.....	59.2	14.7	73.9
1911.....	58.0	14.7	72.7
1921.....	52.7	15.5	68.2
1931.....	49.8	15.7	65.5
1945.....	49.9	19.8	69.7
1950.....	50.8	19.2	70.0
<b>Netherlands</b>			
1849.....	81.2	9.0	90.2
1859.....	79.7	9.2	88.9
1869.....	82.0	10.6	92.6
1879.....	88.1	10.8	98.9
1889.....	90.6	12.2	102.8
1899.....	89.3	12.1	101.4
1909.....	88.3	12.3	100.6
1920.....	82.1	11.4	93.5
1930.....	74.4	11.5	85.9
1945.....	64.9	13.0	77.9
1949.....	67.9	14.0	81.9
<b>New Zealand</b>			
1864.....	71.3	1.1	72.4
1867.....	76.6	1.5	78.1
1871.....	87.3	2.0	89.3
1874.....	97.5	2.4	99.9
1881.....	108.1	3.0	111.1
1886.....	110.1	3.9	114.0
1891.....	106.5	4.8	111.5
1896.....	96.5	6.0	102.5
1901.....	86.1	7.9	94.0
1906.....	76.5	8.5	85.0
1911.....	72.7	8.6	81.3
1921.....	73.3	8.9	82.2
1926.....	70.3	9.1	79.4
1931.....	60.5	10.1	70.6
1936.....	58.3	11.1	69.4
1941.....	57.2	13.0	70.2
1948.....	60.1	16.3	76.4
<b>Spain</b>			
1860.....	77.8	7.2	85.0
1877.....	76.8	7.7	84.5
1887.....	77.8	9.5	87.3
1900.....	78.9	9.7	88.6
1910.....	82.5	10.6	93.1
1920.....	80.4	10.9	91.3
1930.....	77.4	11.6	89.0
1940.....	74.1	12.2	86.3
<b>United States white population:</b>			
1850.....	113.9	5.8	119.8
1870.....	103.0	6.4	109.4
1880.....	95.7	7.2	102.9
1890.....	88.5	7.9	96.4
1900.....	83.5	8.1	91.6
1910.....	76.1	8.2	84.3
1920.....	73.4	8.8	82.2
1930.....	68.1	10.2	78.3
<b>United States total population:</b>			
1930.....	69.6	9.7	79.3
1940.....	58.6	11.7	70.3
1950.....	59.6	14.2	73.8

TABLE 3 (I). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF DECLINE IN MORTALITY AT AGES 5 AND OVER, FOR ONE HUNDRED YEARS (ASSUMPTION I)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	62.8	15.3	78.1
5	62.9	15.4	78.3
10	62.8	15.7	78.5
15	62.6	16.0	78.6
20	62.3	16.2	78.5
25	62.2	16.4	78.6
30	62.2	16.5	78.7
35	62.5	16.6	79.1
40	62.7	16.7	79.4
45	62.5	16.6	79.1
50	62.4	16.6	79.0
55	62.4	16.5	78.9
60	62.4	16.5	79.0
65	62.6	16.6	79.2
70	62.6	16.6	79.2
75	62.6	16.5	79.1
80	62.5	16.5	79.0
85	62.5	16.4	78.9
90	62.5	16.4	78.9
95	62.5	16.5	79.0
100	62.5	16.5	79.1

TABLE 3 (II). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF DECLINE IN MORTALITY AT ALL AGES FOR ONE HUNDRED YEARS (ASSUMPTION II)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	62.8	15.3	78.1
5	63.1	15.4	78.5
10	64.1	15.7	79.8
15	65.7	16.0	81.7
20	67.9	16.2	84.1
25	70.0	16.3	86.3
30	72.0	16.3	88.3
35	73.7	16.1	89.8
40	74.8	15.7	90.5
45	75.4	15.3	90.7
50	75.7	14.8	90.5
55	76.0	14.3	90.3
60	76.2	13.8	90.0
65	76.3	13.4	89.7
70	76.3	13.1	89.4
75	76.3	12.9	89.2
80	76.2	12.9	89.0
85	76.1	12.9	89.0
90	76.1	12.9	89.0
95	76.2	13.0	89.2
100	76.2	13.0	89.2

TABLE 3 (III). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF SIMULTANEOUS DECLINE IN FERTILITY AND MORTALITY FOR ONE HUNDRED YEARS (ASSUMPTION III)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	62.8	15.3	78.1
5	62.7	15.4	78.1
10	62.2	15.7	77.9
15	61.5	16.0	77.5
20	60.3	16.2	76.5
25	58.7	16.4	75.1
30	57.0	16.5	73.5
35	55.5	16.6	72.1
40	54.3	16.8	71.1
45	53.6	16.9	70.5
50	53.5	17.1	70.6
55	53.5	17.4	70.9
60	53.3	17.7	71.0
65	53.0	18.2	71.2
70	52.8	18.7	71.5
75	52.8	19.1	71.9
80	52.9	19.3	72.2
85	53.1	19.5	72.6
90	53.2	19.5	72.7
95	53.2	19.3	72.5
100	53.0	19.1	72.2

TABLE 3 (V). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF LOW FERTILITY AND MORTALITY, WITH WAR LOSSES, FOR ONE HUNDRED YEARS (ASSUMPTION V)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	53.0	19.2	72.2
5	50.2	21.1	71.3
10	48.8	21.0	69.8
15	47.1	21.0	68.1
20	46.0	20.8	66.8
25	55.2	21.9	77.1
30	55.3	21.5	76.9
35	54.6	20.6	75.2
40	52.7	19.3	72.0
45	51.1	18.5	69.6
50	51.2	18.9	70.1
55	52.4	20.2	72.6
60	53.8	21.4	75.2
65	55.2	22.3	77.5
70	53.3	17.8	71.1
75	52.6	17.8	70.4
80	52.3	18.3	70.6
85	52.5	19.2	71.7
90	53.0	19.9	72.9
95	53.3	19.9	73.2
100	53.4	19.6	73.1

TABLE 3 (IV). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF DECLINE IN MORTALITY FOLLOWED BY DECLINE IN FERTILITY, FOR ONE HUNDRED YEARS (ASSUMPTION IV)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	62.8	15.3	78.1
5	63.1	15.4	78.5
10	64.1	15.7	79.8
15	65.7	16.0	81.7
20	67.9	16.2	84.1
25	70.0	16.3	86.3
30	72.1	16.3	88.3
35	73.2	16.1	89.2
40	72.6	15.7	88.3
45	70.6	15.3	85.9
50	67.3	14.8	82.1
55	63.7	14.4	78.1
60	60.4	14.0	74.4
65	57.5	13.9	71.4
70	55.5	13.9	69.5
75	54.3	14.3	68.6
80	53.8	14.9	68.7
85	53.6	15.7	69.3
90	53.2	16.6	69.8
95	52.9	17.6	70.5
100	52.8	18.6	71.4

TABLE 3 (VI). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF LOW FERTILITY AND MORTALITY, WITH EMIGRATION, FOR ONE HUNDRED YEARS (ASSUMPTION VI)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	53.0	19.2	72.2
5	54.0	20.5	74.5
10	55.0	21.9	76.9
15	54.7	23.3	78.0
20	53.4	24.8	78.2
25	52.1	26.6	78.7
30	52.0	28.6	80.6
35	52.1	29.0	81.1
40	52.2	28.1	80.3
45	52.9	25.9	78.8
50	53.9	22.9	76.8
55	54.4	20.3	74.7
60	54.1	18.6	72.7
65	53.2	17.8	71.0
70	52.4	17.7	70.1
75	52.2	18.4	70.6
80	52.6	19.5	72.1
85	53.2	20.2	73.4
90	53.6	20.0	73.6
95	53.4	19.4	72.8
100	53.0	18.9	71.9

TABLE 3 (VII). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF LOW FERTILITY AND MORTALITY, WITH IMMIGRATION, FOR ONE HUNDRED YEARS (ASSUMPTION VII)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
0	53.0	19.2	72.2
5	52.1	18.2	70.3
10	51.8	17.1	68.9
15	52.5	16.2	68.7
20	53.8	15.5	69.3
25	55.1	14.8	69.9
30	54.9	14.1	69.0
35	54.4	14.1	68.5
40	54.1	14.5	68.6
45	53.3	15.6	68.9
50	52.5	17.0	69.5
55	52.4	18.4	70.8
60	52.7	19.3	72.0
65	53.1	19.8	72.9
70	53.4	19.7	73.1
75	53.4	19.5	72.9
80	53.1	19.1	72.2
85	52.8	18.8	71.6
90	52.8	18.9	71.7
95	52.9	19.4	72.3
100	53.1	19.5	72.6

TABLE 3 (VIII). EXPECTED NUMBER OF PERSONS AGED 0 TO 19 AND 65 AND OVER PER HUNDRED PERSONS AGED 20 TO 64, ACCORDING TO ASSUMPTION OF IMMIGRANTS ONLY, FOR ONE HUNDRED YEARS (ASSUMPTION VIII)

Time period (years)	Age groups (years)		
	0 to 19	65 and over	0 to 19 and 65 and over
5	38.4	1.6	40.0
10	42.8	1.7	44.5
15	49.8	1.9	51.7
20	56.6	2.2	58.8
25	60.8	2.5	63.3
30	59.0	2.7	61.7
35	57.4	3.3	60.7
40	56.2	5.1	61.3
45	53.9	8.4	62.3
50	51.5	12.7	64.2
55	51.2	16.8	68.0
60	52.0	19.5	71.5
65	53.3	20.8	74.1
70	54.0	20.6	74.6
75	54.2	20.0	74.2
80	53.4	18.7	72.1
85	52.5	17.9	70.3
90	52.2	18.3	70.5
95	52.7	19.6	72.3
100	53.2	20.0	73.2

### APPENDIX III

#### Sources of data

##### A. Age distribution

##### ENGLAND AND WALES

United Kingdom, Royal Commission on Population: *Reports and selected papers of the statistics committee*, Vol. II. London, 1950. (Covers census years 1851, 1861, 1871, 1881, 1891, 1901 1911, 1921, 1931, and estimates for 1936, 1941, 1946.)

##### FRANCE

France, Institut national de la statistique et des études économiques. *Annuaire statistique, 1946*. cinquante-septième vol. *Résumé rétrospectif*. Paris, 1947. (Covers census years 1851 to 1936.)

—: *Recensement général de la population, 1946. Premiers résultats détaillés*. Paris, 1949.

France, Statistique de la France: *Résultats généraux du dénombrement de 1861*, deuxième série, tome xiii. Strasbourg, 1864. (Covers census years 1851, 1856, 1861.)

—: *Résultats généraux du dénombrement de 1866*, deuxième série, tome xvii. Strasbourg, 1869.

—: *Résultats généraux du dénombrement de 1872*, deuxième série, tome xxi. Paris, 1873.

France, Statistique générale: *Résultats statistiques du dénombrement de 1881*, Paris, 1883. (Covers census years 1876, 1881.)

—: *Annuaire statistique de la France 1889*, douzième vol. Nancy, 1889. (Covers census of 1886.)

—: *Annuaire statistique de la France 1895/96*, seizième vol. Paris, 1896. (Covers census of 1891.)

—: *Annuaire statistique de la France 1910*, trentième vol. Paris, 1911. (Covers census of 1906.)

League of Nations: *Statistical yearbook of the League of Nations, 1928*. Geneva, 1929. Table 6. (Covers census years 1911, 1921.)

—: *Statistical yearbook of the League of Nations, 1941/42*. Geneva, 1943. Table 3. (Covers census years 1931, 1936.)

##### NETHERLANDS

League of Nations: *Statistical yearbook of the League of Nations 1933-1934*. Geneva, 1934. Table 3. (Covers census years 1920-1930.)

Netherlands, *Centraal Bureau voor de Statistiek: Jaarcijfers voor het Koninkrijk der Nederland. Rijk in Europa, 1915*. The Hague, 1917. (Covers census years 1830, 1840, 1849, 1859, 1869, 1879, 1899, 1909.)

—: *Statistisch zakboek 1950*. Utrecht, 1951. (Covers estimates 1939, 1949.)

##### NEW ZEALAND

League of Nations: *Statistical yearbook of the League of Nations, 1933-1934*. Geneva, 1934. Table 3. (Covers 1921 census and 1931 estimate.)

New Zealand, Census and Statistics Office: *Results of census of the Dominion of New Zealand, 1921*. (Covers census years 1881, 1886, 1891, 1896, 1901, 1911, 1916, 1921.)

———: *The New Zealand official yearbook, 1947-1949, Appendices*. Wellington, 1950. (Covers census years 1936, 1945.)

New Zealand, Registrar-General's Office: *Results of a census of the Colony of New Zealand, 1874*. Wellington, 1875. (Covers census years 1864, 1867, 1871, 1874.)

———: *Statistics of the Colony of New Zealand, 1859*. Wellington, 1860. (Covers census year 1858.)

———: *Statistics of the Colony of New Zealand, 1888*. Wellington, 1889. (Some data for 1878 census.)

#### SPAIN

League of Nations: *Statistical yearbook of the League of Nations, 1935-1936*. Geneva, 1936. Table 3. (Covers census year 1930.)

Spain, Instituto geográfico catastral y de estadística: *Censo de la población de España 1920*, Vol. III. Madrid, 1924. (Covers census years 1900, 1910, 1920.)

Spain, Instituto geográfico y de estadística: *Anuario estadístico de España 1860/61*. Madrid, 1862-1863.

———: *Censo de la población de España 1877*, Vol. II. Madrid, 1879.

———: *Censo de la población de España 1887*, Vol. II. Madrid, 1889.

Spain, Instituto nacional de estadística: *Anuario estadístico de España 1949, año XXIV*. Madrid, 1950. (Covers census year 1940.)

#### UNITED STATES

United Nations: *Demographic Yearbook, 1951*.

United States, Bureau of Census: *Historical statistics of the United States, 1789-1945*. Washington, 1949.

##### B. Vital statistics, 1850-1936

France, Statistique générale de la France: *Statistique internationale du mouvement de la population d'après les registres de l'état civil jusqu'en 1905. Résumé rétrospectif*. Paris, 1907.

———: *Statistique internationale du mouvement de la population d'après les registres de l'état civil, années 1901 à 1910*. Paris, 1913.

(The two above-mentioned volumes contain data for France, England and Wales and the Netherlands for the period 1851-1910; New Zealand for the period 1861-1874; Spain for the periods 1858-1870, 1878-1910.)

Institut international de statistique: *Annuaire international de statistique. Mouvement de la population (Europe)*. Vol. II. The Hague, 1917. (Data for France, 1877-1885; England and Wales, 1876-1913; Netherlands, 1875-1913; Spain 1878-1913.)

———: *Annuaire international de statistique. Mouvement de la population (Afrique, Asie, Océanie)*, Vol. V. The Hague, 1921. (Data for New Zealand 1876-1915.)

———: *Aperçu annuel de la démographie des divers pays du monde, 1922*. The Hague, 1923. (Data for France, England and Wales and the Netherlands for period 1915-1922; New Zealand, for 1912-1922.)

———: *Aperçu de la démographie des divers pays du monde 1931*. The Hague, 1932. (Data for France, England and Wales, Netherlands, New Zealand for 1908-1913, 1921-30.)

———: *Aperçu de la démographie des divers pays du monde 1929-1936*. The Hague, 1939. (Data for France, England and Wales, Netherlands and New Zealand for period 1921-1936; for Spain, 1921-1935.)

League of Nations: *Statistical yearbook of the League of Nations, 1928*. Geneva, 1929. (Data for England and Wales, France, Netherlands, Spain and New Zealand for periods 1905-1909, 1921-1925, 1927.)

Linder, F. E., and Grove, R. D.: *Vital statistics rates in the United States, 1900-1940*. National Office of Vital Statistics. Washington, 1943.

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United States, Bureau of the Census: *Historical Statistics of the United States, 1789-1945*. Washington, 1949.

United States, National Office of Vital Statistics: *Births and birth rates in the entire United States, 1909-1948*. Vital Statistics—Special Reports. Vol. 33, No. 8. Washington, 1950.

##### C. Vital statistics, 1936-1950

United Nations: *Demographic Yearbook, 1949-1950*.

##### D. Life tables

France, Statistique générale de la France: *Statistique internationale du mouvement de la population d'après les registres de l'état civil jusqu'en 1905. Résumé rétrospectif*. Paris, 1907.

United Nations: *Demographic Yearbook, 1948*.

##### E. Age distribution of migrants from Norway

Ferenzi, I.: *International migrations*, Vol. I. New York, 1929.

##### F. Age distribution of German military casualties

Lorimer, F.: *The population of the Soviet Union: history and prospects*. League of Nations. Geneva, 1946.