GLOBAL PROSPECTS FOR POPULATION
GROWTH AND DISTRIBUTION

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ABSTRACT

Accurate estimates of future populations are out of reach
of present techniques; the methods actually used, however they
are described, are extrapolations of past trends and cannot
anticipate turning points in births or other components. The
present paper is no exception. It summarizes the errors of past
work in the expectation that these will indicate the accuracy of
the figures here contained. The method used in this paper is to
suppose some year in which each country will attain bare replace-
ment (an average of about 2.3 children per fertile couple) along
with a smooth transition to that condition, and a continuance of
replacement until the age distribution stabilizes and the popu-
lation becomes stationary. For most countries we took the turn
of the century as about the time when replacement would be
reached. Estimates of population and labor force are shown by
age and sex at 25 year intervals for 150 countries; groupings
are given by continent and degree of development. Printouts are
available showing much more detail than we have been able to pub-
lish in this working paper.

CONTENTS

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1. POPULATION AND ITS ANOMALIES

Population has been an important part of the work at IIASA
from the start. New and powerful techniques have been developed
for the analysis of migration and other components of population
change, and they have been applied to the data of many countries.

The present work estimates present and prospective popula-
tion for all countries of over 250,000 population, using a simple
and uniform technique of projection, and showing results by age,
sex, and labor force for each country. We introduce the numeri-
cal estimates by study of trends in the components of population
growth—birth, death, migration—and precede that by a review of
some of the special difficulties that a student of population has
to face, whether he wishes to forecast the future or merely to
relate population to other social variables. Every serious dis-
cussion of population has to reckon with its multiple facets and
the paradoxes to which these give rise.

People are both the purpose of production and its agents.
One's view of how many people there ought to be depends on which
of these aspects one is looking at: production or consumption.
No such ambiguity arises for other research fields—the more food
the better; the more energy the better. More people permit

greater division of labor and hence greater social product, yet the limits of the milieu come closer as population grows. One who sees the division of labor as dominant will favor a larger population while one concerned with the milieu will favor a smaller.

Technical advance and capital have been feared because they would displace people in production, and that fear is still widespread; in an extreme version machines seem like quasi-humans competing with people for a place in the world. Yet it is the countries with the most capital that have also the lowest unemployment and correspondingly the most conspicuous need for people.

The paradox goes further. The need for people in the capital-rich countries does not translate into large families; in those countries the very demand for labor reduces the birth rate. This perverse result occurs because the plentiful jobs to be filled draw women into the labor force, and childbearing takes second place to careers. On the other side the countries that have the hardest time making use of their citizens are the ones producing the most children.

We tell people that economic development is a goal so important that it justifies any amount of hard work and abstention from consumption in this generation. The history of England, the United States, and the USSR show how demanding the process of development is, and how little is the immediate gratification available to those who accomplish it. Yet more than half of the work force of this generation will be dead within the next 35 years, before full development can occur. The chief beneficiaries will be the children and grandchildren of those now working and saving. Then should not people have many children, so that at least there will be many to benefit from the hardships that are inevitable at the initiation of development? No, for restraint in childbearing is as important for development as restraint in consumption. All this is hard for many of the world's poor to understand.

The transition from a human population of 1 billion on the planet to some 10 billion in a sense underlies all the other

transitions taking place between the 18th and the 21st century. Population growth puts stress on food supplies and hence on land; it is the urgent reason why capital is at once badly needed and difficult to accumulate. Population has much of the responsibility for shortages of energy and materials; it must have some relation to the crowding of public facilities. Increased population and hence more intensive use of land makes deterioration of that land and sporadic or permanent barrenness more likely, as well as more serious when it does take place in proportion to the number of people whose living depends on it.

The division of the planet into countries with rates of increase of 2 percent or more, on the one hand, and countries with virtually zero increase on the other, tells us that the most important datum for population analysis and forecasting is the movement of countries from the one category to the other. When people are poor a small increase in income is likely to be turned into children, through more babies surviving; when they are well on the path of development a small increase of income is likely to be turned into a fall of the birth rate. At some point in the increase of income a flip occurs, and what was a positive effect of income on population becomes a negative one.

If two variables, income and number of children, are positively correlated up to a certain time, when they reach a threshold, and then beyond this threshold start to be negatively correlated, forecasting is especially difficult. We do not know quite how or when a country rises above the level of poverty where population grows rapidly and capital very little, to the affluent condition in which population is under control and capital accumulates rapidly. Such events as the discovery of some new natural resource, or the advent of an energetic leader, perhaps adoption of a religion of abstinence and hard work like Puritanism, can trigger the advent of development, and make previous forecasts of population worthless. The estimates of this paper, like all others, are inevitably subject to such a risk.

We proceed to review briefly current trends in mortality, fertility, and migration, recognizing that the literature on the causes of mortality and on fertility decline and of the numerical

tendencies to date is too rich to be captured in these few pages. We present our best estimate, and compare that with other estimates, for each country of over 250,000 population, then discuss the probable error of such estimates. Population policies and their effectiveness cannot be disregarded by the forecaster, and we mention them briefly for a few countries.

1.1. Mortality

The demographic transition is initiated by the fall in the death rate, a fall whose causes are not yet disentangled. Medical advance has steadily cumulated from the first introduction of vaccination, but the fall in the death rate does not seem to have waited for that. The ending of the plagues that were so large a factor in European mortality from the 14th to the 17th century had little to do with the advance of medical knowledge, but was due rather to an ecological change in which one kind of rat drove out another from human settlements. In recent years medicine has played its part, along with earlier factors of improved sanitation and improved diet. Nutrition seems to have been important, not so much because people die directly of starvation, but because they are weakened by lack of an adequate and varied diet and therefore susceptible to disease.

The net result of all the changes has been a rapidly spreading improvement in mortality conditions. Expectation of life at age zero is as good a measure as any of the progress that has been made and expected. In primitive populations that expectation is on the order of 25 or 30 years; Sweden, with mortality statistics available as early as the 18th century, showed less than 35 years in its first life tables. For the world as a whole the expectation has risen by 1950-1955 to 47 years, then rapidly increased to 58 years by 1975-1980 (United Nations 1981).

Among the many forms of social inequality is inequality before death. United Nations figures show for 1975-1980 an expectation of life at birth of 55 years for the less developed regions, against 72 for the more developed regions (United Nations 1981: 82). Within countries the differentials by sex are great—in the developed regions males stand at about 68 years, females

close to 76 years, a difference of 8 years that contrasts with
2 years for the LDCs. The difference for developed countries
is about equal to the differential between smokers and non-
smokers, and slightly greater than that between blacks and whites
in the United States. Though mortality by income within coun-
tries is harder to measure than sex and age differences, we know
something about it (see, for example, Hauser and Kitagawa 1973,
Sauvy 1957). We also know that some at least of the recent im-
provements in the United States are due to behavioral changes,
exercise and quitting smoking being the two most important, and
these may well be correlated with social class.

1.2. Mortality in Less Developed Countries

Mortality improvement over the postwar period has been
especially great in the less developed countries. As a rough
measure, the mean length of life has gone up on average of about
one-half year per year [13 years in 25, according to UN (1981:
82) estimates] against a rise in the United States since the be-
ginning of the century averaging only about one-third of a year
per year, and since 1950 only about 4 years in 25. China's
record is outstanding, to judge from official figures reported
by the United Nations. For the 25 years from 1950 to 1975 the
expectation of life rose from 47 to 68, a gain of 21 years, or
.8 of a year per year. This and other instances of rapid in-
crease in mean length of life are due less to the introduction
of advanced medical techniques than to extension of rudimentary
health measures to social groups that had previously been al-
together without medical care, and most particularly to improved
diet and sanitation.

Can mortality rates in the developing world continue to im-
prove at the pace of the last 30 years? At one-half year increase
in expectation of life at age zero for each calendar year the
developing countries would take only three decades to pass the
point where the advanced countries now stand. Desirable as such
an advance would be, there is reason to doubt that it can happen.

In fact there has been a gentle fall in the gains over re-
cent decades (see Gwatkin 1980:615): the less developed countries

as a whole increased in expectancy by .64 of a year per year during the 1950s, by .60 in the 1950s, by .52 in the 1960s, and by only .40 in the 1970s. One should not exaggerate the accuracy of these figures, for there are large parts of the world for which we do not know the death rates, but the deceleration seems to be a fact. One can see this strikingly in individual countries. Egypt showed phenomenal gains, up to .9 of a year per year, during the 20 years from about 1940 to 1960, followed by much slower gains since. Most of Africa has shown gains rather less than .5 of a year per year, with slowing in recent years; in parts of Central Africa it has even been said that there has been an absolute deterioration. Yet we cannot be sure of these assertions; the African data are particularly uncertain.

Samuel Preston has used econometric methods to ascertain what proportion of the gains in mortality have been due to health measures, as against economic development. He finds that the credit is about equally divided, with health measures involving no increase of income responsible for about half of the gains. The list of such measures has malaria control at its head, and includes the provision of protected water supplies. For example, malaria control is credited with about one-quarter of the improvement in Sri Lankan longevity. The problems that remain are diarrhea, pneumonia, and malnutrition, and these cannot easily be tackled with raising living standards. An acceleration in the development process could reverse the downtrend in the rate of improvement, but it would be over-optimistic to anticipate such acceleration.

The method used for this paper does not project actual mortality data, but rather moves along the sequence of Coale and Demeny (1966) Model West tables. That these tables are a good fit to past sequences of mortality improvement in most parts of the world has been established, though Noreen Goldman (1980) finds one exception.

1.3. Fertility

Many less developed countries report success in the spread of birth control. Certain small countries around the rim of

Asia were the first to bring their birth rates close to those
of the advanced countries, and Singapore is now well below re-
placement. Some social groups throughout Asia and Latin America
have lowered their births, and the spread of birth control has
been widely reported in Indonesia and elsewhere. Yet the cen-
suses of 1980 have been disappointing, showing for Indonesia,
for instance, a population about 5 million greater than that
anticipated on the basis of the reports of family planning ac-
ceptances. China has promulgated a policy of one- and two-child
families, and if its people will go with this policy it will
very soon fall below replacement. In fact the figure of some
17 million births for 1978 corresponds to less than 2 1/2 child-
ren per fertile married couple, and so is just slightly above
replacement. At the other extreme of family planning success
is Africa, where births show little sign of falling to conform
with the drop of the death rate.

Urbanization has a complex relation to fertility. In
Europe and America during the demographic transition cities were
in the van, with birth rates at each stage lower than rural
birth rates. This is less true of the present LDCs, many of
whose city people retain their rural culture. Yet the migration
contributes an indirect effect that is important in the long run.
If coming to the city does not always or immediately change per-
sonalities, the conditions of the city are such that urban resi-
dents exercise political claims far beyond any that peasants can
exert. Food and shelter are produced spontaneously in the coun-
tryside, without any administrative oversight or contribution;
in the city those citizens who cannot produce their own can call
on government. Governments are alarmed by the expanding cities,
for whose welfare they are asked to take responsibility. Popu-
lation growth in a peasant countryside is in a sense hidden—it
is known to the census takers, but does not have immediate and
pressing public consequences. The burden of increased popula-
tion falls on families in the form of less plentiful food, a
decline in draft animals, and smaller and smaller plots of land.
It does not place as direct a responsibility on government as
does the expansion of urban populations.

In countries that have large amounts of empty land, leaders have often called on their people to settle the frontier. But such countries also have high rates of urbanization; the population increment is more disposed to come to the cities, and especially to the largest cities, than to heed nationalistic appeals. There was much talk of filling empty lands by ambitious governments in the 1960s; by the 1970s the continued flow to the cities, for instance in Mexico, was a major factor in turning the thoughts of governments in the direction of family planning.

How do such considerations translate into numbers expected in the future? For most of the countries of Asia and Latin America they tell us that the drop of childbearing to replacement, say 2.3 children per fertile married couple on the average, will come before the turn of the century; for Africa it will apparently be later than that. However, we do not estimate replacement much later, for Africa stands under the danger of disease and hunger, as the current news reports tell us constantly, and it is in real danger of a rise in its death rate. Our judgement is that replacement will be attained in most of the less developed countries by 2000-2005 at the latest, and by 10 years after that in Africa.

1.4. Taking Account of Rural and Urban

The techniques used in this set of projections do not decompose national populations into subgroups beyond age and sex. Yet we know that in fact subgroups evolve differently, and we also know that whatever the technique of projection, when it is applied separately to subgroups and the results added it comes out different from the simple projection of the undivided whole.

It can be shown mathematically that if subgroups are projected separately on geometric increase, and the results added, that additive total will be greater than the simple total obtained by projecting the whole at a rate of increase equal to the weighted average of the initial rates of increase of the subgroups (Keyfitz 1977:14-18). The reason is that those of the subgroups that are increasing faster will come to have more

weight in the additive version as time goes along, while in the simple version they implicitly retain their initial weight.

But this general effect, which for short-time intervals and moderate differential rate of increase is small, is overwhelmed by a quite different effect in the case of a decomposition into rural and urban parts. In most places and times the urban birth rate is lower than the rural, and if one allows for the shift of population from rural to urban, as it is taking place in the less developed countries of the world today, the projection to future times would on this account come out lower. Work is now underway at IIASA to improve the calculation by a multiregional approach within each country.

1.5. International Migration

With the filling up of the Americas before the middle of the twentieth century the last great movement across the Atlantic from Europe was over, and large scale international migration seemed to be a thing of the past. That proved not to be so. Refugees from Cuba and Vietnam to the United States, guest workers from southern Europe and western Asia to northern Europe, who settled down as residents, legal and illegal, movement from Bangladesh to northern India, and across the US-Mexico border, movement from ex-colonies to ex-metropolises, flight from drought and war in Africa—these are some of the migration currents since World War II, with a total volume unprecedented in world history.

The six million guest workers in northern Europe, the refugees and illegals in the United States, can still be thought of as a continuation of the stream of migration that brought some 60 million workers to the New World during the century or so prior to World War II. That traditional stream consisted of Europeans of lower levels of education, with minimum property, skill, or other attribute that could give them a satisfactory place in the European economy. They were welcomed to the New World as they helped put its rich lands to profitable use and constituted the labor force of its incipient industry. During the 65 years from the Civil War to 1930, they brought the western plains of North America under cultivation, labored in clothing factories in New

York, while other branches of the same stream of migrants contributed to the production of meat and wheat on the Argentine pampas, and built plantations in the forests of Brazil.

The migration of the postwar period, and presumably that of the 50 years ahead of us, is a response, less warmly welcomed by the citizens of the receiving countries, to the increased differences of income between the poor and the rich countries. Migration has always been up the income gradient, but past gradients were less steep, the pressure to move less intense, and hence the flow could be more readily controlled by the receiving countries. Now refugees appear who are not easily turned down; foreigners in Switzerland become numerous enough to disturb its cultural homogeneity; Pakistanis and Jamaicans, the heritage of a dissolved empire, are involved in race riots in England. Refugees from current wars and from political hostility are particularly numerous in Africa, but far from unknown in Asia and Latin America.

Counting illegals, immigration into the United States is thought to be larger than the million plus who entered in 1913, the highest year in the official record. No one knows how many illegals come in, and no one even has any very good suggestion for finding out. As long as Mexico continues to be poor, people will somehow cross the Rio Grande. They could of course be excluded by something approaching a military defense of the frontier, but that would seriously harm the diplomatic and commercial association of the United States and Mexico.

In addition there are genuine advantages in illegal immigration to some segments of United States agriculture and industry. The illegals have no claim to social benefits or legal protection; for some industries they make an ideal labor force. They supply a labor market freer than any that has existed since the early days of the industrial revolution. The domestic objection to control at the point of employment is strong, partly because of the self-interest of employers, and partly because of the principle that no employee ought to have to identify himself and the legality of his residence when applying for a job, say as a lettuce picker. It is safe to forecast

that there will be no immediate or easy solution to the immigration problem. The options have recently been set forth by Philip Martin (1981).

Our forecasts, based on a uniform method, take no account of migration. Present large and sporadic movements hardly lend themselves to extrapolation. Our omission understates the United States population. Put somewhat differently, our method is equivalent to supposing that there will be stationarity over the long term, counting births, deaths, and migration. Any degree in which birth estimates are high, as they well may be, would offset the lack of provision for migration. The estimate that we are using, 248 million in the US in 2000, compares with the medium estimate of the United States Bureau of the Census of 260 million and of the United Nations of 264 million.

A part of the problem everywhere is the population level for the jumping-off point. The US Census of 1980 counted about 5 million people more than it would have counted with the degree of incompleteness of 1970. The level for the year 2000 is much affected by whether the 1980 population is really 222 million, as stated before the census, or 227 million as counted, or over 230 million as it could well be if one adds uncounted illegals. Our forecast extrapolates the pre-1980 census figure.

Starting with 227 million and adding migration of 500,000 per year, which to judge from recent statistics is the least that should be allowed, would bring us to 15 million (plus any natural increase of these) by the end of the century in addition to the 248 million that is shown in our table. The total 248 + 15 = 163 is about the middle of the several other estimates. The United States and China are the two main countries for which time to replacement does not provide a satisfactory scale.

2. POPULATION FORECASTS: ASSUMPTIONS AND ACCURACY

The history of population forecasting is more favorable than that of technological or economic, let alone geological, forecasting, but it is still not good. No one knows what the population will be 50 years hence, and the history of population forecasting is now long enough that we can estimate the range of ignorance.

The experience is here summarized briefly, in such a form that the reader can know within what limits the present work is to be trusted. Aside from being presented along with an error statement, the present work has whatever advantage there is in a uniform procedure applied to all countries. Thirdly, it involves a comparison with some five other forecasts, made by the United Nations, the World Bank, and other agencies, and as far as possible we forced consistency with those other estimates. These three characteristics—a stated confidence interval, a simple and uniform method, and comparison with the main forecasts extant and in the public domain—are the special characteristics of the numbers for the years 1980-2030 given in this paper.

Stated in one sentence, the assumptions are that birth rates will decline to the point of bare replacement of the population about the end of the century, and that death rates will continue to decline for all countries and during the next 50 years they will reach a level somewhat below that of the presently developed countries.

Births are expressed in terms of the total fertility rate; the number of children that a girl child can be expected to have. The sole variable parameter of our method is the time to bare replacement, which is to say to when each girl child will be expected to bear one girl child on the mortality regime then prevailing. Subject to this, fertility was taken as falling in a straight line from the level of 1980 to the date when bare replacement was assumed.

That the time to bare replacement is a convenient parameter was shown by Frejka (1973). Our own calculation shows that each five year delay in the attainment of replacement adds about 700 million to the world population. If one takes it that replacement will be attained in the years 2000-2005 then the ultimate world population comes out to be 9 billion.

Statistics of births by age of mother are not to be had for most countries, and we had only the net reproduction rate estimated by the United Nations to tell us the level. We used this along with the model fertility tables due to Coale and Trussel (1974:185-258).

We allowed some complication in the way that mortality falls. With the age specific death rate for 1975 as the start we took it that the mortality fall would depend on age, on how mortality for all ages together stands in 1975, and on the time when the change is taking place. Thus the older ages are assumed to fall more slowly than the younger; the higher the expectation of life the slower the fall; the later in time the slower the fall (Littman and Keyfitz 1977).

All of our projections were carried out country by country and the totals for the several groups of countries obtained by addition. There are two advantages, both small but available at no cost, in projecting for individual countries and then adding. The additive total, as pointed out above, is larger than the unit total obtained for the group as a whole, and we think that if there is any choice it is more precise. Thus for the world as a whole with replacement in 2000-2005 the additive total for 2030 is 8,093 million, and the unit total is 300 million less. The difference is small in relation to error, but we have the convenience that all of the breakdowns are consistent with one another; when we add the continents we get the same result as when we add the less and more developed countries.

We are indebted to the United Nations Populations Division for the basic data on which these calculations are made. In particular the Division was kind enough to provide us with the age distributions, the net reproduction rates, and the expectations of life for the countries of over 250,000 population that they and we recognize in advance of their own publication.

Our adjustable parameter, the time to replacement, is no easier for us to know than for anyone else. We have examined the projections to the year 2000 made by a number of agencies, and how these fall in relation to the several times to replacement. Thus in the case of Egypt, replacement by 2000-2005 would give a 2000 population of 61.3 million, and by 2015-2020, 15 years later, would give 65.8 million for the year 2000. The United Nations, the World Bank, and the United States Bureau of the Census all gave populations for the year 2000 that are between these numbers while Donald Bogue (1979) and Littman and Keyfitz (1977) fall somewhat below this range.

2.1. Check Against Other Forecasts

There exist now at least five projections of population for the countries of the world by the United Nations, the Population Reference Bureau, the World Bank, the US Bureau of the Census, and the Community and Family Study Center of the University of Chicago. Most of them go only to the year 2000, and that of the Bureau of the Census covers only the largest countries. They are far from independent of one another, as is shown in their documentation and in the fact that their results agree closely. But each of them contributes some elements of judgement by competent demographers, and we made use of all of them in determining our own forecast.

For each of the countries we projected with times to replacement from 1990-1995 up to 2020-2025. We then examined the figures for the year 2000 in comparison with the five outside forecasts. We chose a time to replacement that gave us a figure for 2000 about the center of the distribution of the outside forecasts. A few instances will show the combination of calculation and judgement.

2.2. The Largest Countries

In the case of Nigeria the lowest of the five estimates for the year 2000 was 121.6 million, by the Community and Family Study Center of the University of Chicago. The highest was that of the World Bank, with 157.1 million. Between were the other three sources. We noted that the ultimate stationary population forecast by the World Bank was 435 million, and though this was a reasonable extrapolation from past growth, it seemed too high on ecological grounds. One can hardly imagine Nigeria being able to feed such a population, or sell the manufactured goods that would buy food for them. We put Nigeria's time to replacement at 2015-2020 and this gives it 134 million for the year 2000. That is almost exactly what the United States Census Bureau gave, but is considerably below three other estimates.

China's policy has gone through various phases, starting in the 1950s with official opposition to any birth control not immediately in aid of the health of mother and child, and evolving to the ultimate very full recognition of the population problem

in the constitution of 1978. Any ideological opposition to birth control has given way to practical necessity in the face of economic handicap of a fast multiplying population. The regime in Beijing is determined and effective; it has gone to enormous pains to persuade couples to have no more than one child, at most two. Travellers report success in the areas that they visited, though they have not been able to visit a random sample of villages.

Most of the series available to us point to a Chinese population of 1,200 million or less by the end of the century. To assign it replacement by the year 1990-1995 shows 1,361 million by 2000, which is evidently high. Even if replacement is set at 1980, i.e., immediately, the 2000 population would be 1,268 million, which is higher than any of the estimates except that of the Bureau of the Census and reaches 1,453 million by 2030 and 1,617 million by 2075. Unless China is below replacement for a considerable period of time, it will have an ultimate population greater than 1.6 billion.

When government makes population the subject of active policy, it places special difficulties in the way of one who would produce unconditional forecasts. Any forecast then becomes a judgement on the feasibility and on the success of the government's policy. Aside from the usual difficulties, the forecaster has to say by implication whether what the government is doing can succeed— whether among other things that government will stay in power, and whether it will be able to persist in its policy if it does. The population forecaster can hardly shoulder such a burden of judgement, given that whatever skill he has lies in the capacity to extrapolate past figures of births, deaths, and migration.

In the face of all the difficulties, and especially of the rapid changes that China has seen in many fields including the dissemination of birth control, the best that we can do is to take it that the number of births will not rise substantially in the future from where it now is. From an all-time high point of 29 million in 1963 there has been an irregular decline that brought the level to 17 million in the late 1970s. We do not think that it will be allowed to rise substantially above this, even though families of considerably less than two children will

be required to prevent a rise, given the very young age distribution. If the highest that the births are allowed to average during the next 50 years is 20 million, then we can say that the population will be below the survivors of the one billion births plus the present population of one billion by the year 2030. Using a life table of 70-years expectation derived from Coale and Demeny (1966) we find for the year 2030 a population of 1,423 millions. For the turn of the century we find 1,223 million. This latter is straddled by 1,329 million of the United States Bureau of the Census, and by 1,190 of the United Nations. China is the one country for which we have been compelled to depart from our uniform method. If this is in error it is on the high side, to judge from the very convincing statements of the authorities.

Forecasts for India are about the billion mark for 2000, with three below the billion and two above. Assuming replacement by 2000-2005 brings one to 1,020 million by 2000, which is what we are using.

The USSR presents a particularly simple case, with all five of the agencies in the narrow range from 306 million to 312 million. Our own comes out to 310 million.

The United States is assumed to have fertility gently sloping upwards towards replacement, and on our estimate comes out to 248 million by 2000. But this is using the pre-census figure of 222 million for 1980. Our work takes no account of immigration. It is safe to guess that future numbers will be 10, perhaps 15, million higher than our estimate.

Indonesia is the subject of much disaggregation on the part of the several agencies, which run as low as 194 million, and as high as 222 million. Our method, with replacement by 2000-2005, gives 222 million for Indonesia in the year 2000. This puts us at the high end of the range, which seems justified by the 1981 Census.

On Japan the range of agencies was from 129 to 133, almost as narrow as that for the USSR. Our method ended up in the middle, with 131 million. Japan has been exceptional throughout

its history, and this agreement should not excite over-confidence in the common forecast. Apparently Tokugawa Japan (1603-1867) showed crude birth rates in the range 15 to 30 per thousand. This was followed by rising rates up to 1919, falling rates to 1920-1935, and from 1950 a rapid fall in both fertility and mortality (see, Mosk 1979:19). The historical exceptions of Japan and France, as well as the variation within the countries of Europe shown by the Princeton study, undermine trust in the demographic transition as a forecasting instrument.

2.3. Accuracy of Forecasts

A forecaster must respect the unknown forces that determine the future and be modest concerning his own powers to penetrate to these. Such modesty is taught by past experience. Earlier forecasts can indicate the bounds that should be set on present ones, and the bounds turn out to be wide. One method for assessing error is described elsewhere (Keyfitz 1981) and a brief summary will suffice for the present purpose.

The measure of accuracy used is the degree to which the forecast implied annual rate of increase exceeds the realized rate of increase. For example, Whelpton in 1936 forecast the population of the year 1970 at 155 million. In 1936 the United States population was 127 million, so that the rate of increase implied was 0.57 percent. Actually the population grew to 203 million, so that the realized rate of increase was 1.35 percent. That makes our measure of the inaccuracy of the forecast the difference between these two numbers, i.e., 1.35 - 0.57 = 0.78 percentage points. Such differences can be averaged in many ways, of which two that come to mind are the root-mean-square and the mean absolute value. A round number that roughly describes the record of some 1,100 forecasts is 0.3 percentage points in the mean absolute error. Again speaking roughly, this tells us that one could safely bet even odds that the realized rate of increase will turn out to be within 0.3 percentage points of the forecast rate of increase.

In application to our own forecast for the Republic of Korea in the year 2000, we say that the population will be 51.8 million

against a 1980 population of 39.1 million, i.e., a rate of increase of 1.42 percent per year. Adding and subtracting 0.3 percentage points to this we can bet even odds that the realized rate of increase will be between 1.12 and 1.72 percent per year, which would give for the year 2000 a range in the number of people from 48.8 to 54.9 million. For 2030 the limits would be 55.9 to 75.2 million. This range may seem wide, yet it is based on the average of the errors of population forecasts for the several countries of the world.

Two considerations permit some narrowing of this estimate of error. One is that recent forecasts have been more precise than those made earlier. The other is that on this measure of accuracy slowly growing populations are more precise than faster growing ones. These two considerations might at the very outside halve the estimate of error, which would be equivalent to saying that the betting odds that the Korean population will be between 55.9 and 75.2 million in 2030 are not 2:1 but rather 20:1.

This calculation must be modifed in application to the world population. The estimate of error was based on individual coun- tries, and aggregates of countries will have less error in the measure in which offsetting can be expected. The second point is advanced with more hesitation. If we think that the evolution of mortality cannot but be such that bare replacement will be obtained within a limited span of years, then we can hope that that span of years will provide a confidence interval on which we could bet. If we consider that we are coming to such a point in the evolution of population that replacement is 95 percent certain as a world average within 20 to 40 years, then we can, correspondingly, bet 20 to 1 that the world population by the year 2030 will be between 8 and 11 billion, to use round figures.

To summarize the studies of error:

1. A round figure that summarizes the error of past projec- tions is that they have an average absolute departure from the subsequent performance of 0.3 percentage points of increase per year.

2.   Faster growing populations have larger error, say 0.5 percentage points, while those that are near stationarity show about 0.2 percentage points.

3.   The skill and care incoporated in the forecast seem to have less relation to accuracy than the time when the forecast was made.   Forecasts tended to be low in the 1940s for developed countries because the extent of the baby boom was not foreseen, for the less developed because of the subsequent unanticipated fall of mortality.

4.   Size of country, and whether rich or poor, has almost no independent effect on accuracy for countries of given rate of increase.

5.   A most important constancy is with the projection span— accuracy on our measure seems unaffected by whether one is fore- casting 5 or 20 years ahead.   Extrapolation of this constancy permits statements about the error of forecasts 30 or more years ahead, on which we have no direct experience.

6.   The conclusion arising from this is that for the next 10 to 20 years we can provide forecasts of reasonable accuracy; beyond that the population is essentially unknowable.   That should be taken into account in any conclusions drawn on our projections for the next 50 years.   They are to be considered illustrative, suited to incorporating in hypothetical scenarios.

7.   A qualification on the above is that projection methods may now be better than they were in the 1940s and 1950s.   Cer- tainly over the 20 or so years that it is possible to follow there is a clear downtrend in the error.   Forecasts in the 1940s showed a mean departure of about 0.7 percentage points; those of the 1960s a mean departure of less than 0.3 percentage points. We may cautiously accept the downtrend as real, even though a longer series is needed before one can be sure.

8.   Forecasts for areas within countries have been subject to much more error than forecasts for entire countries.   That encourages us to think that forecasts for groups of countries and for the world may well be better than the national forecasts on which most of our observations of forecasting error have been made.

9. Variation among writers, say on the world population of the year 2000, is smaller than one would expect if their estimates were independent. Agreement on the future among forecasts gives little assurance that they are correct.

10. For most populations forecasts by age and sex are not notably more accurate than forecasts made without taking account of age and sex, though populations whose ages are far from the stable distribution corresponding to their age and sex are exceptions to this statement. We have carried out our calculations by age and sex because these are needed for their own sake rather than for any hope of improving the total.

11. Any labor force estimates are based on the population forecasts by age and sex, applying to these the fraction forecast as participating in the labor force. Since the latter are necessarily subject to their own errors, the absolute labor force estimates are subject to greater error than population.

2.4. Meaning of the Variants

It has been the custom to present not one projection variant but three or more. In recent years less stress has been laid on the high and low variants, partly because they are hard to interpret in probability terms. After the harsh experience of error, especially of the population forecasts made in the 1940s, what high and low variants have been published show a considerable range between lower and upper variants, but even so, no one thinks that these are really lower and upper bounds on the possible future population.

One way of interpreting them is to see in what portion of cases they have straddled the realization. For instance out of 5 estimates of the 1965 United States population made from 1947 onwards 4 straddled. Taking all of the 26 forecasts on the record from 1947 to 1972 that can be compared with what subsequently happened we find that in 8 cases the lowest and the highest straddled the later population. The high level Population Investigation Committee of London in 1947 made 16 estimates of the population of Great Britain for 1977, and 15 of these turned out to be low; the highest of the 16 was about right.

While the range between high and low variants published by
different authors varies, study shows that in general they are
somewhat wider than a 50 percent confidence interval; one could
bet something like 2:1 odds that they will straddle the subse-
quent population performance.

3. POLICY

In some countries population is seen as a problem, one that
requires to be resolved by an active policy on the part of
government; elsewhere population is no more a subject of policy
than is climate. It is true that many measures, from income
tax to subsidized housing, do affect the birth rate, but we do
not count these where the objective is unrelated to population.
Phenomenal variation appears among countries in how population
is perceived and in the degree to which action on it is thought
to be required.

For France population is one of the great issues; in the
words of Giscard d'Estaing, the country needs to know "whether
France is going to suffer a population decrease or conserve its
vitality" (*Le Monde*, April 20, 1979). It is some time since
these two elements, population decrease and vitality, have been
contrasted. Giscard wanted especially that parents have three
or more children, and over a two year period he arranged a 45
percent increase above inflation in family allowances. On the
other hand, Germany, perhaps with unpleasant memories of earlier
policies, has left population severely alone, despite the fact
that in recent years its birth rate has been strikingly below
that of France. Until a year or two ago German births were
actually less than deaths; it is the largest country so far to
have attained negative population growth, and in this capacity
can be an example to countries that have populations growing
much too fast for their development.

A similar contrast appears between the US and the USSR.
These two countries experienced high births after the war,
reaching peaks, respectively, of 4.3 and 5.3 million in the early
1960s, and saw their births decline greatly during the 1960s,
that decline being followed in both cases by some levelling or

rise in the 1970s. At no point did the United States contemplate policy for raising its birth rate, and the very influential Rockefeller Commission, in whose work many distinguished demographers participated, reported emphatically that the United States population was if anything too large, and whatever policy was to be considered should have as its aim keeping births and immigration low.

The USSR, on the other hand, has been much concerned about its slowing rate of increase. That increase in absolute terms still averaged 2.3 million per year in the 1970s, its lowest decade, slightly more than the United States. Yet population came up as a serious problem at the Twenty-Fifth Congress of the Communist Party, and is repeatedly mentioned as a problem by Soviet demographers. The distinguished scholar V. Petevedentsev (Demeny 1980:169-174) warns that when the small cohorts born in the 1960s reach reproductive age in the 1980s the births will decline if family size is not increased. He says that "It is essential to increase fertility, particularly in order to prevent the formation of a new demographic 'wave'... Effective measures must be taken to stimulate fertility." He later mentions "...the deterioration of the demographic situation referred to at the Twenty-Fifth Congress of the Communist Party of the Soviet Union [that] confirms the need for strong encouragement of fertility." Official measures include extended maternity leave with partial pay and he urges that the pay be generous. Whereas the United States is prepared to see its population grow by immigration, of which an indefinite amount is available from poor countries, the USSR does not consider immigration but stimulates births.

The advent of demographic waves plainly does harm to an economy, and this quite independently of the system under which it operates. Schools have to be built and then closed down; that is expensive in the US as in the USSR. Yet we do not find in the writings of American demographers any promotion of a policy that would avoid or dampen waves. Counter-cyclical family allowances have not been seriously discussed. David Heer (1977) examines these and other questions on the basis of interviews of Soviet demographers in 1975-1976. How to prevent the

high birth rates of the Asian republics from retarding their
economic advance was one of the issues mentioned.

Raising fertility has been a particular concern of the coun-
tries of Eastern Europe, and for a time it looked as through the
measures adopted were having the desired effect. The sudden with-
drawal of permission for legal abortions in October 1966 virtually
doubled the birth rate from 1966 to 1967 (Berelson 1979:209). At
the same time the importation of contraceptives was discontinued
though some seem to have been available clandestinely. Other
measures taken include maternity leave, divorce restrictions,
childbirth compensation for third and later child, change in in-
come tax related to number of dependents—but such measures had
existed before without having much effect on fertility. Teitel-
baum (1972) concludes from the sharp declines in fertility since
1968 that the drastic fertility increases resulting from the 1966
legal shift may be transitory. The absolute number of births is
not the right measure, since age distributions are changing. The
expected number of children that would be born to a woman in
Rumania was 2.72 on the rates of 1974; down to 2.60 in 1977.
Other countries were lower and have fallen more—for instance,
Hungary was at 2.39 in 1975, and down to 2.14 in 1977 (Pressat
1979:533). East Germany touched the low point of 1.54 in 1974,
and has since risen slightly to 1.85, still far below replacement.

Of all countries, Bulgaria has had the most direct system
of positive incentives. Recognizing that most couples will have
a first child in any case, it gave generous allowances for second
and especially for third and later children. But its fertility
is also hesitating; the legislation cannot be called a resounding
success. Most of the other countries of Eastern Europe now dif-
ferentiate allowances according to the order of the child. It
will take further time to judge the results, but the first analy-
sis is not encouraging.

Indian policy to curtail births has had its ups and downs
(Kocher 1980:299). Mrs. Gandhi's unfortunate attempt to apply
coercion was a major factor in her defeat in 1977. The govern-
ment that followed was more conservative in all respects, in-
cluding family planning, but it did increase the family planning

budget to nearly (US)\$ 200 million annually, as well as the health
budget, the latter also with population control objectives in
mind. The Sixth Five-Year Plan covering the years 1978-1983 does
not identify rapid population growth as a major obstacle to econ-
omic advance as previous plans had done. Meanwhile the election
of January 1980 brought Mrs. Gandhi back to power, now with less
drastic population policies. The inefficiency of the governmental
machinery for motivating family planning and disseminating equip-
ment has been a concern, and there is some hope of tightening, now
within a framework of voluntary limitation. An encouraging fea-
ture of the Indian situation is the impressive fall in fertility
in some of the more progressive states, including Kerala, Tamil
Nadu, and the Punjab.

On the whole the promise of Indian planning is less than that
of China. China is the first country to attain a billion people,
but India is likely to overtake it on present prospects, and it
could reach a billion and a half if death rates do not rise in
the meantime.

The above consideration of policy is included here to show
the awkward relation to forecasting. Any forecast is an implied
judgment on the effectiveness and success of a population policy
A demographer is not the right professional—if there is any—to
judge the competence and effectiveness of governments. By making
the forecast an extrapolation in one form or another of birth
and death series, the demographer avoids the burden of explicitly
judging the effectiveness of population policies.

4. A CONTRIBUTION TO TECHNIQUE

We can make no pretense in this paper of forecasting national
populations more accurately than others are doing. The way we
assess other forecasts, and then use them to check and adjust ours
may constitute an advance. What we have done is to work out the
population of each country for the year 2000 on the supposition
that replacement would be attained by 1990-1995, 1995-2000, etc.,
so obtaining a scale of values for the year 2000, on which we
could place previous forecasts such as those of the United Nations
and the World Bank. This takes the place of a study of their
documentation to find the assumptions that underly their work.

There are reasons why those concerned with future popula-
tions do not often take the time to fully comprehend the assump-
tions embodied in the forecasts of others. In the first place
the documentation is often incomplete; moreover even when the
assumptions are actually written down they are hard to dig out
of the fine print. We have been unable to duplicate the arith-
matic used by anyone else, and do not expect anyone else to be
able to reproduce ours. Even if the barrier of understanding
the algorithms of others could be surmounted, the labor required
to reproduce their numbers would be great. It seems much pre-
ferable to set up a scale with a known set of assumptions, and
then in a sense work backwards to infer what assumptions are in-
volved in the calculations of others.

An example for the case of Brazil will show the technique.
The calculation with replacement by the period 2000-2005 gave
191,000 and by the period 2015-2020, 15 years later, gave 206,000.
These might be thought of as reference points, to which we can
relate the several extant forecasts. The Population Reference
Bureau shows 199 million and the World Bank 200 million, inter-
mediate between our two reference points. The United Nations
gives 187 million, the United States Bureau of the Census 226
million, the one implying the attainment of bare replacement at
some time in this century, the other later than 2015-2020. The
Community and Family Study Center of the University of Chicago
gave 187 million, also implying replacement by some time in the
present century. With these estimates and the scale by which
we could evaluate them before us, we determined 2000-2005 as the
time when replacement would be reached, and so our number of the
year 2000 is 191 million. Though throughout this work we took
into account the other estimates, we put ours toward the low end
of their distribution.

5. TABLES PRESENTED

This section concludes the paper with a set of tables that
forecast populations over the next 50 years. We show the numbers
at 10-year intervals from 1980 to 2030 for individual countries,
including all of those with over 250,000 population as reported

by the United Nations. They are also aggregated into three categories of less developed and three categories of more developed countries. Corresponding information is provided for labor force.

The tables that are presented are a small selection from the extensive printouts available. These show all countries at five year intervals, in five-year age groups, by sex, for the 100 years from 1975. We have little confidence in our long-term projections, for reasons that appear above in the section devoted to the error of forecasts. The errors apply *a fortiori* to the labor force, where we have depended on participation rates provided by the International Labor Office up to the year 2000; the years beyond 2000 are taken at the 2000 participation rates.

Table 1. Population projections for the next 50 years for countries with more than 250,000 inhabitants.[a]

Category	1980	1990	2000	2010	2020	2030
afganistan	16057.	20927.	26832.	33020.	38174.	43115.
albania	2771.	3479.	4034.	4598.	5080.	5452.
algeria	18969.	26290.	35215.	44765.	52802.	60534.
angola	7049.	8993.	11369.	13830.	15905.	17894.
argentina	26901.	29766.	32172.	34139.	35909.	37273.
australia	14413.	15907.	17117.	18134.	18980.	19564.
austria	7579.	7774.	7947.	8116.	8255.	8337.
bangladesh	85964.	111661.	142964.	175243.	202833.	228848.
barbados	262.	304.	336.	368.	397.	417.
belgium	9928.	10223.	10417.	10591.	10701.	10750.
benin	3502.	4618.	5979.	7391.	8578.	9718.
bhutan	1301.	1629.	1994.	2343.	2628.	2909.
bolivia	5640.	7283.	9024.	10512.	11938.	13234.
botswana	818.	1098.	1420.	1727.	1982.	2233.
brazil	123775.	157404.	190561.	218666.	244966.	267589.
bulgaria	8976.	9323.	9530.	9663.	9709.	9770.
burma	35113.	43550.	52386.	59765.	66821.	73190.
burundi	4207.	5295.	6630.	8111.	9599.	10852.
cambodia	7906.	9855.	11932.	13892.	15539.	17104.
canada	23805.	26054.	27646.	29000.	29988.	30440.
cape verde	330.	406.	473.	530.	583.	623.
central african republic	2284.	2842.	3495.	4108.	4626.	5141.
chad	4475.	5555.	6805.	7992.	8986.	9971.
chile	11107.	13056.	14758.	16167.	17439.	18362.
china	983000.	1113000.	1223000.	1314000.	1383000.	1423000.
colombia	26384.	33447.	39778.	45058.	50268.	54278.
comoros	344.	438.	530.	605.	682.	745.
congo	1520.	1932.	2425.	2927.	3350.	3754.
costa rica	2237.	2841.	3378.	3825.	4257.	4579.
cuba	10127.	11699.	13040.	14290.	15302.	16039.
cyprus	643.	708.	757.	801.	835.	851.
czechoslovakia	15311.	16031.	16631.	17253.	17661.	17955.
denmark	5148.	5312.	5438.	5545.	5621.	5639.
dominican republic	6054.	7664.	8911.	10258.	11371.	12262.
ecuador	8091.	10804.	13643.	16054.	18369.	20444.
egypt	41621.	51781.	61861.	70394.	78368.	85266.
el salvador	4851.	6473.	8183.	9615.	10995.	12230.
equatorial guinea	360.	444.	540.	631.	707.	783.
ethiopia	32747.	42623.	54689.	67267.	77858.	88008.
fiji	646.	791.	911.	1017.	1106.	1167.
finland	4809.	4972.	5049.	5107.	5111.	5053.
france	54080.	56855.	59225.	61453.	63033.	64082.
gabon	545.	608.	679.	747.	805.	860.
gambia	593.	767.	976.	1193.	1375.	1549.
german dem. rep.	16791.	16941.	17111.	17276.	17315.	17232.
germany, fed. rep. of	61627.	61977.	62280.	62090.	61668.	61051.
ghana	11545.	15229.	19523.	23604.	26969.	30356.
greece	9255.	9686.	10030.	10282.	10494.	10665.

[a] Calculations for China are based on constant birth cohorts of 20 million per year from 1980 on; the procedure for these projections is described in Keyfitz (1982).

-27-

Table 1 continued.

Category	1980	1990	2000	2010	2020	2030
guadeloupe	367.	448.	501.	561.	613.	651.
guatemala	7258.	9525.	11887.	13860.	15738.	17408.
guinea	4979.	6302.	7841.	9297.	10500.	11704.
guinea-bissau	573.	680.	812.	948.	1063.	1173.
guyana	904.	1148.	1344.	1533.	1706.	1834.
haiti	5866.	7410.	8905.	10134.	11391.	12421.
honduras	3674.	5018.	6498.	7722.	8921.	10018.
hong kong	4748.	5496.	6045.	6498.	6928.	7219.
hungary	10744.	10935.	11060.	11197.	11218.	11237.
iceland	232.	265.	292.	316.	338.	352.
india	696439.	863944.	1019902.	1146610.	1273371.	1375181.
indonesia	152116.	188391.	222252.	250181.	278781.	302145.
iran	38086.	50206.	62909.	73663.	83998.	93191.
iraq	13121.	18007.	23868.	30115.	35286.	40266.
ireland	3366.	3849.	4235.	4655.	5041.	5346.
israel	3804.	4458.	5046.	5568.	6056.	6427.
italy	57238.	59886.	61908.	63520.	64722.	65622.
ivory coast	7764.	10081.	12944.	15881.	18294.	20638.
jamaica	2313.	2903.	3351.	3838.	4272.	4616.
japan	116835.	124858.	131279.	134967.	136032.	136079.
jordan	3228.	4439.	5878.	7268.	8385.	9535.
kenya	16111.	22600.	30936.	39797.	47269.	54581.
korea, dem. peo. rep. of	18198.	23202.	27746.	31544.	35308.	38290.
korea, republic of	39057.	46310.	51800.	57261.	61648.	64843.
kuwait	1220.	1694.	2272.	2881.	3369.	3846.
lao people's democratic republic	3717.	4675.	5761.	6798.	7651.	8499.
lebanon	3123.	3933.	4665.	5274.	5887.	6370.
lesotho	1325.	1635.	1982.	2307.	2580.	2845.
liberia	1934.	2578.	3284.	3866.	4429.	4940.
libyan arab republic	2894.	3933.	5180.	6386.	7347.	8346.
luxembourg	364.	372.	373.	374.	373.	370.
madagascar	8679.	11098.	13985.	16947.	19448.	21827.
malawi	6093.	8167.	10724.	13382.	15621.	17776.
malaysia	14235.	17988.	20953.	23892.	26543.	28538.
mali	6909.	8973.	11381.	13677.	15576.	17486.
malta	346.	372.	391.	411.	423.	428.
martinique	357.	437.	495.	556.	610.	652.
mauritania	1631.	2136.	2731.	3301.	3772.	4248.
mauritius	968.	1175.	1364.	1527.	1667.	1778.
mexico	70878.	95238.	120835.	142424.	163072.	181393.
micronesia	345.	438.	524.	596.	666.	723.
mongolia	1668.	2161.	2675.	3097.	3499.	3854.
morocco	20275.	27324.	34907.	41253.	47459.	53095.
mozambique	10381.	13219.	16658.	20158.	23115.	25941.
namibia	995.	1281.	1617.	1955.	2241.	2511.
nepal	14251.	17914.	22103.	26040.	29304.	32570.
netherlands	14132.	15111.	15886.	16493.	16942.	17130.
new zealand	3291.	3696.	4017.	4320.	4578.	4757.
nicaragua	2750.	3744.	4803.	5695.	6556.	7329.
niger	5295.	7011.	9030.	10969.	12572.	14194.
nigeria	76325.	102286.	134087.	167030.	194727.	221346.
norway	4104.	4295.	4453.	4603.	4754.	4855.

Table 1 continued.

Category	1980	1990	2000	2010	2020	2030
pakistan	87285.	114797.	143580.	167548.	190803.	211489.
panama	1919.	2433.	2914.	3309.	3697.	3999.
papua new guinea	3111.	3929.	4830.	5678.	6378.	7063.
paraguay	3154.	4192.	5229.	6120.	6967.	7705.
peru	17735.	22956.	28319.	32832.	37131.	40926.
philippines	49910.	64433.	77708.	88767.	99695.	108305.
poland	35755.	38600.	40616.	42518.	43739.	44486.
portugal	9904.	10842.	11611.	12318.	12963.	13456.
portuguese timor	754.	938.	1134.	1298.	1456.	1598.
puerto rico	3379.	3951.	4451.	4877.	5247.	5497.
reunion	537.	668.	792.	902.	995.	1071.
romania	22157.	23683.	25132.	26255.	27140.	27955.
rwanda	4773.	6420.	8549.	11014.	13538.	15683.
saudi arabia	8490.	11395.	14962.	18760.	21893.	24929.
senegal	5656.	7321.	9339.	11427.	13188.	14872.
sierra leone	3440.	4377.	5458.	6482.	7333.	8180.
singapore	2448.	2851.	3162.	3431.	3641.	3758.
somalia	3520.	4504.	5752.	7157.	8570.	9772.
southern rhodesia	7310.	9856.	12925.	16087.	18745.	21284.
spain	37512.	41144.	43952.	46495.	48683.	50437.
sri lanka	15118.	18344.	20967.	23380.	25534.	27125.
sudan	18351.	23695.	29772.	35639.	40405.	45179.
surinam	425.	593.	755.	882.	1026.	1142.
swaziland	553.	716.	905.	1085.	1234.	1383.
sweden	8245.	8305.	8333.	8367.	8388.	8361.
switzerland	6509.	6719.	6876.	6979.	7018.	6996.
syrian arab republic	8879.	12341.	16096.	19244.	22324.	25120.
thailand	48300.	62004.	74778.	85341.	95888.	104269.
togo	2626.	3446.	4433.	5449.	6306.	7123.
trinidad and tobago	1192.	1429.	1622.	1792.	1943.	2048.
tunisia	6457.	8335.	10065.	11494.	12976.	14176.
turkey	45260.	56009.	64451.	72806.	80357.	86190.
u.s.s.r.	266077.	291222.	309623.	324956.	336221.	344850.
uganda	13029.	17040.	21804.	26644.	30721.	34587.
united kingdom	56672.	58225.	59456.	60616.	61824.	62552.
united republic of cameroon	8379.	10432.	12865.	15353.	17467.	19468.
united republic of tanzania	17779.	23681.	31245.	39823.	48534.	55951.
united states	220765.	236650.	247866.	258205.	266270.	270080.
upper volta	6891.	8858.	11147.	13329.	15135.	16946.
uruguay	2981.	3260.	3500.	3697.	3888.	4047.
venezuela	15233.	19926.	24605.	28541.	32241.	35426.
vietnam	53658.	66307.	78462.	88581.	98931.	107478.
windward islands	440.	587.	725.	839.	963.	1060.
yemen	5981.	7671.	9705.	11646.	13269.	14934.
yemen, democratic	1894.	2483.	3185.	3849.	4401.	4961.
yugoslavia	22317.	24049.	25383.	26426.	27098.	27564.
zaire	28064.	36099.	45668.	55451.	63634.	71389.
zambia	5710.	7649.	10018.	12480.	14549.	16538.

Table 2. Population projections of aggregated countries with less than 250,000 inhabitants.

Category	1980	1990	2000	2010	2020	2030
other east africa	181.	231.	286.	331.	375.	412.
other middle africa	84.	105.	126.	142.	159.	173.
other northern africa	87.	111.	135.	155.	176.	193.
other middle america	221.	289.	358.	413.	470.	517.
other tropical south america	57.	71.	87.	98.	108.	117.
other northern america	118.	129.	138.	145.	151.	154.
residual other east asia	300.	359.	410.	451.	489.	518.
other eastern south asia	169.	209.	251.	284.	318.	345.
other middle south asia	379.	474.	567.	641.	717.	779.
other western south asia	1551.	2021.	2480.	2853.	3238.	3556.
residual western south asia	692.	883.	1066.	1217.	1370.	1495.
other northern europe	236.	248.	257.	266.	276.	282.
other southern europe	82.	88.	93.	98.	101.	103.
other western europe	50.	54.	56.	58.	60.	62.
other caribbean	805.	997.	1173.	1320.	1463.	1572.
other melanesia	499.	646.	790.	904.	1021.	1116.
other polynesia	502.	668.	821.	947.	1077.	1180.

Table 3. Aggregated projections resulting from Tables 1 and 2.

Category	1980	1990	2000	2010	2020	2030
u.s., canada, etc.	291519.	319701.	342986.	364484.	381791.	393672.
western europe and japan	468254.	491431.	509836.	523720.	532819.	538007.
socialist countries	400899.	434263.	459119.	480140.	495183.	506501.
petroleum exporters	335090.	433539.	539670.	639122.	729617.	811333.
ldc's more than 400 dol	343778.	434333.	522290.	597432.	668075.	727877.
ldc's less than 400 dol	2694412.	3366344.	3977559.	4580297.	5123159.	5587630.
more developed regions	1160672.	1245396.	1311941.	1368344.	1409792.	1438179.
less developed regions	3277968.	4024374.	4764071.	5419934.	6014549.	6512071.
world, sum of other projections	4438640.	5269770.	6076012.	6788278.	7424341.	7950251.

Table 4.   Labor force projections for the next 50 years for countries with more than 250,000 inhabitants.

Category	1980	1990	2000	2010	2020	2030
afganistan	5408.	7090.	9317.	12209.	15378.	18170.
albania	1195.	1528.	1950.	2372.	2629.	2823.
algeria	4198.	5926.	8410.	11875.	15707.	19175.
angola	1881.	2403.	3133.	4102.	5179.	6133.
argentina	10348.	11497.	12706.	13749.	14383.	14772.
australia	6245.	6950.	7663.	8198.	8436.	8594.
austria	3407.	3651.	3756.	3847.	3833.	3802.
bangladesh	29720.	38636.	50310.	66055.	82663.	96979.
barbados	114.	140.	166.	192.	201.	205.
belgium	3912.	4102.	4170.	4242.	4169.	4121.
benin	1608.	2079.	2680.	3571.	4550.	5415.
bhutan	639.	802.	999.	1239.	1463.	1619.
bolivia	1793.	2350.	3172.	4095.	4946.	5530.
botswana	365.	497.	659.	887.	1120.	1308.
brazil	39874.	52129.	68312.	84721.	98093.	106338.
bulgaria	4723.	4821.	4920.	4975.	4981.	5012.
burma	14064.	17111.	20905.	25957.	30526.	33594.
burundi	2086.	2537.	3107.	3986.	4963.	5936.
cambodia	3323.	4028.	4870.	6078.	7200.	8048.
canada	10431.	11574.	12487.	13153.	13059.	12939.
cape verde	96.	124.	152.	182.	202.	214.
central african republic	1237.	1518.	1853.	2336.	2816.	3179.
chad	1663.	2105.	2674.	3368.	4055.	4588.
chile	3733.	4665.	5513.	6259.	6707.	6935.
china	430554.	495174.	582393.	643598.	672553.	687025.
colombia	8450.	11130.	14271.	17606.	19870.	21273.
comoros	123.	158.	202.	257.	301.	332.
congo	525.	681.	911.	1182.	1486.	1756.
costa rica	755.	1012.	1303.	1582.	1757.	1858.
cuba	3215.	4115.	4867.	5408.	5712.	5835.
cyprus	298.	334.	371.	397.	398.	399.
czechoslovakia	7560.	8014.	8609.	8776.	8844.	8978.
denmark	2460.	2607.	2713.	2731.	2704.	2689.
dominican republic	1672.	2355.	3127.	3798.	4256.	4596.
ecuador	2564.	3497.	4861.	6408.	7813.	8770.
egypt	11593.	14523.	18133.	22320.	25913.	28326.
el salvador	1513.	2089.	2869.	3764.	4571.	5105.
equatorial guinea	105.	129.	160.	201.	242.	274.
ethiopia	13505.	17318.	22224.	29349.	37167.	44095.
fiji	207.	266.	323.	372.	395.	409.
finland	2349.	2481.	2502.	2452.	2321.	2269.
france	23244.	25202.	26763.	27981.	28012.	28180.
gabon	260.	280.	306.	348.	389.	422.
gambia	274.	345.	437.	574.	722.	851.
german dem. rep.	9012.	9522.	9447.	9415.	9288.	9062.
germany, fed. rep. of	28792.	30019.	29124.	28567.	28024.	27255.
ghana	4332.	5723.	7712.	10306.	13107.	15371.
greece	3903.	4119.	4271.	4456.	4536.	4561.

Table 4 continued.

Category	1980	1990	2000	2010	2020	2030
guadeloupe	139.	181.	228.	278.	296.	311.
guatemala	2184.	2924.	3879.	4995.	5988.	6664.
guinea	2240.	2792.	3457.	4411.	5380.	6124.
guinea-bissau	177.	209.	251.	306.	368.	421.
guyana	293.	406.	531.	656.	724.	767.
haiti	2799.	3567.	4478.	5600.	6515.	7230.
honduras	1065.	1492.	2066.	2776.	3436.	3885.
hong kong	2212.	2487.	2818.	3166.	3280.	3345.
hungary	5218.	5282.	5395.	5322.	5283.	5326.
iceland	96.	111.	128.	144.	151.	155.
india	269761.	333059.	409163.	501319.	572762.	619003.
indonesia	54011.	66275.	81275.	100870.	116518.	127584.
iran	10692.	14338.	19460.	25346.	30485.	33829.
iraq	3197.	4339.	6006.	8223.	10728.	13047.
ireland	1251.	1446.	1737.	1993.	2143.	2269.
israel	1353.	1641.	2023.	2345.	2548.	2694.
italy	21313.	22662.	23487.	24206.	24466.	24555.
ivory coast	3896.	4984.	6280.	8143.	10217.	12005.
jamaica	829.	1191.	1599.	1985.	2203.	2325.
japan	60720.	66573.	70189.	70226.	70310.	70800.
jordan	749.	1042.	1467.	2002.	2590.	3055.
kenya	5770.	8016.	11049.	15645.	21010.	25917.
korea, dem. peo. rep. of	8000.	10521.	13850.	17300.	19825.	21496.
korea, republic of	14843.	18491.	22392.	25497.	27049.	27915.
kuwait	340.	449.	609.	811.	1062.	1308.
lao people's democratic republic	1770.	2158.	2645.	3345.	4043.	4582.
lebanon	864.	1153.	1473.	1832.	2082.	2225.
lesotho	687.	845.	1038.	1294.	1551.	1757.
liberia	657.	883.	1178.	1565.	1935.	2193.
libyan arab republic	721.	957.	1308.	1755.	2262.	2682.
luxembourg	146.	145.	144.	141.	137.	137.
madagascar	4439.	5603.	7045.	9092.	11280.	13171.
malawi	2573.	3451.	4563.	6151.	7903.	9446.
malaysia	4959.	6567.	8604.	10536.	11668.	12500.
mali	3705.	4831.	6217.	8066.	9886.	11237.
malta	122.	131.	143.	148.	148.	149.
martinique	127.	176.	223.	272.	296.	307.
mauritania	472.	625.	823.	1084.	1350.	1558.
mauritius	337.	434.	522.	611.	661.	689.
mexico	20451.	28857.	40460.	53280.	64771.	72204.
micronesia	121.	160.	212.	262.	299.	322.
mongolia	622.	810.	1047.	1335.	1595.	1760.
morocco	5296.	7346.	10235.	13841.	17182.	19424.
mozambique	3869.	4787.	5959.	7719.	9648.	11324.
namibia	322.	411.	530.	687.	855.	997.
nepal	6849.	8624.	10748.	13502.	16075.	17861.
netherlands	5501.	5986.	6278.	6487.	6430.	6381.
new zealand	1348.	1545.	1756.	1928.	1998.	2043.
nicaragua	823.	1179.	1684.	2256.	2778.	3126.
niger	1666.	2254.	3030.	4012.	4995.	5778.
nigeria	28179.	37331.	50133.	68068.	88632.	107458.
norway	1565.	1665.	1790.	1884.	1910.	1926.

Table 4 continued.

Category	1980	1990	2000	2010	2020	2030
pakistan	24442.	32451.	43238.	56575.	68490.	70453.
panama	659.	861.	1106.	1359.	1539.	1648.
papua new guinea	1556.	1918.	2346.	2951.	3540.	3982.
paraguay	1032.	1416.	1956.	2529.	3012.	3323.
peru	5241.	7137.	9711.	12491.	14972.	16582.
philippines	18241.	23692.	30584.	38469.	44289.	48252.
poland	19511.	21045.	22730.	23972.	24072.	24457.
portugal	3808.	4159.	4606.	5034.	5277.	5440.
portuguese timor	229.	288.	366.	457.	541.	597.
puerto rico	1104.	1382.	1633.	1846.	1961.	2011.
reunion	170.	231.	288.	346.	388.	413.
romania	12013.	12877.	13685.	14462.	15131.	15586.
rwanda	2495.	3328.	4421.	6006.	7875.	9787.
saudi arabia	2304.	2970.	3917.	5231.	6745.	8171.
senegal	2326.	2927.	3711.	4876.	6149.	7260.
sierra leone	1270.	1590.	2024.	2616.	3229.	3705.
singapore	971.	1135.	1287.	1398.	1424.	1440.
somalia	1378.	1721.	2162.	2826.	3603.	4400.
southern rhodesia	2427.	3254.	4401.	5970.	7728.	9304.
spain	13150.	14625.	16051.	17455.	18215.	18696.
sri lanka	5185.	6511.	7882.	9257.	10005.	10456.
sudan	5845.	7604.	9849.	12659.	15499.	17689.
surinam	101.	168.	242.	344.	423.	463.
swaziland	254.	325.	416.	546.	684.	798.
sweden	3653.	3763.	3863.	3810.	3739.	3712.
switzerland	3172.	3331.	3382.	3383.	3342.	3309.
syrian arab republic	2168.	3092.	4408.	6074.	7617.	8624.
thailand	22733.	29176.	36535.	45405.	51815.	56371.
togo	1100.	1416.	1813.	2400.	3039.	3602.
trinidad and tobago	467.	602.	719.	835.	892.	915.
tunisia	1618.	2141.	2833.	3652.	4259.	4635.
turkey	19572.	23984.	29709.	35848.	39755.	42787.
u.s.s.r.	134374.	144349.	151872.	161287.	162959.	166147.
uganda	5364.	6991.	8969.	11750.	14737.	17325.
united kingdom	26735.	28089.	29147.	30137.	30224.	30000.
united republic of cameroon	3841.	4641.	5663.	7190.	8806.	10191.
united republic of tanzania	7374.	9647.	12552.	16930.	22140.	27515.
united states	101485.	110754.	119282.	125589.	124619.	123533.
upper volta	3646.	4675.	5928.	7636.	9330.	10610.
uruguay	1148.	1267.	1402.	1531.	1611.	1652.
venezuela	4672.	6483.	8716.	11083.	13068.	14288.
vietnam	24515.	29880.	36543.	44967.	51575.	56472.
windward islands	144.	214.	293.	404.	478.	516.
yemen	1496.	1991.	2628.	3505.	4443.	5170.
yemen, democratic	460.	617.	822.	1102.	1403.	1634.
yugoslavia	10215.	10969.	11656.	12113.	12266.	12417.
zaire	11663.	14837.	18974.	24630.	30767.	36111.
zambia	2100.	2767.	3638.	4914.	6345.	7636.

Table 5. Labor force projections of aggregated countries with less than 250,000 inhabitants.

Category	1980	1990	2000	2010	2020	2030
other east africa	69.	95.	124.	159.	187.	209.
other middle africa	35.	44.	53.	67.	77.	83.
other northern africa	22.	28.	39.	51.	60.	67.
other middle america	64.	89.	122.	158.	187.	207.
other tropical south america	18.	25.	31.	37.	43.	46.
other northern america	54.	60.	66.	69.	70.	71.
residual other east asia	123.	154.	186.	217.	235.	243.
other eastern south asia	64.	83.	103.	128.	147.	160.
other middle south asia	140.	176.	219.	271.	313.	340.
other western south asia	399.	525.	696.	899.	1066.	1188.
residual western south asia	230.	295.	384.	483.	562.	617.
other northern europe	107.	112.	121.	128.	130.	133.
other southern europe	33.	36.	38.	40.	40.	40.
other western europe	20.	21.	24.	26.	27.	27.
other caribbean	304.	406.	518.	630.	707.	748.
other melanesia	188.	247.	318.	406.	478.	527.
other polynesia	162.	228.	318.	413.	483.	527.

Table 6. Aggregated projections resulting from Tables 4 and 5.

Category	1980	1990	2000	2010	2020	2030
u.s., canada, etc.	130165.	145055.	160115.	172936.	177159.	179723.
western europe and japan	209460.	225039.	234425.	239516.	240287.	240606.
socialist countries	203822.	218407.	230264.	242694.	245454.	249808.
petroleum exporters	111137.	142844.	185003.	240017.	293409.	336733.
ldc's more than 400 dol	110820.	144714.	187884.	232355.	267854.	290306.
ldc's less than 400 dol	1090611.	1366190.	1691113.	2065267.	2365529.	2594164.
more developed regions	543447.	588501.	624804.	655145.	662900.	670136.
less developed regions	1269280.	1560334.	1932778.	2343099.	2680263.	2924087.
world, sum of other projections	1812727.	2148835.	2557582.	2998245.	3343163.	3594224.

Table 7.   Assumed time interval at which replacement level will be
reached for countries with more than 250,000 inhabitants.

Country	Time interval	Country	Time interval
afganistan	2015/2020	lesotho	2010/2015
albania	1995/2000	liberia	2005/2010
algeria	2015/2020	libyan arab republic	2010/2015
angola	2015/2020	luxembourg	1995/2000
argentina	2000/2005	madagascar	2015/2020
australia	2000/2005	malawi	2015/2020
austria	1995/2000	malaysia	1995/2000
bangladesh	2015/2020	mali	2010/2015
barbados	1995/2000	malta	2000/2005
belgium	2000/2005	martinique	1990/1995
benin	2015/2020	mauritania	2010/2015
bhutan	2010/2015	mauritius	2010/2015
bolivia	2005/2010	mexico	2005/2010
botswana	2010/2015	micronesia	2000/2005
brazil	2005/2010	mongolia	2005/2010
bulgaria	1995/2000	morocco	2005/2010
burma	2005/2010	mozambique	2015/2020
burundi	2025/2030	namibia	2015/2020
cambodia	2010/2015	nepal	2010/2015
canada	2000/2005	netherlands	1995/2000
cape verde	2000/2005	new zealand	1995/2000
central african republic	2010/2015	nicaragua	2005/2010
chad	2010/2015	niger	2010/2015
chile	2000/2005	nigeria	2015/2020
colombia	2000/2005	norway	2000/2005
comoros	2000/2005	pakistan	2005/2010
congo	2015/2020	panama	2000/2005
costa rica	2000/2005	papua new guinea	2010/2015
cuba	1990/1995	paraguay	2005/2010
cyprus	1995/2000	peru	2005/2010
czechoslovakia	1995/2000	philippines	2000/2005
denmark	2000/2005	poland	2000/2005
dominican republic	1990/1995	portugal	2000/2005
ecuador	2005/2010	portuguese timor	2005/2010
egypt	2005/2010	puerto rico	2000/2005
el salvador	2005/2010	reunion	2010/2015
equatorial guinea	2010/2015	romania	2005/2010
ethiopia	2015/2020	rwanda	2025/2030
fiji	1995/2000	saudi arabia	2015/2020
finland	2000/2005	senegal	2015/2020
france	1995/2000	sierra leone	2010/2015
gabon	2010/2015	singapore	1990/1995
gambia	2015/2020	somalia	2025/2030
german dem. rep.	1995/2000	south africa	2010/2015
germany, fed. rep. of	1995/2000	southern rhodesia	2015/2020
ghana	2010/2015	spain	1995/2000
greece	2000/2005	sri lanka	1995/2000
guadeloupe	1990/1995	sudan	2015/2020
guatemala	2005/2010	surinam	2000/2005
guinea	2010/2015	swaziland	2010/2015
guinea-bissau	2015/2020	sweden	2000/2005
guyana	1995/2000	switzerland	1995/2000
haiti	2000/2005	syrian arab republic	2005/2010
honduras	2005/2010	thailand	2000/2005
hong kong	2000/2005	togo	2015/2020
hungary	2000/2005	trinidad and tobago	1995/2000
iceland	2000/2005	tunisia	2000/2005
india	2000/2005	turkey	1995/2000
indonesia	2000/2005	u.s.s.r.	2005/2010
iran	2005/2010	uganda	2015/2020
iraq	2015/2020	united kingdom	1995/2000
ireland	1995/2000	united republic of cameroon	2015/2020
israel	2000/2005	united republic of tanzania	2025/2030
italy	1995/2000	united states	2000/2005
ivory coast	2015/2020	upper volta	2010/2015
jamaica	1990/1995	uruguay	2000/2005
japan	1995/2000	venezuela	2005/2010
jordan	2010/2015	vietnam	2000/2005
kenya	2015/2020	windward islands	2000/2005
korea, dem. peo. rep. of	2000/2005	yemen	2010/2015
korea, republic of	1990/1995	yemen, democratic	2010/2015
kuwait	2015/2020	yugoslavia	2000/2005
lao people's democratic republ	2010/2015	zaire	2015/2020
lebanon	2000/2005	zambia	2015/2020

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