

# POPULATION BULLETIN OF THE UNITED NATIONS

Nos. 21/22-1987



UNITED NATIONS



DEPARTMENT OF INTERNATIONAL ECONOMIC AND SOCIAL AFFAIRS

# POPULATION BULLETIN OF THE UNITED NATIONS

**Nos. 21/22-1987**



**UNITED NATIONS**  
New York, 1988



## NOTE

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The term "country" as used in the text of this publication also refers, as appropriate, to territories or areas.

The views expressed in signed papers are those of the individual authors and do not imply the expression of any opinion on the part of the United Nations Secretariat.

Papers have been edited and consolidated in accordance with United Nations practice and requirements.

ST/ESA/SER.N/21-22

UNITED NATIONS PUBLICATION

Sales No. E.87.XIII.5

01000

ISBN 92-1-151166-6

Copyright © United Nations 1987  
All rights reserved  
Manufactured in the United States of America



## PREFACE

The purpose of the *Population Bulletin of the United Nations*, as stipulated by the Population Commission, is to publish population studies carried out by the United Nations, its specialized agencies and other organizations with a view to promoting scientific understanding of population questions. The studies are expected to provide a global perspective of demographic issues and to weigh the direct and indirect implications of demographic policy. The *Bulletin* is intended to be useful to Governments, international organizations, research and training institutions and other bodies that deal with questions relating to population and development.

The *Bulletin* is prepared by the Population Division of the Department of International Economic and Social Affairs of the United Nations Secretariat and published semi-annually in three languages—English, French and Spanish. Copies are distributed widely to users in all member countries of the United Nations.

Although the primary source of the material appearing in the *Bulletin* is the research carried out by the United Nations Secretariat, officials of governmental and non-governmental organizations and individual scholars are occasionally invited to contribute articles.







## CONTENTS

	<i>Page</i>
Explanatory notes .....	vi
State of population research and research needs as expressed at the International Conference on Population and at its preparatory meetings	
Jean-Claude Chasteland.....	1
Population growth and development: an unexplained boom	
Jean-Claude Chesnais .....	17
Population, resources and food in Africa	
David Norse .....	26
Population and the environment	
United Nations Secretariat.....	32
Determinants of excess female mortality	
Eduardo E. Arriaga and Peter O. Way .....	45
Projection of age-specific mortality rates	
John H. Pollard.....	55
International co-operation in the area of population	
United Nations Secretariat.....	70
Recent developments in population trends and policies	
United Nations Secretariat.....	78



### Explanatory Notes

Reference to "dollars" (\$) indicates United States dollars, unless otherwise stated.

The term "billion" signifies a thousand million.

Annual rates of growth or change refer to annual exponential rates, unless otherwise stated.

A hyphen between years (e.g., 1984-1985) indicates the full period involved, including the beginning and end years; a slash (e.g., 1984/85) indicates a financial year, school year or crop year.

A point (.) is used to indicate decimals.

The following symbols have been used in the tables:

Two dots (.) indicate that data are not available or are not separately reported.

A dash (—) indicates that the amount is nil or negligible.

A hyphen (-) indicates that the item is not applicable.

A minus sign (-) before a number indicates a deficit or decrease, except as indicated.

Details and percentages in tables do not necessarily add to totals because of rounding.

The following abbreviations have been used:

CELADE Centro Latinoamericano de Demografía

CICRED Comité international de coopération dans les recherches nationales en démographie (Committee for International Co-operation in National Research in Demography)

CMEA Council for Mutual Economic Assistance

DHS Demographic and health surveys

ECA Economic Commission for Africa

ECE Economic Commission for Europe

ECLAC Economic Commission for Latin American and the Caribbean

ESCAP Economic and Social Commission for Asia and the Pacific

ESCWA Economic and Social Commission for Western Asia

FAO Food and Agriculture Organization of the United Nations

GNP Gross national product

IIASA International Institute for Applied Systems Analysis

IPPF International Planned Parenthood Federation

ISI International Statistical Institute

IUCN International Union for the Conservation of Nature and Natural Resources

IUSSP International Union for the Scientific Study of Population

OECD Organisation for Economic Co-operation and Development

OPCS Office of Population Census and Surveys (United Kingdom)

UNDP United Nations Development Programme

UNEP United Nations Environment Programme

UNFPA United Nations Fund for Population Activities

UNICEF United Nations Children's Fund

WFS World Fertility Survey

WHO World Health Organization

WWF World Wildlife Fund

WPPA World Population Plan of Action

# STATE OF POPULATION RESEARCH AND RESEARCH NEEDS AS EXPRESSED AT THE INTERNATIONAL CONFERENCE ON POPULATION AND AT ITS PREPARATORY MEETINGS\*

*Jean-Claude Chasteland\*\**

## SUMMARY

One of the ways in which demography advances is by reappraising the problems with which it deals and, in that connection, international conferences play a major role. The International Conference on Population (1984) and the four expert group meetings organized for its substantive preparation gave Governments an opportunity to convey to the scientific community the issues in the field of population research which were of major concern to them.

This article is organized around three main themes. The first concerns current needs in population research as perceived by Governments, and the extent to which currently available knowledge is considered adequate. The second concerns the main characteristics of current demographic research and the extent to which it corresponds to the needs perceived by Governments, as described in the first part of the article. The third concerns priority. With limited human and financial resources, particularly in the present world economic situation, on what basis should we decide which population research projects we pursue?

## INTRODUCTION

When one surveys the appraisals of population data collection and research from the vantage of the mid 1980s—when the International Conference on Population was held (1984) at Mexico City (hereinafter, the Mexico City Conference), one is struck by how few such appraisals there are, in comparison with the mid 1970s—when the United Nations World Population Conference was held (1974) at Bucharest (hereinafter, the Bucharest Conference). One explanation may be that the Bucharest Conference reflected an era of major change in demographic concepts, theories and values. The change was expressed in two ways: first, demographers were urged to acknowledge that given the complexity of the contemporary world, population problems could not be dealt with apart from their economic and social context; secondly, they were asked to recognize and accept the responsibility imposed by the political dimensions of their field of study. Like economics, which

gave rise in the nineteenth century to political economy, demography was to become political demography.

In 1984, the reactions of the demographic community to the Mexico City Conference were notably calm, since it was not a matter of proposing a new approach but rather of reaffirming the one adopted at Bucharest. Today demographers are expected to be concerned, no more and no less than 10 years ago, with the welfare of people in a national or international context.

Relations between demographers and politicians have not always been without ambiguity, but it appears that a kind of *modus vivendi*—or, rather, *modus operandi*—has been gradually established, which is often a source of mutual enrichment. Demographers who may have doubts about such close co-operation may wish to recall the declaration of principles of the sociologist Emile Durkheim: "Sociology would not be worth one hour of effort if it did not help to solve social problems."<sup>1</sup> While it is desirable for demography to concern itself with the public good and to help promote it as far as possible, it must do so without subordinating itself to political or ideological considerations which would be out of place in a discipline which must, if it is to be of any use, be scientific—that is, objective in relation to the passions or pressures of the moment.

Like the other social sciences, demography advances on three fronts. In the first place, it develops by building

\* Original in French and largely based on an earlier paper prepared by the author for the International Meeting on Aid and Co-operation in the Field of Population and Development: Issues and Strategies, held at Florence, 3-4 June 1985, and organized by the International Union for the Scientific Study of Population (IUSSP) in collaboration with the Department for Development Cooperation of the Italian Ministry of Foreign Affairs and the United Nations Fund for Population Activities.

\*\* Director, Population Division, Department of International Economic and Social Affairs, United Nations Secretariat.

*The limits of present knowledge*

The Mexico City Conference obviously attached great importance to the relationship between socio-economic development, the environment and population. In reaffirming that development was the key to all other problems, the Conference confined itself to making a general statement, leaving practical implications to the technical experts. Nevertheless, demographic variables were not seen as having only a passive role, since recommendation 1 states, *inter alia*, that "... population factors . . . have a major impact on the attainment of development objectives . . .".<sup>6</sup>

This section is concerned with the overall implications of population growth and the interplay between demographic and non-demographic variables. The question of the determinants and effects of changes in the various demographic variables will be taken up in the sections on fertility, mortality and migration, except for the impact on fertility, which will be dealt with in this section.

It has often been said that, from the point of view of policy relevance, studies of implications are not a clear priority, since their main value is to draw attention to problems that have gone unnoticed. Studies on determinants, which have practical policy-making applications, should be given priority. In my view, that distinction is not entirely acceptable. Ideally, demographers should be able to provide models which make it possible, for example, to evaluate the costs and benefits of different rates of population growth. Such models should also make it possible to evaluate the "costs", both economic and socio-cultural, of implementing population policies and should ultimately help to promote rational choices. From that point of view, studies of implications shed light on the action taken by policy makers, just as studies of determinants guide policy makers in choosing the most effective action to take.

*Accumulation of empirical knowledge*

The demography of growth is taken here to refer to the size of the population, its age structure and its absolute and relative increase. One of the primary purposes of demography has been to investigate changes in those conditions over the short or long term.

Population projections make it possible, *inter alia*, to monitor movements in those variables under clearly defined conditions. They are now recognized as a valuable tool for exploring the future—provided, of course, that they are not assumed to be predictions. Recently, they have begun to be used to test the feasibility of certain quantitative and time-limited population goals, indicate how these goals can be attained and suggest demographic constraints one can expect to encounter. Projections are becoming increasingly useful for population subgroups or

up a body of empirical knowledge—hence, the essential role of data collection and analysis. Secondly, it develops by reappraising the problems with which it deals, and in that connection the Bucharest Conference played an important role. Lastly, it also advances through the development of theory which helps to improve our understanding of social reality.<sup>2</sup> However, progress in the sphere of theory is not bound up with the other two kinds of progress. It can be relatively independent of the political, economic and social environment of the time and does not have to be a response to any immediate need. It may be recalled in that connection that Alfred Lotka's *Théorie des associations biologiques*, which was published in 1939, really became useful only some 15 years later, when it was discovered that the mathematical relationships which Lotka has developed could be a powerful tool for exploring the demography of the developing countries.<sup>3</sup>

Of course, scientific knowledge and progress has to be transmitted to future users in the form of a systematized body of knowledge—hence, the importance to be given to the development of training and to the quality of teachers and educational institutions. It should be pointed out, however, that the problems of education seem to arouse far less interest in 1985 than they did in 1975. The paucity of any literature on the subject is in itself a very telling indication of this regrettable state of affairs.<sup>4</sup>

In order to outline current needs with respect to data and research, it has been necessary to make choices. First, as the title of this paper indicates, I will discuss current research needs with reference to those identified at the Mexico City Conference and, in particular, by the four expert groups which met prior to the Conference to provide scientific groundwork. The four expert groups adopted some 40 recommendations relating directly to data collection and research. Of course, many other action-oriented recommendations were also adopted. It should also be pointed out that certain implications of the Mexico City recommendations for population programmes and population research have already been the subject of one in-depth study which is available for reference.<sup>5</sup>

The ideas presented in this paper, therefore, relate primarily to the problems of applied population research, and more specifically to the solution of the population problems currently facing third-world Governments which, in their view, require governmental intervention. Consequently, I have followed, as far as possible, the order of presentation of the various population issues used at the Mexico City Conference. In connection with each issue, I have attempted to take stock of current empirical knowledge and the theoretical framework of current population research. I have also inquired into the extent to which the questions of concern to the profession have or have not been modified by the emergence of new social problems over the past 10 years. Research has been emphasized, at the expense of data collection, and only those data collection and research problems that fall within the sphere of the social sciences are discussed in this paper; biological research on human reproduction is not covered.

\* This section will deal with the questions raised not only in the section of the Mexico City recommendations entitled "Socio-economic development, environment and population" but also in the sections entitled "Population growth" and "Population structure".



subregions. However, the value of such projections is still limited by inadequate or inappropriate levels of disaggregation in the basic data.

Population projections, which thus far have essentially been extrapolations of trends observed in the past, will be able to make significant progress only when they take into account the quantitative relationships between demographic and socio-economic variables.

Whereas the demographic processes of population growth are well understood, far too little is known about their socio-economic effects. Those effects are analysed from the point of view of growth or age structure, while the size-specific effects are neglected in the neoclassical analysis, which usually forms the theoretical framework for analysing effects. In macro-economic terms, the growing body of recent empirical data on the impact on saving and investment, employment, income distribution, technical change and international trade often appear to be in conflict with the neoclassical theories and are, at best, difficult to interpret. However, insufficient demographic data and especially socio-economic data continue to aggravate the theoretical difficulties inherent in the subject. Having seen the obstacles to minimum standards of quality and comparability for demographic data, one can well imagine the difficulties involved in establishing comparable population and socio-economic data series.

At the time the Club of Rome released its report,<sup>7</sup> what was uppermost in people's minds was the impact of demographic growth on natural resources and the environment. There again, however, the empirical data did not fully justify the fears expressed at the time, at least not if one takes into account movements in the real prices of their resources. One of the most important problems confronting the developing countries is population pressure and the need to increase food production. A useful contribution to this question has been provided by the concept of agricultural carrying-capacity, which affords a better understanding of the complex relationships between food production and population trends.

The quality of the environment in which a population lives clearly has an impact on its state of health, just as the population can have an adverse or beneficial impact on the quality of the environment. The difficulty of assessing the relative impact of the various factors which have a bearing on the environment and of studying their interaction or the feedback between them arises partly from the lack of statistical data, which makes it very difficult to assess past changes, and partly from the inadequacy of existing theoretical models.

The many obstacles that must be overcome in order for a correct evaluation of the macro-economic impact of population growth to be made were summed up as follows: There is an "enormous difference between (a) attempting to identify some of the causal factors that actually contributed to an observed effect, and (b) attempting to specify what the world would have been like in the absence of one of the causes that actually did occur".<sup>8</sup>

The direct effects of population growth on certain sectors of economic activity are better documented. There are well-known studies of its impact on education, health and social services. Less is known, however, about its

delayed effects (for example, the economic impact of the development of human resources through the improvement of health and education etc.).

There is no consensus concerning the impact on individuals, families and communities in terms of health, education and welfare. On the one hand, some observations seem to indicate that high fertility and large families are a rational adaptation to the given economic and social environment; observations gathered by anthropologists, on the other hand, have shown that individuals and families suffer in terms of health, education and welfare as a result of high fertility.

This brief survey of present empirical knowledge about the impact of population growth is rather discouraging, especially compared with the progress which has been made, as described below, in studying the determinants of fertility, especially its direct determinants.

#### *Reappraisal of the problems*

Over the past 10 years, population growth in the third world has declined for the first time. The decline has generated opposing interpretations: some emphasize that it has not been all that far-reaching, but has, in fact, been limited to a single country, China. Others have countered that the decline was only moderate, owing to simultaneous and very significant declines in fertility and mortality, and that what was significant was that fertility had declined in many countries. Whichever view one takes, the growth potential that has been building up for more than 20 years in the age structures has continued and even intensified its effects. Despite the deceleration in growth rates in the third world, annual increases are rising steadily and will continue to do so into the next century. Against the background of relative deceleration, there is superimposed a progressive aging of the population; its consequences, still largely unfelt in the third world, call for careful evaluation.

The economic picture in the third world has been marked by a few successes, but by many more difficulties. One of the bright spots has been an overall increase in agricultural production, exceeding the rise in population, although there have been serious failings in Africa, where agricultural output has not kept pace with population growth.

Relative to the North, the South has, with a few exceptions, experienced greater deterioration. Not only has the disparity between the total income of the industrialized countries and that of the developing countries become sharper but—what is worse—the gap between their per capita incomes has widened. Nevertheless, within the third world itself, substantial differences have emerged, and its economic homogeneity, like its demographic homogeneity, is a thing of the past.

During the past 10 years, the varied performances of the developing countries—countries with high rates of population growth as well as those whose rates were low, those pursuing bold population policies and those where such policies were non-existent—with regard to the rational utilization of their resources, the protection of the environment and the management of their economies, have strained to the limit the analytical capac-

ities of demographers and economists. The contradictions that have appeared make it clear that the existing models and theories were not always adequate.

#### *Theoretical framework*

The kind of consensus which existed among demographers in the 1960s and 1970s (it was less widely accepted among economists) with regard to the implications of growth no longer exists today. (And the findings emerging from empirical observation point in several different directions.) The prevailing neoclassical orthodoxy with its emphasis on the adverse effects of population growth has yielded some ground to theoretical structures in which population growth plays a neutral or even positive role in the economic and social development process, thereby posing the need for very active research on a subject which was prematurely regarded as closed.

In the absence of any completely satisfactory theoretical framework, we can use a conceptual framework of more limited practical scope: the integration of population factors into development. It should be noted, however, that neither the Bucharest nor the Mexico City Conference spelled out the extent to which such factors are integrated and the nature of the interactions involved. Another possible approach to research would be to try not only to identify the more stable patterns and associations but also to seek out feedback and laws that hold over some limited domain. Those could provide a basis for the development of middle-range theories and simple models with which to better understand some of the existing data. The time for building demographic/economic models on a grand scale, it seems, is past. The lack of empirical data, the fragility of theoretical constructs and the high cost of such modelling inhibit, for the time being, any attempt to reactivate the line of research, although it was a line that made it possible to bring together in the mind of the researcher empirical data, theoretical analysis and action-oriented ideas.

#### *Concerns of the international community*

The Expert Group on Population, Resources, Environment and Development, which met at Geneva in April 1983, adopted a number of recommendations on research. In its recommendation 35, the Group observes that "the study of the interrelationship between equality and population, resources and the environment is constrained by a lack of statistical information disaggregated by social groups . . .". In its recommendation 36 the Group "recommends that priority should be given to studies on the response of production and income distribution to the growth of population and other variables". In its recommendation 37, the Expert Group notes that "it is difficult to estimate the relationships between population factors and income distribution" using country analyses. Therefore, it recommends that greater attention should be given to studying those relationships from a historical perspective. The latter recommendation is especially timely since data covering relatively long periods is beginning to become available in several countries and has not yet been analysed. Lastly, the Group adopted two extremely useful recommendations on the way in which population factors should be taken into account in planning. Recommendation

41 indicates that "population variables are usually treated as exogenous in planning exercises". It therefore recommends that greater emphasis should be given to research on the "population consequences of broad development strategies". Recommendation 42 states that "a body of reliable methodologies for integrated planning of population, . . . environment and development programmes does not now exist and, therefore, . . . research should be undertaken to develop such methodologies".<sup>9</sup>

The participants in the Mexico City Conference took up the question of research on the interrelationship between population and development in several connections. With regard to research as such, they adopted recommendation 72, which states "Special emphasis should be given to research on the integration of population processes with socio-economic development, considering not only applied but theoretical and methodological topics".<sup>6</sup> That recommendation must also be regarded as very important by researchers, since it clearly establishes the importance attached by a political conference to basic research. In addition, recommendations 2 and 3 refer explicitly to the integration of population programmes in economic and social programmes and the influence of various economic and social programmes on the implementation of population programmes.<sup>6</sup>

#### ROLE AND STATUS OF WOMEN

##### *The limits of present knowledge*

##### *Accumulation of empirical knowledge*

Data from a number of sources enable us to analyse the relationship between the status of women and demographic phenomena. The first source is the censuses. Vital statistics provide valuable information on the differentiation by sex of certain demographic processes. In addition, specialized sample surveys, such as the World Fertility Survey or sociological or anthropological surveys, provide specific information on the relationship between the status of women and population trends.

Unfortunately, census data are often not very detailed or specific, and data collected by surveys are often partial and too limited in scope for purposes of global interpretation. However, the analysis of census data has given us a better quantitative idea of women's status in society. Interesting information has been extracted on such subjects as the relationships between education and employment, and fertility, mortality and migration. Intensive study of those relationships, particularly as regards fertility, complemented by such surveys as the World Fertility Survey, has helped to measure the impact of demographic factors on the status of women and has opened new avenues for intervention by Governments seeking to improve that status by, for example, controlling fertility.

##### *Reappraisal of the problem*

In the 1960s and 1970s, the status of women was a major political and social issue. It became the focus, in 1975, of the World Conference of the International Women's Year, held at Mexico City. Since then, it has been under continuous discussion, both at the national level and in United Nations bodies and various non-governmental organizations.

International awareness of the link between population and the status of women has become especially keen. Thinking through the question has encouraged the international community to formulate and implement a number of programmes of intervention where the two factors intersect.

#### *Theoretical framework*

Various theoretical models have been suggested to explain the differential and almost invariably inferior status of women. Some anthropologists have proposed that the "patriarchal ideology" underlying the system of male domination is founded on the biological differences between the sexes. Marxist authors explain the inequality between the sexes by reference to unequal access to ownership of the means of production, and maintain that with the shift to other production lines, change occurs. Suggestions have been made to amalgamate the two theories. For instance, emphasis has been placed on the essential and decisive role of the unequal access of women to the most rewarding jobs, even in societies with very different political régimes. In any case, it would be extremely difficult today to define the inferior status of women as a uniform phenomenon.

Historical analysis has shown that in the industrial societies of the nineteenth century, a decline in fertility was accompanied by an increased rate of activity by women and a higher level of education. That correlation, although it has not been established in all cases in the developing countries, has aroused a great deal of interest because it affords opportunities for intervention on population matters which do not conflict with the pursuit of more general social goals.

#### *Concerns of the international community*

The Mexico City Conference decided to give preferential treatment to the question of improving the status of women by detaching it from the context of reproduction and the family in which the Bucharest Conference had considered it. Clearly the shift was intended to mean that the status of women should be dealt with in relation to other demographic phenomena as well. For example, recommendation 18 of the Mexico City Conference states that "All efforts should be made to reduce maternal morbidity and mortality" and urges Governments to "... support family planning as a health measure." Those measures are clearly intended to improve the status of women from the health point of view. The same is true of recommendation 44, on migration, which stipulates that "Governments are ... urged to pay special attention to the difficulties of adaptation encountered in urban areas by migrant women of rural origin. ..." That recommendation clearly implies that relevant studies have been made on those problems of adaptation to urban life.

#### DEVELOPMENT OF POPULATION POLICIES

##### *The limits of present knowledge*

##### *Accumulation of empirical knowledge*

Data on population policies are still very sparse, but in the past 10 years, there has been considerable effort to

increase them and to increase their scope. From policies on fertility and birth control, collection has extended to such other demographic variables as the marriage rate, mortality, and internal and international migration.

Researchers have gathered information not only on the policies adopted but also on the decision-making processes that led to their adoption—for example, the attitudes or perceptions of Governments with regard to the major population problems.

Another important step forward was taken when part of the data gathering was geared to international comparability. In that connection, mention should be made of the pioneering role played by the United Nations Population Inquiries among Governments and of the establishment of a data bank on population policies in the Population Division.

On the basis of those data, gleaned from replies to the Population Inquiries and other official documents, demographers analyse the formulation of population policies by examining how the relationships between demographic and non-demographic processes are perceived. Although there now exists a relatively complete inventory of those relationships, all too little is known about how they are arrived at, at what quantitative thresholds they appear or do not appear, how they evolve and to what extent they are influenced by development problems generally.

A second step in the analysis of policy formulation is to identify the persons involved and determine how cultural and bureaucratic obstacles were dealt with. It is important to identify the criteria applied and, more especially, the values taken into account. Needless to say, a great deal remains to be done in that regard, for population policies have become more widespread and far-reaching, and they cannot be implemented, as the Mexico City Conference repeatedly pointed out, without taking into account basic human values and human rights.

A final basic step towards successful policies is continuous monitoring of their implementation, followed by evaluation of their effectiveness. In some demographic areas of intervention, like fertility, substantial progress has been made in the methods of measuring the impact of birth control programmes. There has been less progress in the area of mortality, and very much less in the area of migration policy, as can be seen below.

One of the technical difficulties to be overcome in evaluating population policies is how to isolate their effect from that of more strictly political and social policies. It is absolutely essential to do so, given the complexity and multiplicity of state interventions in the economic and social fields. For lack of data and appropriate methodologies, very little is known about the impact of population policies, particularly in the third world.

#### *Reappraisal of the problems*

The Bucharest Conference represented a turning point in legitimizing interventions by public authorities in population matters at the national and international levels. Of course, the problems involved in formulating population policies are primarily a national matter, but it is also true that such factors as changes in relative size



of a national population, the importance attached to that size for purposes of international assistance, and population movements such as international migrations are subjects of common interest which transcend national boundaries.

Conferences such as those of Bucharest and Mexico City not only provided Governments with a catalogue of legitimate interventions but also reminded them that those interventions remain legitimate provided they respect certain values and principles. Still, it is striking to note how little interest there is in the profession in considering those values and principles and generally giving some thought to the normative aspects of changes and interventions in population matters.

The World Population Plan of Action, adopted at the Bucharest Conference, stimulated thinking about the methodology for dealing with problems barely touched upon thus far—namely, those involved in integrating population policies with other development policies. The Plan also repeatedly emphasized the need—now that such a broad range of population policies exists—to develop methods of evaluation.

#### *Theoretical framework*

The researcher in population policies has no recognized scientific frame of reference. Since they are so close to action, population policies are more vulnerable than other areas of demographic research to ideological and dogmatic preconceptions. Moreover, their scope is poorly defined; at most, it is agreed that they should be explored from a multidisciplinary and, ideally, an interdisciplinary point of view; beyond that, the analyst is left to his own devices.

The modest methodological approach that had emerged shortly before and especially after Bucharest has pretty much run its course. Consequently, there is much to be done, and it becomes all the more urgent since population policy continues to be made year after year and there are consequently more and more policies to study.

#### *Concerns of the international community*

The four expert groups that were convened in preparation for the Mexico City Conference adopted a number of recommendations concerning research on population policies or the urgency of implementing them. Six of them (on fertility, mortality and migration) relate to the problems of policy evaluation. They will be considered in greater detail in the sections below dealing with reproduction and the family, morbidity and mortality, and migration and population distribution.

Apart from the recommendations for action adopted at Mexico City on specific demographic variables which often have implications for research on population policies, two recommendations deal specifically with the development of population policies. Recommendation 11 reminds Governments that population policies should be integrated into other social and economic policies, and recommendation 12 encourages them to adopt innovative measures to ensure successful population policies.<sup>6</sup>

Two further recommendations relate to research on population policies. Recommendation 70 urges Govern-

ments to “give priority to service and operational research . . .”, and recommendation 72 emphasizes the innovative role of research in “policy formulation, implementation and evaluation”.<sup>6</sup>

## MORBIDITY AND MORTALITY

### *The limits of present knowledge*

#### *Accumulation of empirical knowledge*

Demographers frequently express dismay over the lack of data on mortality levels and trends. Their dismay is understandable when the situation concerning mortality studies is compared with that concerning fertility studies. There has been no world survey on mortality, and the only available source of data in the most disadvantaged countries is a one-time census. While the most modern methods of indirect estimate are satisfactory for analysing mortality levels, they are unsatisfactory for purposes of estimating trends. Yet, a knowledge of trends is essential—for example, in evaluating the effects of health policies.

The situation is even more unsatisfactory when it comes to examining the causes of mortality, the mortality differential or even adult mortality.

As in the analysis of fertility, an attempt has been made to find statistical associations between the level and pattern of mortality and specific socio-economic variables linked with development, such as education, income and urbanization. But where there has been real progress in achieving an empirically based understanding of declines in mortality, it was possible to distinguish, among the factors that accounted for the decline, those linked with economic and social progress from those relating to the application of specific medical technologies.

Even less is known about the conditions that determine the persistence or development of differential mortality than about those that account for changes in fertility patterns, and only a few countries have conducted studies on the question. The studies have identified the influence of factors such as urbanization, education, income and employment. Thus, for example, it has been shown that the education of mothers greatly influences the health of young children, perhaps more than other factors. But the mechanisms through which mothers' education operates are still only beginning to be understood.

Mortality is determined not only by non-demographic factors but also by other demographic variables. Studies on the linkage between fertility and mortality have demonstrated the positive effect of child-spacing on the health of both mother and child; other studies have dealt with the interaction between mortality, migration and population distribution. Better distribution of the population in a healthier environment or within reach of adequate health facilities contributes, for example, to declines in mortality levels.

Lastly, on the borderline with demography, research on the combined effect of diet and a few elementary health measures on the level of mortality among young children has indicated a new approach to the formulation

of innovative health programmes. What has been called the "revolution in child survival techniques" is partly the result of translating that new insight into practice (rehydration, breast-feeding, child-spacing, monitoring of baby weight etc.).

The impact of a reduction in mortality may be judged from the point of view of its effects on the individual and the family, and on a macro-economic level. From a purely demographic point of view, one of the first effects is to increase the size of the family. On the economic level, the increase in job productivity, together with mortality decline, should help to increase income. However, there are few empirical data to substantiate that effect. On a macro-demographic or macro-economic level, the effects of a decline in mortality on population growth are different from the effects of a decline in fertility, because the age-specific effects are themselves different. The effects on capital formation and agricultural production of population growth resulting from a reduction in mortality appear to be positive on the whole, but there is no unanimity on that point. What is certain is that mortality decline contributes to an increase in the number of new entries on the job market and presumably to a better utilization of human resources.

### *Reappraisal of the problem*

In recent years, two events have aroused interest: a slower rate of decline in mortality, especially apparent in Africa, and the abrupt change in outlook resulting from the adoption of primary health care programmes by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) at the International Conference on Primary Health Care, held at Alma-Ata in 1978. Awareness of the slower decline was undoubtedly strengthened by seeing the effects of the economic crisis in most third-world countries. It suddenly became clear that the optimistic extrapolations of the "inevitable" decline in mortality were open to challenge and that mortality could decline at a slower rate, remain constant or even go up again. The range and even the existence of those changes in trends are, of course, a matter of the greatest statistical uncertainty in many countries, particularly in Africa, where the data source is a one-time census.

The first of the two events was a reminder of the need to develop ways of monitoring a demographic trend as crucial as mortality with at least some measure of accuracy. The slowdown was subsequently interpreted as possibly reflecting the loss of effectiveness of certain health policies in dealing with certain medical or social problems and even in some cases as a sign that they were basically ill-adapted to an unprecedented crisis. The second event, arriving as it did precisely when the need for a new approach to health problems was becoming evident, stimulated thinking about what could be done immediately and at no vast expense to reduce mortality without waiting to reach a given level of economic and social development and to match the level of medical and health resources in the industrial countries.

### *Theoretical framework*

Despite progress in conceptualizing and analysing the determinants of mortality trends and in separating those factors linked with development from those resulting from improved medical technologies or health programmes, there is still much to be done. Further efforts are all the more necessary because the need to take more effective and rapid action to identify the determinants of mortality cannot be satisfied without a better understanding of the complicated system of interaction between health, mortality, socio-economic changes and health programmes at the individual, family and community levels. The work in progress has not thus far included research on the biological mechanisms (direct variables) through which socio-economic determinants influence mortality. Reference is made in that connection to a veritable "black box" interposed between socio-economic variables and mortality. That is certainly one of the subjects high on the agenda for theoretical exploration and empirical research in the years to come.<sup>10</sup>

### *Concerns of the international community*

The Expert Group on Mortality and Health Policy which convened in Rome in 1983 focused on the crucial problem of statistical data. Four recommendations were adopted on that subject.<sup>11</sup> Recommendation 31 states that "because information on levels, trends and differentials in mortality, causes of death and morbidity is necessary for the formulation, implementation and evaluation of health and social development policies, national Governments should create new, or strengthen existing, systems of data collection . . .". Recommendation 32 requests that "as the regular reporting to the World Health Organization . . . of information on selected diseases of major concern is essential to disease control . . . , measures should be taken to ensure accuracy and continuity in such reports". Recommendation 33 considers that "information on levels, trends and differentials in mortality among adults is much less abundant than that concerning infants and children, and special emphasis should be placed on data collection and research for adult ages". Recommendation 34 stresses that "a co-ordinated international data collection and research programme on health and mortality should be established . . .". That recommendation reflects the desire for an investigative tool comparable to the World Fertility Survey and without which no serious progress will be made in studying mortality.

With regard to research as such, five recommendations deal with the situation in the third world. Recommendation 35 urges that "there should be research on the effectiveness and efficiency of different national health systems and development strategies for reducing mortality . . .". Recommendation 36 states that "studies should be made to identify strategies to strengthen government action for more rapid reduction of levels and inequalities in mortality . . ." In recommendation 38, it is proposed that ". . . epidemiological, demographic and clinical research on the health effects of life-style characteristics should be intensified". Lastly, recommendation 39 touches on the question of the effects of aging and states

that "since new declines in mortality in countries that have already achieved low levels will result in accelerated aging of the population, . . . the United Nations, its specialized agencies and other research institutes should undertake further studies on the problems associated with aging . . ." <sup>11</sup>

The Mexico City Conference, conscious, no doubt, that the mortality reduction goals adopted at Bucharest had not been attained in many countries, particularly in Africa, adopted a series of quite detailed recommendations on mortality. They concern, for example, the adoption of quantitative, fixed-date goals (recommendation 14) and the general principles to be followed when Governments intervene (recommendations 15 and 16). Recommendations 17-21 relate to infant and maternal mortality. Recommendation 17 deals specifically with the need to ". . . identify the underlying causes of morbidity and mortality among infants and young children"; recommendation 18 calls for the adoption of quantitative targets for maternal mortality, and in subparagraph (e) stresses the need to avoid abortion. (It should be noted that information on abortion levels and trends, not to speak of its differential aspects and determinants, is scarce in the third-world countries.) Recommendations 18-21 also contain various suggestions for measures to reduce infant mortality in accordance with the strategy of health for all by the year 2000. Recommendations 22, 23 and 24 deal with adult mortality and contain, *inter alia*, useful comments on the impact of the environment and of life-style on health levels.<sup>6</sup>

## REPRODUCTION AND THE FAMILY

### *The limits of present knowledge*

#### *Accumulation of empirical knowledge*

Studies in fertility during the past 10 years have made more spectacular progress than those in any other demographic sector. More effective utilization of available data (as a result, *inter alia*, of the significant development of methods of indirect estimation) from censuses, vital statistics, service statistics, and especially surveys, particularly the World Fertility Survey, have helped to establish a body of general knowledge on fertility levels and trends and have led to a better understanding of contraceptive practices. That knowledge is of course still far from perfect, especially in Africa south of the Sahara, but it is definitely improving. It is to be hoped that the demographic and health surveys (DHS) project of the Westinghouse programme, which is a kind of follow-up to the World Fertility Survey, will provide for researchers the long-awaited opportunity to study the process of fertility change over time.

In fertility or mortality studies, the demographer tries to break down demographic data into their basic components. The direct determinants of fertility which have been isolated and quantified are marriage, the voluntary limitation of fertility through contraception, sterilization and abortion, sterility linked to breast-feeding and frequency of sexual relations.

The direct determinants are much better known than the socio-economic ones, although very marked progress has been made with respect to some of the latter. For example, the role of education in fertility appears to have been particularly well researched. But there are still problems for determinants such as employment, income (distribution or level), urbanization, the status of women, child labour and old-age security and in interpreting the specific effects of the demographic interaction between infant mortality and fertility on the one hand, and between migration and fertility, on the other.

Even when relationships are relatively well established, it is not necessarily clear over what range they hold. Yet knowledge of the limits of that range would clearly be of obvious concern for the purposes of policy formulation and implementation.

There has been interesting research done on beliefs and value systems as the motivation for deciding whether or not to have children. Those research projects that seek to explain the perceived value of children in different rural societies should be noted. Decision-making on whether or not to have children has also been studied in relation to the different periods in the family life cycle. But what remains less well understood are the mechanisms for forming community-based attitudes on fertility and the implicit influence of cultural and institutional factors in general. Studies on such questions, which are still theoretical, are all the more important since, by investigating the influence of the social environment on decision-making, they should help to establish the long-sought links between the micro-demographic or micro-economic level and the macro-demographic or macro-economic level.

One of the most promising research projects conducted in the past 10 years, concentrated mainly in Asia, dealt with the evaluation of the economic value of children in rural areas. The studies showed that in many cases even very young children, far from being a burden to families, were making a real contribution to their well-being. Naturally, if that finding were found to be universally applicable, it would have substantial practical implications.

Much of the research which has been done on the impact of family planning has proved worthwhile. Although there is still progress to be made, the problem is now clearly circumscribed, and advances have been made which will provide more satisfactory answers to questions concerning, for example, the effects of family planning programmes and general development, respectively, and the comparative effectiveness of different types of family planning programmes.

However, family planning programmes are not the only governmental interventions which can influence fertility trends. Of the many economic and social measures adopted with or without an ultimate demographic goal, some almost certainly have effects which are not easily identified. Moreover, an overall development strategy, the choice of a development style, may itself have a definite, although hard to measure, impact on fertility patterns (and also on mortality and migration trends). This is clearly an untapped field of research of consider-



able importance, both theoretically and with respect to policy.

### *Reappraisal of the problem*

The rapid decline in fertility observed in economic and political contexts as different as those of countries such as China and Brazil or as similar as those of Sri Lanka and the Indian state of Kerala may lead us to reconsider the reasons for that decline. The reconsideration should lead to renewed questioning of the model of the demographic transition, which has already been badly shaken by studies on the demography of nineteenth-century Europe.

Another question to which there is no easy answer is: Why has fertility remained at a high level or even increased in certain regions of the world—specifically, in Africa south of the Sahara? Although demographers have been emphasizing that the spread of new values related to various aspects of modernization—for example, the ideal of the nuclear family and the role of consumption—has a key role in lowering fertility, in much of the third world the dissemination of such values does not seem to have had the anticipated effect.

### *Theoretical framework*

Fertility is one of the fields in which theoretical research has been most active in the past 10 years. Nevertheless, the demographer cannot rely on any one theory of fertility, as was the case when the theory of the demographic transition was universally accepted, nor are there theories which can, for instance, help predict changes in fertility with a sufficient degree of accuracy and be applicable to both developing and industrial countries.

What we have today is a very provocative series of partial theories exploring, for instance, the socio-economic context in which fertility decisions are made, or the effect on fertility of changes in the flow of wealth from generation to generation, or the effect on fertility of family survival strategies—strategies which are actually adaptations to changes in the different modes of production. In all the new theoretical approaches, emphasis should be placed on the important role played by disciplines other than demography, such as economics, anthropology and sociology.

### *Concerns of the international community*

The Expert Group on Fertility and the Family, which met at New Delhi in 1983, adopted 11 recommendations on fertility research.<sup>12</sup>

On the subject of data, the Group requests, in its recommendation 36, that “highest priority should be given to improving the supply and quality of statistics . . . on fertility . . . patterns”. In recommendation 37, it goes on to say that “the World Fertility Survey (WFS) has made an important contribution to the knowledge of reproductive behaviour and fertility regulation. Future work in this area should give more emphasis to developing national capabilities . . .”.

On the subject of research proper, the Expert Group adopted three groups of recommendations: the first has

to do with the determinants of fertility. Thus, in recommendation 39, the Group states that “more research on institutional and cultural determinants of fertility should be encouraged . . .”; in recommendation 40 it states that “studies should be carried out to determine how and in what phases of the family life cycle fertility decisions are made . . .”; in recommendation 41, the Group observes that “. . . research is still required on the mechanisms through which socio-economic factors . . . influence fertility behaviour”; and in recommendation 42, it is stated that “the tendency of modernization to first elevate and then reduce fertility should be further investigated”.

The second group of recommendations has to do with operational research. Recommendation 44 suggests that “studies should be made of the comparative effectiveness and demographic impact of family planning programmes under alternative organizational structures . . .”; recommendation 45 states that “research should be undertaken to determine how culture impedes or enhances the acceptance of family planning and what measures are likely to minimize any conflict between family planning programme efforts and cultural beliefs and institutions”; and recommendation 46 says that “emphasis should be given to the development of improved methodologies for assessing the impact of direct and indirect policy measures on fertility”.

Apart from the implications for research of the action-oriented recommendations of the Mexico City Conference, which are many, several recommendations specifically relate to research on reproduction. Recommendation 69, for example, says that “Governments and funding agencies are urged to allocate increased resources for research in human reproduction and fertility regulation . . .”. Recommendation 70 deals with operational research and states that “Governments and intergovernmental and non-governmental organizations should give priority to . . . operational research . . .” with the understanding that the research be related primarily to family planning programmes.

## POPULATION DISTRIBUTION AND INTERNAL MIGRATION

### *The limits of present knowledge*

#### *Accumulation of empirical knowledge*

The lack of statistical data on migration is well-known: of the 13 recommendations adopted by the Expert Group on Population Distribution, Migration and Development, three deal with problems of basic data. As in the case of mortality, no world-level survey has yielded comparative information of good quality.<sup>13</sup>

Yet, internal migration accounts for a large part of population change. The rate of increase in urban population is easily 4-6 per cent a year, much higher than the current rate of natural increase. And it is known that internal migration accounts in most cases for a substantial proportion of urban population growth. A phenomenon of such magnitude deserves attention, especially since Governments themselves regard it as a priority among population problems.<sup>14</sup>

It has been found that one of the principal characteristics of internal migratory movements is their great diversity. Thus, the first step in analysing them is to attempt to classify the various movements observed. Internal migration does not merely consist, for example, of movements from the country to the city; there are also large population flows between cities and between rural areas; some movements are of brief duration, whereas others are circular.

Understanding the multiple movements is greatly handicapped by the lack of basic data referred to above. Since the most common source of information is still the census, estimates on the volume of internal migrations are often obtained through indirect methods and by using the data from two successive censuses. The information obtained is limited to an estimate of the net migration flow. Moreover, censuses are a poor instrument for monitoring other movements such as short-lived or circular migrations. Except for the major multiround surveys, the very few surveys made of internal migration are generally limited to small geographical areas. All these deficiencies explain why the understanding of internal migration is faulty.

Some progress has been made in the study of the determinants of internal migration with the publication of surveys on the motivations for migratory movements. Macro-demographic studies have tended to confirm the findings of those motivation studies. For instance, the studies have demonstrated the importance of differences in real wages or in job opportunities between urban and rural areas in explaining internal migration. However, for a more in-depth understanding of the economic and social mechanisms which determine the geographical distribution of the population, those immediate determinants should be transferred to a broader economic and social regional and national context, which should, in turn, explain the mechanisms which create those wage and job differences.

Governments have not been indifferent to the internal population movement taking place in their national territories and to the redistribution of the population. Most of them have adopted more or less comprehensive policies of intervention. Some of the interventions seek to slow down or even stop certain movements (mainly towards the big cities) by direct action; others pursue the same goal but add indirect means. One of the difficulties in trying to assess those policies, apart from the lack of data, is the almost total absence of a methodological yardstick that can satisfactorily measure the real effects both of the policies and of so-called "development styles".

Rural-to-urban migration affects not only the migrants but also the people remaining in the villages and the people already in the receiving cities. Studies of both the sending and the receiving areas have tried to highlight the economic and social effects of migration, but the findings are not conclusive. Thus, in order to appreciate the overall effects of migration—which are perceived differently by individuals and responsible authorities—they would have to be evaluated simultaneously in the sending and receiving areas.

In connection with the study of fertility, it has been observed that migration to urban centres generally has a negative impact on fertility. Migration also has an effect on mortality levels inasmuch as population movements can help to improve or worsen the state of health or socio-economic conditions in general.

#### *Reappraisal of the problem*

Unlike other demographic patterns whose consequences are sometimes difficult to discern, because they only develop fully with time, internal migrations, owing to their frequently high rate, have consequences that are immediately perceived by Governments.

Despite the clearly expressed concerns of Governments about empirical knowledge, theoretical models and the formulation and evaluation of policies being implemented, much still remains to be done. One of the first difficulties to be overcome undoubtedly stems from the fact that migration problems involve several disciplines (demography, economics, geography, regional planning etc.) and call for a multidisciplinary effort.

#### *Theoretical framework*

Over and above a sound understanding of the mechanisms of present-day population movements, a satisfactory theoretical framework should make it possible to foresee such movements and provide a rationale for intervention.

Today, there are several theories on which demographers are not all agreed. One attempts to explain migratory movements by means of a profit-maximization analysis which holds that geographical mobility contributes to the social mobility of migrants and indirectly to the economic growth of the country as a whole. Another approach, the structuralist approach, regards population movements as part of a household survival strategy and as a result of the deterioration of living conditions in rural areas. Both theories recognize that there must be an economic rationale to explain population movements.

Other theories have taken into account individual or collective motivations for the migratory process. Still another theory is based on a type of analysis similar to that of the demographic transition, which holds that modernization causes fertility decline. According to that theory, urbanization, like fertility, progresses in stages as the country gradually modernizes.

Recently attempts have been made to unify the theoretical field which embraces the various phenomena of internal and external migration. It is clear that we are still far from being able to answer basic action-oriented questions such as: What migratory flows between regions are desirable? What is the desirable size of a given city? etc.

#### *Concerns of the international community*

As noted above, three of the recommendations of the Expert Group on Population Distribution, Migration and Development deal with the collection of data; two deal with internal migration.<sup>13</sup> Recommendation 37 calls on Governments and the international community "to promote the collection of data and the undertaking of analyses relevant to the formulation and evaluation of poli-

cies on population distribution . . .". Recommendation 39 emphasizes that "countries are urged to make every effort to improve the quality, timeliness, quantity and comparability through the time of the information they gather on the migration process, including its causes and consequences".

With regard to research, the Expert Group noted, in recommendation 41, that "the formulation of policy requires an in-depth understanding of the types of migration flows exhibited by a given population and of the interrelationships existing between them". Recommendation 42 states that "Governments should give high priority to the study of the consequences of migration . . . the consequences of migration should be assessed in terms of both sending and receiving countries as well as from the perspectives of migrants and their families". Recommendation 43 asserts: "It is recommended . . . that migration be studied . . . from a family perspective". Recommendation 44 suggests that ". . . the following topics should be given priority: . . . the role of migration . . . in modifying labour force participation and structure in sending and receiving areas, its impact on employment, its influences on the redistribution of wealth . . . and its effects on the status of women". Recommendation 45 is a request to Governments to ". . . promote the development of methods to evaluate the effectiveness of population distribution policies". Recommendation 46 states that "In order to assess the potential impact of migration on the redistribution of the population and to evaluate the performance of population distribution policies, national planners need flexible and realistic demographic models. . . ." Lastly, recommendation 48 says that ". . . policies adopted for purposes other than the modification of population distribution often have substantial effects . . . Governments should promote objective evaluation of these policies in terms of their population distribution and migration effects".

Of the nine recommendations adopted at the Mexico City Conference,<sup>6</sup> several have direct implications for research on internal migration: for example, recommendation 37, on evaluation of costs and benefits of various migration policies; or recommendation 38, urging Governments, in formulating policies, to take into account the characteristics of migratory movements and the interrelationships between mobility and fertility and mortality. Other recommendations have indirect implications.

## INTERNATIONAL MIGRATION

### *The limits of present knowledge*

#### *Accumulation of empirical knowledge*

As in the case of internal migration, research on international migration is hampered by a lack of statistical data. One would think *a priori* that more should be known about movements across borders since in most cases official documents must be obtained in order to cross a border. Unfortunately that is not the case: first, because a large number of border crossings are made illegally, and secondly, because the many different kinds

of international movements of short and long duration make it difficult to keep track of them. This is another area in which the existence of quantitative data depends largely on the analysis of censuses or of the few existing surveys of the socio-economic characteristics of migrants. In any case, the difficulties encountered in trying to estimate flows and characteristics of illegal migrants continue to be very great.

The economic and social determinants of international migration are not very different from those of internal migration. In addition, however, there are legal factors (more or less stringent regulations governing the entry or departure of migrants) and political factors (the refugee problem) which come into play.

Given the nature of international migratory movements, policies governing them obviously play an important role in receiving and sending countries alike. However, there are limits to what even very restrictive policies can achieve, as evidenced by the volume of illegal migration in most regions of the world. From a purely technical point of view, little is known about whether or to what degree the various policies are successful.

One of the obvious macro-economic effects of emigration for sending countries is to relieve pressure on the labour market and to generate a flow of foreign exchange into the national economy (remittances from emigrants). However, the costs to sending countries of emigration should be taken into account: for example, the loss sustained by the national economy as a result of the expatriation of skilled workers and even semi-skilled workers who leave the country in their mature working years. Various attempts have been made to estimate those costs, but they have been inconclusive. It is even more difficult to assess the full impact on receiving countries. The availability of low-paid and low-skilled workers may have an adverse effect on the employment structure by inhibiting modernization and the more systematic use of less labour-intensive methods of production.

When the overall situation of the individuals involved is assessed, the unstable and precarious living conditions of migrants and the difficulties of assimilation in receiving countries must be weighed against the economic advantages in terms of employment and wages.

### *Reappraisal of the problem*

International migration is one of the areas of demography in which new situations have had the strongest impact. The economic crisis which began shortly before the Bucharest Conference has continued to the present and has had a substantial impact on the volume and direction of migratory movements. Entirely new receiving countries have appeared, and other, traditional, countries of immigration have closed their doors to the newcomers. In reaction to the policies adopted by the Governments of some receiving and some sending countries, new forms of migration have emerged, and it is not known whether they are a lasting or temporary phenomenon.

In North/South and sometimes South/South international relations, international migration problems have often been a source of serious conflicts between Govern-

ments and also between population groups of different cultural and ethnic origins. In the economic sphere, the emergence—with or without a new international economic order—of a new international division of labour, affecting traditional flows of capital and persons, has been the focal point of discussions on the future pattern of international migration. However, it is the points of conflict that have tended to be given the greatest attention not only by Governments but also by researchers, especially sociologists and anthropologists.

#### *The theoretical framework*

Earlier comments on the theory of internal migratory movements can, for the most part, be applied to international migratory movements, especially with reference to recent efforts to amalgamate the various findings and theories.

#### *Concerns of the international community*

The Expert Group on Population Distribution, Migration and Development which met at Hammamet in 1983<sup>13</sup> adopted a number of recommendations on research in the field of internal migration, some of which are applicable to international migration as well—namely, recommendations 37, 39, 42, 44 and, presumably, recommendation 43.

Other recommendations, however, deal more specifically with international migration. For example, recommendation 40, on data collection, states that “countries for which international migration is important are invited to share information regarding the flows and status of international migrants . . .”. Recommendation 49 states that the “international community should promote research into the specific implications of refugee movements, giving particular attention to their impact on population distribution, on the labour market and on rural development programmes . . .”.

The 11 recommendations adopted at the Mexico City Conference with respect to international migration, apart from the effort they represent to classify the types of migratory movements and the prominence they give to protecting the rights of migrants, can be implemented only on the basis of sound knowledge of the determinants and consequences of the phenomena which they are intended to influence.

### PRODUCTION OF RESEARCH: APPRAISAL AND SUGGESTIONS

#### *Appraisal*

Demography is a science which produces hundreds of books and scientific journals every year. It is a discipline which organizes dozens of symposia and seminars. It is also a profession represented by an international scientific association with an established reputation and national associations which are expanding rapidly. Lastly, it is a discipline which is enriched through its increasingly intensive contacts with related disciplines such as economics, anthropology, sociology, genetics, biology, geography and history, not to mention its long-standing connections with mathematics and statistics. I

shall attempt here to offer a clearer idea of the nature of its intellectual output.

Let us look first at the volume and geographical origin of that output. We shall take as an indication the number of scientific journals and articles abstracted by the Committee for International Co-operation in National Research in Demography (CICRED) in its *Review of Population Reviews*.

Table 1 gives a breakdown for 1983 and 1984 of 81 journals classified by region of origin and by the number of articles abstracted. Of course, the *Review of Population Reviews* does not provide abstracts from every scientific journal that is directly or indirectly concerned with population issues, but those that it does abstract are the major forums in demography.<sup>15</sup>

TABLE 1. BREAKDOWN OF JOURNALS AND ARTICLES ABSTRACTED IN 1983-1984 *Review of Population Reviews*, BY REGION OF ORIGIN

Region of origin	Number of journals	Articles	
		Number	Percentage
Developing countries			
Africa.....	2	49	1.7
Latin America.....	5	72	2.5
Asia.....	16 <sup>a</sup>	383	13.1
Middle East.....	1	5	0.1
Subtotal: developing countries.....	24	509	17.4
of which least developed.....	(0) <sup>b</sup>	(0)	(0.0)
Developed countries.....	57	2 411	82.6
TOTAL	81	2 920	100.0

<sup>a</sup> Not including Australia, New Zealand and Japan.

<sup>b</sup> Forty-six countries, mostly in Africa, according to the UNDP definition of least developed countries.

Over the two-year period, which was chosen to avoid random fluctuations as much as possible, 24 of the 81 journals were based in developing countries. The Asian region accounted for a significant part of the 24, with 16 journals based there. Of the 2,920 articles abstracted, only 17.4 per cent were from third-world countries.

In table 2, 2,457 articles are reviewed and classified according to the topics discussed at the Mexico City Conference.

The relative importance given to the various topics, with the exception of fertility, does not correspond very

TABLE 2. BREAKDOWN OF JOURNALS AND ARTICLES ABSTRACTED IN *Review of Population Reviews*, BY TOPIC, 1983-1984

	Number of articles	Percentage of total
Fertility.....	937	32.1
including family planning.....	(196)	(6.7)
Mortality.....	303	10.4
International migration.....	265	9.1
Internal migration.....	170	5.8
Population policies.....	156	5.3
Population, resources and the environment.....	337	11.5
Status of women.....	70	2.4
Aging.....	64	2.2
Other.....	618	21.2
TOTAL	2 920 <sup>a</sup>	100.0

<sup>a</sup> The actual number of articles abstracted (2,457) is fewer than 2,920 because some articles are referred to more than once.



closely to the research priorities as expressed by Governments.

The discrepancy between the importance attributed to certain topics at the Mexico City Conference and the importance they are receiving in current population research seems especially marked in such sectors as the status of women, internal migration, population policies and the interaction between population and development. Of course, it can be explained by the fact that, since the periodicals in question are produced mainly in developed countries, they tend to deal primarily with topics that concern those countries or to deal with them according to an order of priority specific to those countries. It can also be explained by the fact that such topics as migration and spatial distribution, which straddle the boundary between several disciplines, are not very well reflected in *Review of Population Reviews*, which focuses essentially on demographic publications.

Table 3 considers the membership in the International Union for the Scientific Study of Population (IUSSP) on the basis of geographical origin. The data for 1974 and 1984 are compared.

The *Directory of Members* of IUSSP confirms that the community of demographers is thriving, since the number of members has risen from 1,270 to 1,625 in 10 years, an increase of 28 per cent. There has been an especially sharp increase in the number of members from the developing regions. However, that number is still less than half the number from developed countries. A breakdown by country of origin shows that 69 of the 126 developing countries had members in IUSSP in 1984, as compared with 32 of the 42 developed countries, and that the Asian region topped the list of members, with Africa and Latin America some distance behind, although the most rapid growth in membership occurred in the latter two regions.

The scientific output in demography, as in other sciences, is not the result of individual researchers working in isolation; it requires a suitable work environment—that is, research centres where researchers can find not only the resources (libraries, equipment etc.) but also the intellectual stimulation they need.

An accurate inventory of research centres throughout the world is hard to come by. There is, of course, the difficulty of grouping centres with widely differing resources and scientific influence under one heading. However, CICRED made a useful contribution by publishing its *Directory of Demographic Research Centres* in 1980, and the data presented here have been drawn from that publication.

Table 4 gives a breakdown of research centres by major region. Of the developing regions, Asia and Latin America, which have a respectable number of centres, are in a relatively favourable position. In the case of Asia, that status is attributable to the large number of centres in India, and, in the case of Latin America, to the centres situated in Brazil and Mexico. Africa and the Middle East are clearly worse off, but since the *Directory* was prepared some years ago, the situation may have improved somewhat. Naturally, the actual activities of the centres would have to be evaluated, but except for the number of researchers they employ, the necessary data are not available. Even those figures are not available for every centre.

#### SUGGESTIONS

The recommendations adopted at the Mexico City Conference and by the four pre-Conference expert groups provide valuable—but ultimately insufficient—guidance for researchers. They give the impression that research on fertility has the same order of priority as, for instance, research on migration, mortality, the interrelationship between population and development etc. Only the need to improve the basic data emerges as the overriding priority, no doubt because it is non-political. The consensus on that priority should imply a need to make the best possible use of existing data, but that is not always the case.

Clearly, if the list of gaps in knowledge identified by researchers and the list of needs perceived by intergovernmental bodies are to be at all useful, there must also be a set of criteria for establishing an order of priority among those needs. Drawing heavily on the suggestions made in

TABLE 3. BREAKDOWN OF IUSSP MEMBERSHIP, BY PLACE OF ORIGIN, 1974 AND 1984

	1974		1984		Number of countries in region(s)	Number of countries in region(s)
	Number of members from which come	Number of countries in region(s)	Number of members from which come	Number of countries in region(s)		
Developing countries						
Africa .....	86	15	43	159	27	51
Latin America .....	116	20	25	151	21	32
Asia <sup>a</sup> .....	197	15	26	200	16	31
Middle East .....	9	3	12	13	5	12
Subtotal: developing countries .....	408	53	106	523	69	126
of which least developed .....	15	6	27	54	15	46
Developed countries .....	862	28	42	1 102	32	42
TOTAL	1 270	81	148 <sup>b</sup>	1 625	101	168 <sup>b</sup>

<sup>a</sup> Including Australia, Japan and New Zealand.

<sup>b</sup> Number of States Members of the United Nations in 1974 and 1984, respectively.

TABLE 4. BREAKDOWN OF DEMOGRAPHIC RESEARCH CENTRES  
ENUMERATED BY CICRED, 1980

	Number of centres	Number of countries in region(s)
Developing countries		
Africa.....	33	51
Latin America.....	51	30
Asia <sup>a</sup> .....	69	30
Middle East.....	4	12
Subtotal: developing countries.....	157	123
of which least developed.....	6	46
Developed countries.....	156	42
TOTAL	313	165 <sup>b</sup>

<sup>a</sup> Not including Australia, Japan and New Zealand.

<sup>b</sup> Number of States Members of the United Nations in 1980.

1976 by Bernard Berelson,<sup>16</sup> I would suggest the following list of criteria for research programmes to be carried out over the next decade.

(a) The research topic selected should be of some importance; it should not be peripheral, and the findings should make a significant contribution to the advancement of knowledge;

(b) The research should have reasonable prospects for success, and a realistic assessment should be made of the resources available for the purpose (intellectual, financial etc.);

(c) The research topic should be one that can be handled within a specified time-frame; it should be programmable within that time-frame, for example, in five-year phases, renewable after the results of the first phase are reviewed;

(d) The research topic should deal with an area in which the accumulation of knowledge and experience is likely to produce results. The results achieved in evaluating the impact of family planning programmes or in studying the direct determinants of fertility are good examples of the cumulative effect of research in certain fields. The data collected in recent years should finally provide a basis for research with a historical or longitudinal dimension which can, in turn, sustain a highly productive and useful body of analysis;

(e) The research topic should act as a catalyst and a co-ordinating force for a segment of the profession. The World Fertility Survey is an example of success in that respect. A similar project on mortality or internal migration could be equally successful;

(f) The research findings must be easy to translate into directives for policy intervention in a new field, for improving or giving new direction to action already under way, for evaluating the costs and benefits of action to be undertaken and, lastly, for evaluating the effectiveness of what has already been done;

(g) Lastly, the topic should be responsive to a felt need by users—i.e., policy makers, the directors of private foundations and major international organizations. Research on fertility falls into this category, but certainly not research on internal migration. Nevertheless, migration has been considered for years by policy makers in

the developing countries as one of their priority problems. The same can be said for mortality, with a future now more difficult to predict.

#### CONCLUDING REMARKS

The role of the demographer is infinitely complex today. With demands made on him from all quarters, challenged by problems which often transcend his discipline, called upon to take sides in ideological or political quarrels, pressured to provide immediate solutions to age-old problems, embarrassed by the increasingly frequent invasion into his thinking by normative considerations, and finally asked to remain uninvolved in the financial side of things but to show realism in formulating projects, the demographer is sometimes tempted to seek refuge in—or rather, return to—personal research.

The temptation does not last very long: the demographer is of this world and is perfectly well aware of his duties *vis-à-vis* the world. However, among the rights to which he considers himself entitled is the right to devote himself to basic research. It is not only a guarantee of creative freedom but also an investment for the national or international community, since basic research is one of the paths by which demography as a whole advances.

Is this only an impression or is it the reality? The active co-operation which existed at the time of the Bucharest Conference between researchers and users representing private foundations, major international organizations and, of course, governmental authorities has changed. That accounts in part for the relatively few reviews which have been made of research, particularly when such reviews often constitute the basic documents for tripartite discussions between donors, recipient countries and researchers.

Co-operation is more necessary today than ever before, for demography can offer much more to users than it could 10 years ago. At the same time, the profession is aware that an in-depth discussion on priorities is necessary all around, for the priorities are not always clearly discernible. The profession is also aware that the major users—i.e., the representatives of third-world countries—must become more closely involved in the process of collective thinking, like the representatives of major foundations and international institutions. It is through an ongoing process of co-operation, the practical details of which remain to be worked out, that progress can be made.

#### NOTES

<sup>1</sup> Quoted by Raymond Aron, *Dix-huit leçons sur la société industrielle* (Paris, Gallimard, 1962) p. 22.

<sup>2</sup> R. Aron, *op. cit.*

<sup>3</sup> Alfred Lotka, *Théorie des associations biologiques* (Paris, Hermann et cie, 1939), p. 149.

<sup>4</sup> At the International Conference on Population, 1984, there was no document prepared which was comparable to the paper presented by Nora Federici for the World Population Conference, 1974, entitled "Training in the field of population". See *The Population Debate: Dimensions and Perspectives. Papers of the World Population Conference, 1974* (United Nations publication, Sales No. E/F/S.75.XIII.4).

<sup>5</sup> Frederick Sai and others, "Recommendations of ICP and the UNFPA: future implications", a report of an expert working group, submitted to the Executive Director, UNFPA, 1 February 1985.

<sup>6</sup> *Report of the International Conference on Population, 1984, Mexico City, 6-14 August 1984* (United Nations publication, Sales No. E.84.XIII.9), chapter I, sect. B.

<sup>7</sup> Club of Rome, *The Limits to Growth* (New York, Universe Books, 1974).

<sup>8</sup> Peter D. McClelland, *Causal Explanation and Model Building in History, Economics and the New Economic History* (Ithaca, Cornell University Press, 1975), p. 65. Quoted by Geoffrey McNicoll in "Consequences of rapid population growth: an overview and assessment", *Population and Development Review*, vol. 10, No. 2 (June 1984), p. 212.

<sup>9</sup> *Population, Resources, Environment and Development: Proceedings of the Expert Group on Population, Resources, Environment and Development, Geneva, 25-29 April 1983* (United Nations publication, Sales No. E.84.XIII.12).

<sup>10</sup> W. Henry Mosley and Lincoln C. Chen, "An analytical framework for the study of child survival in developing countries", in *Child Survival, Strategies for Research*, a supplement to *Population and Development Review*, vol. 10 (1984), p. 25.

<sup>11</sup> *Mortality and Health Policy: Proceedings of the Expert Group on Mortality and Health Policy, Rome, 30 May-3 June 1983* (United Nations publication, Sales No. E.84.XIII.4).

<sup>12</sup> *Fertility and the Family: Proceedings of the Expert Group on Fertility and the Family, New Delhi, 5-11 January 1983* (United Nations publication, Sales No. E.84.XIII.7).

<sup>13</sup> See *Population Distribution, Migration and Development: Proceedings of the Expert Group on Population Distribution, Migration and Development, Hammamet (Tunisia), 21-25 March 1983* (United Nations publication, Sales No. E.84.XIII.3).

<sup>14</sup> The successive findings of United Nations surveys confirm its importance. An analysis of the last survey appears in *World Population Trends, Population and Development Interrelations and Population Policies: 1983 Monitoring Report*, vol. II: *Population and Development Interrelations and Population Policies* (United Nations publication, Sales No. E.84.XIII.11).

<sup>15</sup> The quarterly review *Population Index* includes in its bibliography not only scientific journals but also books and miscellaneous works, including many statistical sources. For 1973 and 1974 taken together, 5,526 bibliographical notices were published; in 1983 and 1984, the number had risen to 6,573, or an increase of 22 per cent in 10 years.

<sup>16</sup> Bernard Berelson, "Social science research on population: a review", *Population and Development Review*, vol. 2, No. 2.

#### REFERENCES

- Aron, Raymond (1962), *Dix-huit leçons sur la société industrielle*. (Paris, Gallimard).
- Barlow, Robin (1979), "Health and economic development: a theoretical and empirical review", *Research in Human Capital and Development*, vol. 1.
- Berardo, Felix M. (1980), "Decade preview: some trends and directions for family research and theory in the 1980s", *Journal of Marriage and The Family*, vol. 42, No. 4.
- Berelson, Bernard (1976), "Social science research on population: a review", *Population and Development Review*, vol. 2, No. 2.
- Bilsborrow, Richard E. (1981), "Priority areas for future research on demographic-economic interrelationships", *Population and Development Modelling: Proceedings of the United Nations/UNFPA Expert Group Meeting on Population and Development Modelling, Geneva, 24-28 September 1979* (United Nations publication, Sales No. E.81.XIII.2).
- \_\_\_\_\_ (1985), "The integration of population in development planning: some methodological issues and suggestions", a paper prepared for the IUSSP International Population Conference, Florence, 5-12 June 1985.
- Birdsall, Nancy (1977), "Analytical approaches to the relationship of population growth and development", *Population and Development Review*, vol. 3, Nos. 1 and 2.
- Blanchet, Didier (1984), "Croissances économiques et démographiques dans les pays en développement: indépendance ou interdépendance?", *Population*, vol. 40, No. 1.
- Bulatao, Rodolfo A. (1984), "Reducing fertility in developing countries: a review of determinants and policy levers", World Bank Staff Working Paper No. 680 (Washington, D.C., World Bank).
- \_\_\_\_\_ and others (eds.) (1983), *Determinants of Fertility in Developing Countries*, vols. 1 and 2 (New York, Academic Press).
- Caldwell, John C. (1982), *Theory of Fertility Decline* (New York, Academic Press).
- Cassen, Robert H. (1976), "Population and development: a survey", *World Development*, vol. 4, Nos. 10 and 11.
- Chesnais, J. C. (1985), "Progrès économique et transition démographique dans les pays pauvres: trente ans d'expérience (1950-1980)", *Population*, vol. 40, No. 1.
- Clague, Alice S. and Yeun-chung Yu (1982), *International Demographic Statistics: Proceedings of the Social Statistics Section: Papers Presented at the Annual Meeting of the American Statistical Association, Cincinnati, Ohio, 16-19 August 1982* (under the sponsorship of the Social Statistics Section) (Washington, D.C., American Statistical Association).
- Committee for International Co-operation in National Research in Demography (1980), *Directory of Demographic Research Centers* (Paris).
- \_\_\_\_\_ (1983 and 1985), *Review of Population Reviews* (all issues) (Paris).
- Demeny, Paul (1982), *International Aspects of Population Policies*. Center for Population Studies Working Papers, No. 80 (New York, Population Council).
- Federici, Nora (1974), "Training in the field of population", *The Population Debate: Dimensions and Perspectives. Papers of the World Population Conference, Bucharest, 1974*, vol. I (United Nations publication, Sales No. E/F/S.75/XIII.4).
- Food and Agriculture Organization of the United Nations (1982), "Potential population supporting capacities of lands in the developing world" (PPA/INT.513).
- Goldstein, Sidney (1981), "Research priorities and data needs for establishing and evaluating population redistribution policies", *Population Distribution Policies in Development Planning: Papers of the United Nations/UNFPA Workshop on Population Distribution Policies in Development Planning, Bangkok, 4-13 September 1979* (United Nations publication, Sales No. E.81.XIII.5).
- \_\_\_\_\_ and A. Goldstein (1979), *Survey of Migration in Developing Countries: A Methodological Review* (The Hague, International Statistical Institute).
- Groupe INED-INSEE-ORSTOM-MINCOOP (1976), "Evaluation des méthodes de collecte des données démographiques", *STATECO*, No. 8.
- Gwatkin, Davidson R., Janet R. Wilcox and Joe D. Wray (1980), "Can health and nutrition interventions make a difference?: the policy implications of field experiment experience". Monograph 13 (Washington, D.C., Overseas Development Council).
- Hauser, Philip M. (ed.) (1979), *World Population and Development: Challenges and Prospects* (New York, Syracuse University Press).
- Hernandez, Donald J. (1985), "Fertility reduction policies and poverty in third world countries: ethical issues", *Studies in Family Planning*, vol. 16, No. 2.
- Indiana University Fertility Determinants Group (undated), *Quantitative Approaches to Analyzing Socio-Economic Determinants of Third World Fertility Trends: Reviews of the Literature* (Washington, D.C., Futures Group).
- International Union for the Scientific Study of Population (1974 and 1984), *Directory of Members* (Liège).
- \_\_\_\_\_ (1985), *Proceedings of the IUSSP Seminar on Social Policy, Health Policy and Mortality Prospects, Paris, 28 February to 4 March 1983* (forthcoming).
- Keyfitz, Nathan (1981), "The limits of population forecasting", *Population and Development Review*, vol. 7, No. 4.
- Kritz, Mary M., Charles B. Keely and Silvano M. Tomasi (eds.) (1981), *Global Trends in Migration: Theory and Research on International Population Movements* (New York, Center for Migration Studies).
- McNeill, William H. and Ruth S. Adams (eds.) (1978), *Human Migration Patterns and Policies* (Bloomington, Indiana University Press).

- McNicol, Geoffrey (1984), "Consequences of rapid population growth: an overview and assessment". *Population Development Review*, vol. 10, No. 10.
- Miro, Carmen A. and Joseph E. Potter (1980), *Population Policy: Research Priorities in the Developing World*. Report of the International Review Group of Social Science Research on Population and Development (London, Frances Pinter).
- Morrison, Peter A. (ed.) (1983), *Population Movements: Their Forms and Functions in Urbanization and Development* (Liège, Ordina Editions).
- Mosley, W. Henry and Lincoln C. Chen (1984), "An analytical framework for the study of child survival in developing countries", *Child Survival, Strategies for Research; Population and Development Review*, supplement to vol. 10.
- Office of Population Research, Princeton University (1974, 1975, 1983 and 1984), *Population Index* (all issues).
- Population Council (1981), "Research on the determinants of fertility: a note on priorities", *Population and Development Review*, vol. 7, No. 2.
- Population Information Program (1984), "Migration, croissance démographique et développement", *Population Reports*. Série M, No. 7 (Baltimore, Johns Hopkins University).
- Roussel, Louis (1984), "Démographie et sociologie: deux disciplines solidaires", *European Journal of Population*, vol. 1, No. 1.
- Ruzicka, Lado T. (1983), "Mortality transition in the third world countries: issues for research", *IUSSP Newsletter*, No. 17.
- Seltzer, William and Yeun-chung Yu (1982), "Data collection, national systems", in John A. Ross (ed.), *International Encyclopedia of Population* (New York, Free Press).
- Stolnitz, George J. (1983), "Three to five main challenges to demographic research", *Demography*, vol. 20, No. 4.
- Tabah, Léon (1975), "New emphases in demographic research after Bucharest?", a paper presented at the UNFPA/United Nations Interregional Consultative Group of Experts on the World Population Plan of Action, Geneva, 15-19 September 1975. United Nations Fund for Population Activities (UNFPA/WPPA/12).
- \_\_\_\_\_ (1981), "Population projections and action in the field of population", *Population Projections: Problems and Solutions*. Report of the Workshop on Population Projections, Budapest, 17-28 March 1980 (TCD/SEM.81/3).
- Tapinos, G. (1981), "Population et division internationale du travail", *IUSSP International Population Conference, Manila, 1981: Solicited Papers* (Liège, International Union for the Scientific Study of Population).
- Tapinos, Georges (1980), "De l'utilité des perspectives démographiques", *Perspectives de population, d'emploi et de croissance urbaine*. Chaire Quêtelet 80 (Louvain-la-neuve, Université Catholique de Louvain).
- United Nations (1978), *The Methodology of Measuring the Impact of Family Programmes on Fertility* (United Nations publication, Sales No. 78.XIII.8).
- \_\_\_\_\_ (1984a), *Report of the International Conference on Population, 1984, Mexico City, 6-14 August 1984* (United Nations publication, Sales No. E.84.XIII.9).
- \_\_\_\_\_ (1984b), *Fertility and the Family: Proceedings of the Expert Group on Fertility and the Family, New Delhi, 5-11 January 1983* (United Nations publication, Sales No. E.84.XIII.7).
- \_\_\_\_\_ (1984c), *Population Distribution, Migration and Development: Proceedings of the Expert Group on Population Distribution, Migration and Development, Hammamet (Tunisia), 21-25 March 1983* (United Nations publication, Sales No. E.84.XIII.3).
- \_\_\_\_\_ (1984d), *Population, Resources, Environment and Development: Proceedings of the Expert Group on Population, Resources, Environment and Development, Geneva, 25-29 April 1983* (United Nations publication, Sales No. E.84.XIII.12).
- \_\_\_\_\_ (1984e), *Mortality and Health Policy: Proceedings of the Expert Group on Mortality and Health Policy, Rome, 30 May-3 June 1983* (United Nations publication, Sales No. E.84.XIII.4).
- \_\_\_\_\_ (1985a), *World Population Trends, Population and Development Interrelations and Population Policies: 1983 Monitoring Report*, vol. II: *Population and Development Interrelations and Population Policies* (United Nations publication, Sales No. E.84.XIII.11).
- \_\_\_\_\_ (1985b), "Research requirements for integrating population factors into development planning", a paper presented at the United Nations Fund for Population Activities Expert Group Meeting on Population and Development, 22-24 January 1985.
- \_\_\_\_\_ . Department of Technical Co-operation for Development (1985), *Courses on Population and Development: Aspects of Technical Co-operation* (United Nations publication, Sales No. E.85.II.A.1).
- United Nations Fund for Population Activities. *Report of the UNFPA Working Group Meeting on the Implications of the Recommendations of the International Conference on Population for the Activities of UNFPA, New York, 28 January to 1 February 1985* (forthcoming).
- United States Bureau of the Census (1977), *Planning for Internal Migration: A Review of Issues and Policies in Developing Countries (ISP-RD-4)* (Washington, D.C., United States Government Printing Office).
- Weiner, Myron (1985), "International migration and international relations: suggestions for future research", talk prepared for Population Council seminar, 18 March 1985.
- World Fertility Survey (1984), *Major Findings and Implications* (London, Alden Press).
- Yu, Y. C. (1983), "Overview of 1980 round of population censuses and their emerging issues", *International Statistical Institute, 44th Session: Invited Papers*, vol. 1.

## POPULATION GROWTH AND DEVELOPMENT: AN UNEXPLAINED BOOM\*

*Jean-Claude Chesnais\*\**

### SUMMARY

Have the unprecedented rates of population growth in the developing countries over the past 30 years been an obstacle to their development, as has been suggested by most of the writing on the subject? This paper attempts to answer the question from an empirical approach, a review of the existing studies on the subject, and from a more theoretical point of view.

It must be noted first that the available data since 1950 for a number of selected developing countries do not support the view that high rates of population growth have impeded rapid increases in the GDP per capita. Indeed, for the 1950s and the 1960s, one finds that the higher the rates of population growth, the higher the increases in GDP per capita. However, for the 1970s one finds an inverse relationship between rates of population growth and increases in GDP per capita.

The lack of a significant relationship is also the dominant feature of the various attempts made so far to find a correlation between population growth and GDP per capita. A partial explanation to these somewhat disappointing results is the time lag which exists between demographic changes and economic evolution.

To be sure, relationships between population growth and the development process must be considered across quite long periods of time. But more importantly, the search for such relationships needs to take into consideration all the relevant factors, whose effects are not necessarily similar. So, whereas certain factors favour a negative correlation between population growth and economic growth—i.e., increased pressure on limited natural resources, detrimental effects of important demographic investments on productive investment etc.—other factors favour a positive relationship—i.e., declines in mortality levels resulting from improved socio-economic conditions triggered by development, availability of a larger labour force, expanding domestic markets etc.

Despite the real handicaps that rapid demographic growth may present to economic takeoff, one must acknowledge that the past three decades, which historically have been the period of maximum population growth for most of the developing countries, have also been a period of exceptional growth in GDP per capita. Yet, despite the recent world-wide recession, the growth of GDP per capita for the developing countries is still globally substantially higher than the corresponding figure observed for the developed countries. The exceptions to the pattern—noticeably in Africa—seem to be more the result of inadequate development strategies and political turmoil than the high rates of population growth observed.

Finally, it may be concluded that demographic growth and economic development are capable of reinforcing each other. Furthermore, it seems likely that one of the crucial factors explaining the unexpected relationship between population growth and economic development is the impact of the rapid mortality declines in developing countries which have positively affected the attitudes of population *vis-à-vis* development issues.

\*Original in French and largely based on an earlier article of the author entitled, "Progrès économique et transition démographique dans les pays pauvres: trente ans d'expérience (1950-1980)", *Population*, 40e année, No. 1 (January-February 1985), pp. 11-28.

\*\*Institut national d'études démographiques (INED), Paris, France.



## INTRODUCTION

The developing countries experienced their highest rates of population growth (2-4 per cent, depending on the country) between 1950 and 1980. Indeed, beginning in the 1950s the population growth rates of poor countries, which started to climb during the preceding decades, gradually peaked, reaching their ceiling in the following decade; they had already begun to decline in the 1970s. Since for most of these countries—at least, the most populated (except sub-Saharan Africa)—the phase of highest population growth is henceforth a thing of the past, a preliminary retrospective assessment can now be made, particularly since statistical measurement has improved to the point where the development experience of poor countries since the Second World War is increasingly better understood. The debate on the consequences of rapid population growth is, therefore, becoming less academic; it is becoming part of economic history.

The question before us is simple: to discover whether that historically unprecedented population boom prevented a rise in living standards or, on the contrary, went hand in hand with a measure of economic progress.

The simplest empirical analysis of the relationship between population growth and economic growth involves establishing the correlation between population increase and per capita product increase at constant prices over a specified period.

This will be our initial approach: we will begin by assembling statistical data on the two phenomena under study; secondly, we will present a critical review of the major research on the correlation between them; finally, we will underscore the limitations of that exercise and propose an interpretation of the findings.

## BASIC DATA

For strictly historical reasons and because of statistical limitations, the starting point of the study will be the beginning of the 1950s. From the 1950s on, the global population growth rates of poor countries, which had started to rise during the preceding decades, gradually increased towards a ceiling which would be reached in the next decade and would lead to a slight decrease in the 1970s. The period from 1950 to 1980 stands out because it marks the historical phase of highest population growth in the less developed world. Furthermore, it has been only 30 years since most of the less developed countries established systems of national accounts. Before the results for advanced transition countries are presented,<sup>1</sup> some information on general trends in recent decades will be discussed.

### General trends

For many poor countries, there is no homogeneous macro-economic data series for the period under consideration. However, the OECD Development Centre periodically attempts to harmonize and systematically reconstitute the data. A full assessment can therefore be made for the periods 1960-1970 and 1970-1980, and that source will therefore be used as a matter of priority. Our

comments, however, will sometimes be supplemented by reference to World Bank data.

To find a correlation between indices of population increase and indices of an increase in real per capita income for less developed countries, it is important to include the largest possible number of cases, but to exclude countries failing to meet minimal comparability criteria. It, therefore, seemed essential to exclude:

(a) Under-populated petroleum-producing countries such as the Libyan Arab Jamahiriya, Venezuela, Saudi Arabia and the United Arab Emirates, where a minority enjoys the income from oil, thus sharply distorting the meaning of average per capita product;

(b) South Africa and Zimbabwe, where national income is very unequally distributed between the white, coloured and Asian populations and the overwhelming mass of poor indigenous inhabitants;

(c) Viet Nam, Lao People's Democratic Republic, Democratic Kampuchea, Algeria, Iran (Islamic Republic of) and Iraq,<sup>2</sup> which during all or part of the past few decades, have experienced abnormal conditions and conflicts;

(d) Countries with centrally planned economies where the system of national accounts is built on different factors.

With those exceptions, data on 58 countries for the period 1950-1952 to 1967-1969 and on 77 countries for the period 1960-1980 have been collected. Table 1, illustrating the first period, shows comparative growth in real per capita product<sup>3</sup> (GDP at constant market prices) against population growth rates.

In most countries where macro-economic estimates for a long time period are available, the population growth rate exceeds 2 per cent and, in the group concerned, half the countries have rates above or equal to 3 per cent (which is roughly a doubling of the population in the period under consideration). It is precisely in this subsample with a very rapid population growth that the increase in per capita GDP is markedly more vigorous, showing an annual average of 2.8 per cent instead of 1.1-1.8 per cent for the other groups of countries. At first sight, that finding might seem paradoxical unless one accepts without question Boserup's argument (1981) that by encouraging technological innovation, the

TABLE 1. POPULATION GROWTH AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES, 1950-1952 TO 1967-1969

Average annual rate of population increase (percentage)	Number of countries	Average rate of increase in real per capita product (percentage)
Up to 1.9 .....	10	1.7
2.0-2.4 .....	10	1.1
2.5-2.9 .....	14	1.8
3.0 .....	24	2.8
	58	

Source: Calculated from the basic data of the OECD Development Centre: *Comptes nationaux des pays moins développés* (Paris, 1968-1971).

NOTE: For some countries, the period covered is a little shorter than the period indicated in the heading, and the notion of real product is not the same in all countries.

TABLE 2. POPULATION GROWTH AND ECONOMIC GROWTH IN LESS DEVELOPED COUNTRIES, 1960-1980

Average annual rate of population increase (percentage)	1960-1970		1970-1980	
	Number of countries	Weighted average annual rate <sup>a</sup> of increase in real per capita product (percentage) <sup>b</sup>	Number of countries	Weighted average annual rate <sup>c</sup> of increase in real per capita product (percentage) <sup>b</sup>
2.0 or less .....	18	1.65	14	4.55
2.1-2.5 .....	24	1.48	23	1.95
2.6-3.0 .....	24	2.48	27	3.04
3.1 or more .....	11	3.95	13	1.67
	77		77	

Source: Calculated from the basic data of the OECD Development Centre: "Informations récentes sur les comptes nationaux des pays en développement", *Bulletin No. 14* (Paris, 1981).

<sup>a</sup> Weighted co-efficients for population in mid 1965.  
<sup>b</sup> Gross domestic product at constant market prices.  
<sup>c</sup> Weighted co-efficients for population in mid 1975.

increase in population density would speed up the disappearance of traditional obstacles to economic growth. More data are, therefore, required to corroborate that finding.

A first reading of table 2, which covers a larger number of countries, does corroborate that conclusion for the period 1960-1970, since in countries where the population growth is over 3 per cent annually, the weighted average annual rate of increase in real per capita product is close to 4 per cent, whereas in countries with growth rates between 2.6 and 3 per cent, the weighted average rate of increase does not exceed 2.5 per cent, and comes to about 1.5 per cent. In light of the data, therefore, more rapid population growth tends to mean greater economic progress. However, this empirical finding is not generally applicable because the findings are the reverse for the next decade, and most emphatically so: countries with very rapid population growth for that period show the lowest relative per capita product increase (1.7 per cent annually), whereas their counterparts with population growth not exceeding 2 per cent annually, have rates of economic growth over 4.5 per cent annually.

It is disturbing to compare those findings for two successive periods. However, the explanation, to which we shall return later, is actually simple: the composition of each group of countries changed in relation to the history of the demographic transition. Consequently, from one period to the other, the linear correlation co-efficient between the two series of indices of increase went from +0.185 (non-significant) to -0.287 (a significant value at 5 per cent). A glance at the 22 advanced transition countries, part of the sample of 77 studied, will explain the reversal.

#### *Economic growth in advanced transition countries*

Rates of change in the two series (population and per capita GDP) for each of the two decades are shown in table 3.

Population growth is rapid but very uneven; thus, in 1970-1980, the range is from 1.0 per cent (Uruguay) to

3.6 per cent (Mexico). Two out of three countries have rates between 2 and 3 per cent, which reflects rates of increase 1.5 times to twice those of European populations at the start of industrialization in the nineteenth century. Apart from some South Asian (Sri Lanka) or South-East Asian countries (Hong Kong, Republic of Korea, Singapore, for example), there are a few countries showing a marked decline in rates of population growth.

Disparities in economic growth are far more pronounced than differences in population trends. Thus, dur-

TABLE 3. AVERAGE ANNUAL CHANGE IN POPULATION AND REAL PER CAPITA PRODUCT IN ADVANCED TRANSITION DEVELOPING COUNTRIES (Percentage)

Region and country or area	Population		Real per capita product	
	1960-1970	1970-1980	1960-1970	1970-1980
Africa	2.5	2.9	2.1	1.6
Egypt .....	2.5	2.5	2.0	5.1
Tunisia .....	2.1	2.5	2.3	5.1
Latin America	2.8	2.7	2.5	2.8
Costa Rica .....	3.5	2.5	2.9	3.3
Cuba .....	2.0	1.5	-1.0	4.5
Dominican Republic ...	2.9	3.0	1.5	3.5
Jamaica .....	1.5	1.6	4.0	-2.9
Mexico .....	3.4	3.6	3.7	1.6
Panama .....	3.1	3.1	4.6	1.0
Trinidad and Tobago ..	2.1	1.3	2.1	4.2
Argentina .....	1.4	1.3	2.8	0.7
Brazil .....	2.9	2.8	2.4	5.5
Chile .....	2.1	1.6	2.3	0.7
Colombia .....	2.9	2.5	2.1	3.2
Uruguay .....	1.3	1.0	-0.1	2.5
Asia (excluding China)	2.4	2.3	3.1	4.0
Hong Kong .....	2.7	2.2	7.2	6.8
India .....	2.2	2.1	1.4	1.4
Indonesia .....	2.1	2.4	0.8	5.0
Malaysia .....	3.0	2.7	2.8	5.1
Republic of Korea .....	2.6	1.7	5.9	7.7
Singapore .....	2.3	1.4	6.3	6.9
Sri Lanka .....	2.4	1.6	2.8	4.7

Source: OECD Development Centre, "Informations récentes sur les comptes nationaux des pays en développement", *Bulletin No. 14* (Paris, 1981).

ing the 1970s, despite the world economic recession, half of those countries showed a higher rate of increase of real per capita product than Europe at the height of its growth in the 1970s (averaging +4.1 per cent annually in countries with market economies) (Chesnais and Sauvy, 1973). Conversely, at the same time, some Latin American and South American countries with rates of only 1 per cent and even lower, showed virtual stagnation (Argentina, Chile, Panama), sometimes even regression (Jamaica: -2.1 per cent) in economic growth. The countries are spread out fairly regularly over a very broad range of rates. On the whole, however, the advanced transition countries stand out because their economic growth is substantially higher than that of their counterparts where fertility remained very high. In this regard, a comparison of tables 2 and 4 is revealing. (Table 4 was devised by grouping countries according to rate of population growth.)

The economic advantage enjoyed by countries with a rapid population growth in the 1960s disappears and the reverse occurs in the 1970s: the reversal of relationships noted above (see table 2) in the group of 77 countries is found in a more pronounced form (at least in the two extreme groups). What has occurred? It can immediately be seen that in the 1970s there are 10 countries with a relatively "moderate" rate of population increase (2 per cent or less), instead of four countries in the 1960s. The additional countries in the group include specifically the South-East Asian countries with their unequalled economic growth of 7-8 per cent annually (slightly higher in the 1970s than in the 1960s). For example, Taiwan, Province of China, which belonged to the group with the highest population growth and at the same time (after Hong Kong) the most rapid economic growth during the 1960s, thus moved into the group with the lowest population growth.

The shift of those countries with their exceptional economic performance into the groups with lower population growth accounts for the change. If those four countries, which are in the Japanese sphere of influence, are omitted, the contrast between the two periods disap-

pears almost completely, and the rate of population increase does not seem to have had any particular effect, one way or another, on the rise in living standards. Consequently, differences in population growth apparently have not been an important variable in explaining contrasts in economic growth. In other words, the prevailing view that rapid population increase has been harmful to the development of the countries involved has not been proved: even where the population boom was strongest, there was clearly economic growth, even in the 1970s.

#### REVIEW OF CORRELATION STUDIES

Comparative empirical analysis of the relationship between population increase and economic development is recent, and with the proliferation of studies on the interaction between the economy and population, such evaluations are still relatively rare.

#### *A major conclusion: no significant correlation*

The first studies on correlation, strictly speaking, go back to the 1960s. Kuznets (1967) deals mainly with developed countries over long periods. Having devoted most of his scientific research to the statistical reconstruction of the economic history of the Western countries since the industrial revolution, Kuznets draws on his wide knowledge, and his opinion therefore carries weight. As in some of his earlier work (1954 and 1965, for example), he also adds useful comments on the comparative history of development in Europe and on other countries: in establishing rank correlation over a short period between changes in population and increase in per capita income for 40 poor countries, he does not find any significant relationship between the two phenomena.

Most of the work done since then establishes a relationship between population increase and increases in average per capita income, but sometimes the economic variable used is averaged per capita savings (for example, Conlisk and Huddle, 1969), or per capita food production (for example, Bairoch, 1981). The early work (Easterlin, 1967; Stockwell, 1962, 1966 and 1972; Thirlwall, 1972 etc.) covers only a small number of countries—40 at most. Since the availability of data skewed the study, the countries considered are hardly representative of the less developed world as a whole. With the exception of the work of Kuznets and Easterlin, the calculations also tend to produce significant but contradictory findings, sometimes positive (Thirlwall, 1972), sometimes negative (Stockwell, 1962 and 1966). Subsequently, by taking certain methodological precautions (or avoiding certain artifices),<sup>4</sup> such discrepancies were to become increasingly rare, even non-existent. With the regular publication of basic statistics on the national accounts of the least developed countries by the OECD and the World Bank, the number of valid findings has grown considerably and now covers virtually all countries for which comparison of the data series is meaningful.

A synoptic table of the main work done by 1978 and the resulting findings was prepared by Sagnier (1979).

TABLE 4. POPULATION GROWTH AND ECONOMIC GROWTH IN ADVANCED TRANSITION DEVELOPING COUNTRIES, 1960-1980

Average annual rate of population increase (percentage)	1960-1970		1970-1980	
	Number of countries	Weighted average annual rate <sup>a</sup> of increase in real per capita product (percentage) <sup>b</sup>	Number of countries	Weighted average annual rate <sup>c</sup> of increase in real per capita product (percentage) <sup>b</sup>
2.0 or less....	4	1.72	10	4.58
2.1-2.5 .....	8	1.38	7	2.27
2.6-3.0 .....	6	3.13	3	5.39
3.1 or more..	4	4.28	2	1.53
	22		22	

Source: Calculated from the basic data of the OECD Development Centre: "Informations récentes sur les comptes nationaux des pays développés", *Bulletin No. 14* (Paris, 1981).

<sup>a</sup> Weighted co-efficients for population in mid 1965.

<sup>b</sup> Gross domestic product at constant market prices.

<sup>c</sup> Weighted co-efficients for population in mid 1975.

Save for Stavig (1979), who bases his analysis on a curious mixture of developed and developing countries as well as the market economy and centrally planned economy countries, all writers from Sauvy (1972) to Bairoch (1981), including Chesnais (1973, 1975), Lefebvre (1977, 1978), Bara and Guillaumont (1978), Hagen (1975), Simon (1977) or Simon and Gobin (1980), reach an identical conclusion: there is no significant linear correlation. However, these concordant findings that there is no significant correlation cannot be attributed solely to the extension of the geographical scope of the studies—that is, the introduction of countries with increasingly varied demo-economic systems; the standardization of data and processing procedures used should also be taken into account. The gradual shift in findings from a significant correlation (negative)<sup>5</sup> to a non-significant correlation in the work of the same writer—Stockwell, in this case—who has published calculations at various times since 1962 is rather suggestive in this respect.

In the opinion of some writers such as Bairoch (1981), for whom it is “more than a presumption” that rapid population growth has a distinctly negative impact, the absence of a significant correlation is regarded as unacceptable: it is seen as a paradox, partly due to faulty economic data. Admittedly, this argument is not to be dismissed out of hand, but when a large number of countries, very heterogeneous as regards density, natural resources, social organization, political heritage etc. are studied, analytical reasoning reveals, as will be seen, the interplay of different mechanisms that tend to support *a priori* indeterminate correlation. Before plunging into a discussion on that point, an important empirical problem in this kind of work should be examined: the question of duration and the relation question of the time intervals to be established between the series studied.

#### *The time frame and the interaction between periods*

Population phenomena are slow-acting; even in countries where the population is increasing rapidly, age distribution, for example, changes only very gradually, and in such a way as to generate a chain reaction that lasts for decades. Economic growth, for its part, is subject to many fluctuating circumstantial factors (prices of raw materials, weather conditions, interest rates etc.). Consequently, it is particularly difficult to pair population and economic growth. Two conditions must be met in order to measure the economic impact of population change: first, the change should be extensive enough in scope; secondly, the period considered should be long enough for the expected effects (positive or negative) to become manifest. The 10-year periods on which most existing studies are based are relatively short in population chronology. There is nothing to prevent an indicator such as GNP per capita for a given period from being more reflective of a population increase in the preceding period or periods than the increase in the period under consideration.

But the question of the meaning and importance of time intervals is clearly not without effect. For those who argue that population increase favours economic develop-

ment, the observation period for population should precede the observation period for the economy. Assuming also that population increase is mainly determined by an increase in the number of births (or a decline in infant mortality) and that marginal (informal) productivity is higher than average productivity—conditions that are not generally made clear, then the time interval may begin with the average age at which the child becomes economically active or, at least, the age from which the services provided by the child are worth more than the cost of his upkeep.

In other words, given the importance of the informal sector, the child should be 7-15 years old. Correlatively, and still under the same conditions, for those who expect a negative statistical correlation, the most appropriate time interval should be the age of net maximum cost of the child. In fact, the choice is somewhat arbitrary because the economic contribution of children at various ages has not been established. Therefore, writers tend to proceed cautiously in looking for the maximum correlation: they choose the optimal time interval (with no guarantee that it will remain stable throughout the period or can be theoretically justified *a posteriori*). For example, in Simon (1975) and Sagnier (1979), the time difference is 16 and 11 years of age, respectively.

#### LIMITATIONS OF THE EXERCISE AND INTERPRETATION OF FINDINGS

Because it is a simple process, establishing a correlation is a commonly used tool, but its limitations are often overlooked. Calculation of correlations is more an instrument for invalidating rather than validating a hypothesis.

#### *Limitations of the exercise*

Apart from the difficulty of interpreting the findings, the first limitations are automatically imposed by the variables and methods used. They are as follows:

(a) Use of aggregate variables such as GNP or population increase: if the second is relatively well measured, it can be caused by an endless number of possible combinations of variations in the age structure, directly linked with the phases of the population transition. The combinations have different implications for product growth. With regard to GNP, known to be an unsatisfactory indicator, particularly in cases where monetary transactions play a minor role, the skewing of the relationship mainly affects levels and not trends—hence, geographical comparisons for a given period rather than historical comparisons for a given country; yet, since the arguments here are based specifically on trends,<sup>6</sup> there is less objection;

(b) The comparison of phenomena subject to different historical evolution blurs the linear regression calculation: while the real per capita income curve tends to rise, the population increase curve is bell-shaped, at first rising, then descending (Chesnais, 1979). Hence, for a given country, the correlation over time will be positive in the first phase of transition and negative in the last; and, if the whole transition period is measured, the correlation co-efficient will tend towards zero. Similarly,

when the calculation is made over the same period for countries in different phases of transition, the correlation is hardly likely to be any more significant;

(c) Failure to weigh the statistics in line with the size of the population (for example, the two points representing India are not given any greater weight in the calculation than the two representing Panama). Yet, size does increase internal heterogeneity, with the result that all other things being equal, the changes are closer to the norm than to the extremes.

#### *Interpretation of findings*

The existence of a correlation is not without ambiguity; variation between any two phenomena (A and B) over time, is subject to four interpretations which are not mutually exclusive: it may be a case of A influencing B, or B influencing A, the interaction between A and B or the impact of a third phenomenon, C, on A and B<sup>7</sup> or, finally, sheer coincidence. Conversely, the non-existence of a significant correlation may, in addition to some reasons already mentioned, be the result of the zero sum effect.

An inventory (not restrictive) can thus be drawn up of the factors which produce a correlation in one direction or the other:

#### *Factors leading to a negative correlation*

The usual neo-Malthusian arguments—that rapid population growth hinders economic development—come under this heading. Since most of these arguments are relatively well-known, we shall deal with them only briefly.

Population increase puts additional pressure on limited natural resources (land, space); the effect on agriculture, in particular, is to reduce the average area of arable land and to activate the law of diminishing returns. Because institutional adjustment takes longer, population growth becomes an obstacle to modernization (Brown, 1963).

Continued high fertility forces the majority of the adult population to devote time and effort to rearing children; as a result, productive activity outside the home, especially by women, is substantially reduced.

The large investments necessary to guarantee the same living standard for more people (population investments according to A. Sauvy's terminology) are such that the potential for productive private and public capital formation is seriously affected. (With a marginal capital coefficient of 3 or 4, a rate of population increase of 3 per cent, for example, absorbs 9-12 per cent of national income.) The result is a lower quality of equipment per worker which, in turn, has repercussions on higher productivity (conversely, a decline in fertility frees resources for capital formation; for the United States in the nineteenth century, for example, it has been shown that the reduction in education costs and the increase in human and non-human capital were almost equivalent).

Economic development tends to lead in the short or long run to a reduction in the crude birth rate exceeding the decline in the gross mortality rate (phase three in the transition), with the result that population growth slows.

The initial handicap of the less developed world is already considerable: in the pre-industrial stage, per capita income is well below that which prevailed in the so-called developed countries on the eve of the industrial revolution (Kuznets, 1954), whereas current population growth rates are 1.5 to 2 times the rates current in the Old World at the height of its development.

#### *Factors leading to positive correlation*

These factors can arise both from the effect of income on population and from the reverse.

#### *(a) The influence of economic growth on population growth*

Economic growth can stimulate population increase in various ways: by raising the birth rate (causing remission in some forms of sterility, a decline in intrauterine mortality etc.), by encouraging immigration (which, in turn, stimulates economic growth, thus helping to strengthen the correlation sought), and above all, by reducing mortality.

The positive impact of better health conditions is in fact fundamental, less because of their direct effect (gradual disappearance of economic resource waste associated with premature death, reduction in the destabilizing effect of deaths on family organization, increase in the mental and physical ability to work; it is estimated that in some tropical countries, the proportion of individuals suffering from malaria can be as high as three fifths of the population) than because of their indirect effect on socio-economic change (for example, improvement of the environment: in Europe in the past and in today's poor countries, malaria was for a long time responsible for the abandonment of vast tracts of arable land; decline in age-old fatalism: control of dying produces rational attitudes and it helps to generate the idea of progress). The decline in the incidence of traditional disease represents a historic breakthrough with incalculable implications: it is a precondition for the modernization of societies and, in a way, the first sign of progress. It creates a virtuous (as opposed to vicious) circle par excellence, a powerful cumulative interaction between access to greater prosperity and improvement in the health of the population. They are mutually reinforcing and they activate very complex processes (thus, more income leads to better nutrition and better training, which can, in turn, stimulate both income growth and population growth). This argument is particularly convincing since the decline in mortality is the main driving force of population growth in our time.

For countries classified as less developed, various authors (Adelman, 1963; Weintraub, 1962; Krishnamurty, 1966; Demeny, 1974) have established, at least for the 1960s, that the (negative) correlation of average per capita income with mortality levels was very marked when the correlation with fertility levels was low or almost non-existent. In the circumstances, a positive correlation between income growth and population growth should be expected. However, this stronger negative correlation with mortality than with fertility can only be demonstrated, *a priori*, at the beginning of the transi-



tion (in rich countries, the link between income and life expectancy at birth becomes less clear). Consequently, it is quite plausible that this short-lived variability in the income effect is the cause of the positive correlation found for the 1950s and 1960s (when most developing countries were in the initial phase of their transition) and of the absence of correlation for the 1970s, whereas, thereafter, the correlation was to become clearly negative as soon as fertility declined sharply enough in many countries. That result is no more than the logical consequence of the main proposition of the transition theory, which holds that socio-economic development affects mortality before it has any impact on fertility.

(b) *The influence of population growth on economic growth*

Under favourable conditions, industrialization can make population growth a valuable stimulus to higher living standards, by employing labour to exploit natural resources and by enlarging the markets necessary to absorb and make mass production profitable (the point is illustrated by the United States in the last century). In other words, population growth can influence supply and demand of economic units.

The potential impact on the main aggregates of national income is as follows: the increase in the number of inhabitants has, as its corollary, a sharp rise in needs and in consumption; that mechanism is by its nature obvious but complex in degree. As to investment itself, it may increase as the population grows; for example, in India, the rate of net capital formation in relation to national income more than doubled between the beginning of the 1950s and the beginning of the 1970s. These expanded needs facilitate economies of scale and intensify production by mobilizing work capacity and underutilized resources and by altering agricultural techniques (reduction in non-cultivated areas, use of fertilizers, irrigation, mechanization multiple cropping (Boserup, 1965 and 1981).

Changes in job openings produce two processes that generate increased productivity: one is geographical and sectoral migration linked to population pressure in the countryside. This transfer of the economically active population from low-yield agriculture to high-productivity sectors—even in countries where the surplus agricultural population is too large to be absorbed—has generally resulted in an increase in average productivity (Fisher, 1935; World Bank, 1977). Generally, a strong positive relationship can be noted between the rate of increase in non-agricultural labour and real per capita increase in productivity (Clark, 1967). Japan's economic history illustrates this process better than that of any other country. The great expansion of the non-farm population can, moreover, lead to higher food prices that may relax rigid agricultural supply and, through pressure on wage costs, pave the way for the adoption of an industrial strategy for the labour-intensive production of manufactured goods.

The second process is the replacement of generations of illiterate or semi-illiterate workers by new and better trained generations with a more modern outlook. This

process is very dynamic since, despite the regularly reported shortcomings, progress in education in recent decades has been considerable; slowly, imperceptibly, like any structural phenomenon, it may prove decisive in the long run (Leibenstein, 1969).

The persistence—after eliminating the main biases discussed above—of non-significant correlations between population trends and economic growth could, therefore, be due to the fact that the negative effects of rapid economic growth have been offset by contrary influences related to the mechanisms described. Furthermore, economic history shows that population growth and economic growth have gone hand in hand in industrial countries over the past two centuries, although it was not possible to establish a visible relationship between the corresponding growth rates. The search for a correlation implicitly assumes a relationship between rates of growth, whereas the phenomena may be linked more by nature than by degree.

*An unexpected and unexplained boom*

There is a clear contradiction between the pessimism of contemporary economic literature and historical reality. The dominant theories cannot account for economic development in recent decades. The fact remains to be explained: in developing countries<sup>8</sup> the per capita GNP growth rate in the period 1950-1975 was slightly higher than that of the developed capitalist countries (average 3.4 instead of 3.2 per cent annually) (Morawetz, 1977). What is more, since the first oil shock, this gap has continued—an annual average, according to OECD (1985), of 2.2 instead of 1.7 per cent from 1973 to 1983. It has even widened according to data from the last World Bank report (1985): 2.6 and 1.7 per cent, respectively, for the period 1973-1983.

This finding is particularly spectacular since the industrialized countries, with significantly fewer population constraints, enjoyed per capita income increases of only about 2 per cent annually from the century-long phase of economic expansion to the middle of the century, and since many of the countries involved were for centuries doomed to zero growth.<sup>9</sup> The predictions of disaster made after the Second World War have been proved wrong, in spite of a population boom much greater than expected. Early United Nations population projections (1951) reckoned on population growth close to 1 per cent for Africa and Asia over the period 1950-1980, whereas the rate was close to 2.5 per cent. The economic predictions of experts as famous as Rosenstein-Rodan (1961) or Chenery (1966) were excessively pessimistic; in retrospect, growth in the vast majority of cases turned out to be much higher than predicted.

Let us examine those predictions. Rosenstein-Rodan predicted, in a study of 66 developing countries, that none would achieve a 3 per cent annual per capita GNP growth for the period 1961-1976. In fact, 18 countries achieved that rate and, in most cases, the real value of per capita income was, at least, 10 per cent higher than the projection. Similarly, in work done some years later by Chenery and Strout on 45 developing countries, the projections regarded as high were achieved or exceeded

in more than half the cases. Growth in India was not as low as in the scenario envisaged by Coale and Hoover (1958), assuming continuing high fertility: the increase in average income was higher by half than that projected in the model.

This unquestionable economic progress is not, however, without its problems. It is being achieved, notably in petroleum-importing countries, at the cost of increasing indebtedness to Western banks (in other words, on credit). It is also very uneven from country to country, resulting in an increasingly greater heterogeneity among them. But, apart from some extreme cases, like Bangladesh, Egypt or some regions of China where population pressure creates a precarious balance between population and subsistence, curiously enough, it is in the less densely populated African countries that economic growth is lagging most. Indeed, the situation is one of stagnation, even economic regression. Of course, rapid population growth certainly does not generate economic take-off but, on examination, the factors of underdevelopment are seen to be related more to errors in strategy (inadequate investments in food production and general infrastructure), and to prevailing political instability than to the specific constraints of population. In Africa, the countries experiencing a sharp drop in real per capita product over the period 1973-1983 are Angola, Mozambique, Somalia, Uganda and Zaire. In Latin America, Argentina, Bolivia and especially El Salvador and Nicaragua, all of which are facing political crises, are among the countries where the economic situation is worsening.

But the main point is the importance of the changes taking place in developing countries, which can be illustrated by a few examples. Between 1950 and 1985, the population of the two Asian giants, China and India, grew by almost 1 billion. That growth in population has not prevented substantial economic progress: in India, where change has been less profound, the standard of living has gone up by two thirds, and in China, according to the national statistical yearbook, per capita consumption levels doubled between 1952 and 1982. In other heavily populated countries like Pakistan, per capita income doubled and in Mexico and Brazil, it tripled.

The population explosion, therefore, coincided with a historically unprecedented economic boom. The phenomenon is reminiscent of the past two centuries of European history. In both cases, the developments were unexpected and, above all, ran counter to prevailing ideas.

#### CONCLUSION

The usual paradigms of classical theory are unable to explain a historical change as striking as the economic expansion of the poor countries. Their failure is the result of two flaws in the initial approach. First, the "population question" is normally described as a race between two rates. This premise hampers an understanding of the issues. Not only do population growth and economic development have common structural origins but they are also both subject to dynamic and cumulative

interaction. Consequently, a policy of improving agricultural techniques, of building canals or providing irrigation removes obstacles not only to income growth but also to improved health conditions (resulting in further population growth). In turn, an improvement in health conditions is a powerful enough force to eliminate some traditional restraints on technological change and innovation.

Secondly, the excessive attention paid to high fertility has led to neglect of the key role of declining mortality in today's population dynamics. A change in perspective has, from the economic standpoint, a decisive influence, for contrary to what was long accepted, the decline in mortality is far from an exogenous factor in economic development. On the contrary, a reduction in mortality is a pre-condition for long-term savings and private investment (because it extends the time frame of economic units). In this sense, income growth and population growth are linked *a priori*; they are two facets of the same phenomenon: development.

---

#### NOTES

<sup>1</sup> Countries showing a sharp drop in fertility and, as a result, a decline in population growth.

<sup>2</sup> Such a list could easily be extended, for political instability is characteristic of the poorest countries.

<sup>3</sup> For the first period, the definition is not the same for all countries. Furthermore, no account has been taken of differences in price structure (the work of Kravis/Heston/Summers does not allow enough ground to be covered). However, it is a minor disadvantage because the focus is on variations and not on levels of per capita product.

<sup>4</sup> See, for example, the early work of Stockwell criticized in *Population* (Chesnais and Sauvy, 1973).

<sup>5</sup> On only 16 countries at the outset (and over a very short period).

<sup>6</sup> It cannot be denied that there is a bias favouring a rise in GNP as the economy undergoes modernization, because a commercial value is attributed to services that were not previously remunerated. But nothing proves—as Bairoch (1981) assumes—that this bias is stronger for countries with more rapid population growth.

<sup>7</sup> Thus, population growth and economic growth may respond to the same external stimulus, such as institutional change or technological progress. For instance, the accumulation of knowledge and technological skill lead to greater control over public health and economic production, so that the two phenomena may become manifest simultaneously, as in Europe in the nineteenth century.

<sup>8</sup> Although there are significant disparities among countries, the finding is sufficiently surprising to merit attention.

<sup>9</sup> Measuring growth is not free of bias. A leaning towards a finding of increased growth is the result of the rapid expansion in business activity and foreign trade which has been more vigorous in the developing economies. The disparity in growth as compared with the developed economies may, as a result, be exaggerated. Account should also be taken of the increasing indebtedness to Western banks.

---

#### REFERENCES

- Adelman, I. (1963), "An econometric analysis of population growth", *American Economic Review*, vol. 53, pp. 314-319.
- Bairoch, P. (1981), "Population growth and long-term international economic growth", *International Population Congress*, IUSSP (Manila), pp. 141-163.
- Bara, M. F. and P. Guillaumont (1978), "La croissance démographique optimale: à la recherche d'une vérification empirique", *Population*, No. 6, pp. 1,207-1,216.

- Blanchet, D. (1981), "Croissance économique et démographique dans les pays en développement", *Population*, No. 1, pp. 29-45.
- Boserup, E. (1965), "The conditions of agricultural growth", *The Conditions of Agrarian Change Under Population Pressure* (London, Allen and Unwin).
- \_\_\_\_\_. (1981), *Population and Technology* (Oxford, Basil Blackwell).
- Brown, L. R. (1963), *Man, Land and Food*, (Washington, D.C., United States Department of Agriculture).
- Chenery, H. B. and A. Strout (1966), "Foreign assistance and economic development", *American Economic Review*, vol. 56, pp. 679-733.
- Chesnais, J. C. (1979), "L'effet multiplicatif de la transition démographique", *Population*, No. 6, pp. 1,138-1,144.
- \_\_\_\_\_. and A. Sauvy (1973), "Progrès économique et accroissement de la population: une expérience commentée", *Population*, No. 4-5, pp. 843-857.
- \_\_\_\_\_. (1975), "Croissance démographique et développement économique dans les pays peu développés de 1960 à 1972", *Population*, No. 6, pp. 1,150-1,155.
- Clark, C. (1967), *Population Growth and Land Use* (London, Macmillan).
- Coale, A. J. and E. M. Hoover (1958), *Population Growth and Economic Development in Low-Income Countries* (Princeton, Princeton University Press).
- Conlisk, J. and D. Huddle (1969), "Allocating foreign aid: an appraisal of self-help model", *Journal of Development Studies* (July), pp. 245-251.
- Demeny, P. (1974), "The population of the underdeveloped countries", *Scientific American*, (September), pp. 149-159.
- Easterlin, R. A. (1967), "The effects of population growth on the economic development of developing countries", *The Annals of the American Academy of Political and Social Science*, No. 369, pp. 98-108.
- Fisher, A. G. B. (1935), *The Clash of Progress and Security* (London, Macmillan).
- Glover, D. and J. L. Simon (1975), "The effects of population density upon infrastructure: the case of road-building", *Economic Development and Cultural Change*: 453-468.
- Hagen, E. E. (1975), *The Economics of Development* (Homewood, Illinois, R. D. Irwin).
- Kravis, I. B., R. Heston and R. Summers (1982), *World Product and Income: International Comparison of Real GDP, Phase III* (Washington, D.C., World Bank and Baltimore, Johns Hopkins University Press).
- Krishnamurty, K. (1966), "Economic development and population growth in low-income countries: an empirical study of India", *Economic Development and Cultural Change*, pp. 70-75.
- Kuznets, S. (1954), "Underdeveloped countries and the pre-industrial phase in the advanced countries", *Proceedings of the World Population Conference, Rome*, vol. V, pp. 947-970.
- \_\_\_\_\_. (1965), "Demographic aspects of modern economic growth", *Proceedings of the World Population Conference, Belgrade, 1965*, vol. I: Summary Report, pp. 305-314.
- \_\_\_\_\_. (1967), *Population and Economic Growth. Proceedings of the American Philosophical Society* (June), pp. 170-193.
- Lefebvre, A. (1977), "Croissance démographique et progrès économique dans les pays en développement de 1960 à 1975", *Population*, No. 6, pp. 1,287-1,293.
- \_\_\_\_\_. (1978), "Croissance démographique et progrès économique dans les pays en développement de 1960 à 1975", *Population*, No. 6, pp. 1,221-1,227.
- Leibenstein, H. (1969), "Pitfalls in benefit-cost analysis of birth prevention", *Population Studies*, vol. 23, pp. 161-170.
- Morawetz, D. (1977), *Twenty-five Years of Economic Development: 1950 to 1975*. (Baltimore, World Bank).
- McNicoll, G. (1984), "Consequences of rapid population growth: overview and assessment", *Population and Development Review*, vol. 10, No. 2, pp. 177-240.
- OECD Development Centre (1981 and 1985), *Information récentes sur les comptes nationaux des pays en développement*, latest bulletins, particularly, Nos. 14 and 17.
- Rosenstein-Rodan, P. (1961), "International aid for underdeveloped countries", *Review of Economics and Statistics*, vol. 43, pp. 107-138.
- Sagnier, G. (1979), "Une hypothèse de décalage en démographie économique", *Population*, No. 3, pp. 718-723.
- Sauvy, A. (1972), "Les charges et les avantages de la croissance de la population", *Population*, No. 1, pp. 9-26.
- Simon, J. L. (1975), "The positive effect of population on agricultural savings in irrigation systems", *Review of Economics and Statistics*, vol. 57, pp. 71-79.
- \_\_\_\_\_. (1977), *The Economics of Population Growth* (Princeton, Princeton University Press).
- \_\_\_\_\_. and R. Gobin (1980), "The relationship between population and economic growth in LDC's", in J. L. Simon, ed., *Research in Population Economics*, vol. II (Greenwich, Connecticut, Jai Press).
- Stavig, G. R. (1979), "The impact of population growth on the economy of countries", *Economic Development and Cultural Change* (July), pp. 735-750.
- Stockwell, E. G. (1962), "The relationship between population growth and economic development", *American Sociological Review* (April), pp. 250-252.
- \_\_\_\_\_. (1966), "Some demographic correlates of economic development", *Rural Sociology*, vol. 31, No. 2 (June), pp. 216-224.
- \_\_\_\_\_. (1972), "Some observations on the relationship between population growth and economic development during the 1960's", *Rural Sociology*, vol. 37, No. 4, pp. 628-632.
- \_\_\_\_\_. (1980), "A note on the association between population growth and economic development in low-income countries", *Rural Sociology*, vol. 45, No. 1, pp. 132-138.
- Thirwall, A. P. (1972), "A cross section study of population growth and the growth of output and per capita income in a production function framework", *Manchester School of Economics and Social Studies* (December), pp. 339-356.
- Weintraub, R. (1962), "The birth rate and economic development: an empirical study", *Econometrica*, No. 4, pp. 812-817.
- World Bank (1985), *World Development Report* (Washington, D.C.).

# POPULATION, RESOURCES AND FOOD IN AFRICA

*David Norse\**

## SUMMARY

Recent droughts provide only a partial explanation of the decline in per capita food production in sub-Saharan Africa. More fundamental is the neglect of agricultural development combined with rapid population growth. Furthermore, prospects for meeting future food requirements of that region are uncertain at best. The main nutritional requirements will be met by the direct consumption of cereals. In some African countries income growth will permit cereal consumption to grow more rapidly than the population. But for the majority of countries on that continent, population growth will account for almost the entire growth in the demand for cereals (from 77 million tons in 1979-1981 to around 200 million tons in 2010). During the same period, production is expected to grow by 2 per cent per annum, to 100 million tons, meeting only half of the total demand. Only part of the deficit can be filled by imports from developed countries. A greater part of the gap must be closed by putting new arable land under cultivation at a more rapid rate. The most promising approach would be to raise yields per hectare closer to realizable levels. Slowing the rate of population growth, at the same time, would not only reduce demand but permit the channelling of more resources into agricultural development. Furthermore, it would lessen rates of soil degradation caused by cultivating marginal lands and reducing fallow periods. Over the longer term, the greatest scope for expanding the population-supporting capacity of land lies in technological improvements, especially those closely related to present systems of farming. There is evidence that African Governments are now implementing policies to promote production, but, as yet, few countries of the region have taken corresponding steps to reduce rates of population growth.

## INTRODUCTION

During the past 12 months, public attention in developed countries has frequently been focused on the impact of drought in Africa and the plight of millions of people in the 20 or so affected countries. There is nothing new or unusual about such droughts. They are a common feature in about half of Africa's countries and affect more than one third of the continent's land area. Although it is seldom that they last three years, that has been the case in Botswana, Ethiopia, Zimbabwe and some other countries.

However, droughts are only a partial explanation for the fact that sub-Saharan Africa is the only region where food production per capita has declined since the early 1960s. They do not account for the poor performance of semi-arid countries in cropping seasons with favourable rainfall. They do not explain the slow growth of per capita food production in the humid countries of western and central Africa.

So what has happened in Africa? Why are the majority of countries now unable to feed themselves, whereas 10-

20 years ago they were essentially self-sufficient? Since there is no clear-cut evidence for a long-term climatic change towards lower rainfall, why are countries now more vulnerable to drought? What are the forces at play, and, in particular, what is the role of population growth?

This paper will argue that through inaction on population growth and relative neglect of agriculture during the past two decades, most African countries have undermined their social and economic development, increased their vulnerability to drought, and set themselves almost impossible food production tasks for the coming 15-25 years. It seems inevitable that the agricultural situation will deteriorate at least in the short term, with increasing dependence on food aid and commercial food imports. Looking further ahead, however, it is possible to conceive of resources and measures that would enable many countries to reverse the past trends of declining per capita food production. Much of the argumentation and evidence for the paper is drawn from two studies completed by FAO: *Agriculture: Toward 2000*,<sup>1</sup> commonly known as *At 2000*, and *Potential Population Supporting Capacity of Lands in the Developing World*.<sup>2</sup>

*At 2000* was an assessment of world food and agricultural prospects to the year 2000. It was based on a detailed examination of present and potential arable land

\*Economic and Social Policy Department, Food and Agriculture Organization of the United Nations.

and irrigation capacity and existing technological opportunities. Trends and normative food supply and demand projections were completed for 90 developing countries, including 43 in Africa. Population growth assumptions were based on the United Nations' 1980 assessment,<sup>3</sup> using principally the medium variant but also testing the implications of the low variant.

The population-supporting capacity study was a joint FAO/UNFPA/IIASA project. Its principal objective was to estimate the human population that could be fed adequately if all or part of the potentially available arable land was developed for food production. Very comprehensive soil and climate maps were used in conjunction with data on the agro-climatic requirements of different crops. Consequently, by allowing for the soil, light, temperature and moisture requirements for optimal and sub-optimal growth of some 18 food crops, the study was able to estimate the potential land area available for growing those crops. Then, by bringing together the land area estimates with present and projected populations, population-supporting capacity could be determined, albeit only approximately. Moreover, the effect of technological progress on population-supporting capacity could be estimated by considering the impact of different assumptions on the use of fertilizer, improved seeds etc., or the lack thereof.

#### LONG-TERM DEMAND FOR FOOD

Although there has been and will continue to be a switch by consumers towards industrially processed and more expensive foods, home processed staple crops will continue to dominate the consumption patterns of most people in Africa and provide 60-70 per cent of their calorie needs. In a few, primarily humid, western and central African countries, the principal staple will be the traditional roots and tubers, notably cassava and yams. For many countries, however, cereals will continue to be the most important source of both calories and proteins, and the dominant group of crops. Hence, the following analysis concentrates on cereals.

Trend projections of cereal consumption are based on exponential curves fitted statistically to time series data on per capita food consumption in terms of calories between 1966 and 1981, subsequently decomposed into

individual commodities. Projections of cereal demand take account of the main uses—that is, for both direct and indirect consumption, including the grain fed to livestock or used for beer-brewing, seed, industrial purposes, and waste. Direct consumption is the dominant use—over 80 per cent for Africa as a whole, and over 70 per cent even in North Africa, though substantially less in some middle-income countries where the use of feedgrains has been expanding rapidly.

Aggregate food consumption is projected to increase at about 3½ per cent per year, as in the 1970s, but with some pronounced subregional and national differences, stemming largely from differences in past economic performance (table 1). In middle-income countries, like Algeria and Tunisia, and in the more successful agricultural producers of the 1970s, notably Cameroon and the Ivory Coast, income growth is projected to raise direct plus indirect cereal consumption faster than population growth, leading to a per capita cereal demand in 2010 some 25 per cent greater than in 1979-1981. However, in almost all other African countries population growth is projected to account for nearly all the expansion in cereal demand. The latter is consistent with most medium-term economic forecasts, which point to stagnant or even declining per capita income growth over the next 10 years or so in the majority of sub-Saharan countries.

More pronounced growth is expected for some commodities, given continuing high rates of urbanization and changes in consumer preference. The main change is the switch from indigenous staples like maize, sorghum and millet, which tend to require long preparation and cooking time, to convenience foods based on wheat and rice, which at present are largely imported. Demand for milk products has also been growing strongly, particularly in urban areas. That trend is expected to continue and will stimulate the demand for feed grains in some countries.

A quantitative picture of these changes is given in table 1. Total cereal demand is projected to increase from about 77 million tons in 1979-1981 to around 200 million in 2010. An increasing proportion of total cereal demand is for wheat and rice, which cannot be grown at all in some countries and only in certain agro-ecological regions of many others, primarily because the air temperature is too high (wheat) or water for irrigation is lacking (wheat and rice).

TABLE 1. TREND PROJECTIONS OF GROWTH IN TOTAL FOOD AND CEREAL DEMAND

Subregion	Population 1980 (millions)	Population growth rate, 1980-2010 percentage/ year	Growth rate in total food demand percentage/ year	Total cereal demand		Growth rate in cereal demand, 1980-2010 percentage/ year
				1979/1981 (millions of tons)	2010	
Mediterranean and arid northern						
Africa.....	90.5	2.5	3.8	27.1	63.8	2.9
Humid and sub-humid western Africa ..	114.0	3.4	4.0	15.6	49.0	3.8
Humid central Africa.....	41.5	3.6	3.7	2.6	7.9	3.7
Sudano-Sahelian Africa.....	55.2	2.7	3.1	10.1	23.9	2.9
Sub-humid and mountainous eastern						
Africa.....	80.8	3.4	3.5	12.3	29.8	2.9
Sub-humid and semi-arid southern						
Africa.....	58.5	3.5	4.0	8.9	26.1	3.6
TOTAL	440.5	3.1	3.7	76.6	200.5	3.2



## FOOD PRODUCTION PROSPECTS

Comparison of trend consumption projections with trend production projections point to the likelihood of a steadily deteriorating grain situation with a widening gap between supply and demand (see the figure). Cereal production is projected to reach just over 100 million tons by 2010, with an aggregate growth rate of about 2 per cent per year. This is slightly above the 1966-1981 trend of 1.7 per cent, because it is assumed that Governments of certain countries will be forced, by both internal and external factors, to act on their negative trends in cereal production and raise producer incentives and investment in agriculture.

Projected production for 2010 is approximately 100 million tons less than projected consumption—that is, a deficit 20 times greater than that in 1969-1981. Consequently, achieving trend consumption would be dependent on commercial imports and/or food aid. Substantial commercial imports are likely to be beyond the financial resources of most low-income countries in Africa, which account for more than half of the projected deficit. They are faced now and in the short-to-medium term at least with serious debt repayment problems that will probably be compounded by poor trade prospects for most of their traditional agricultural exports.

It is technically feasible for the developed countries to produce sufficient grain surplus to provide food aid of the projected magnitude. However, such a 10-fold increase would be beyond the capacity of the existing and foreseeable transport and distribution infrastructure of most African countries. Furthermore, it would be difficult to provide without undermining local food security by discouraging domestic production. Therefore, one needs to examine the prospects for reversing the trend of declining per capita food production.

With the exception of northern Africa, all the African subregions have significant areas of undeveloped land potentially suitable for crop production (table 2, col. 3). However, if there is no major change in the mix of crops grown, only a proportion of those areas will be available for cereals (table 2, col. 4). Moreover, aggregation into subregions masks the very limited area available in certain countries.

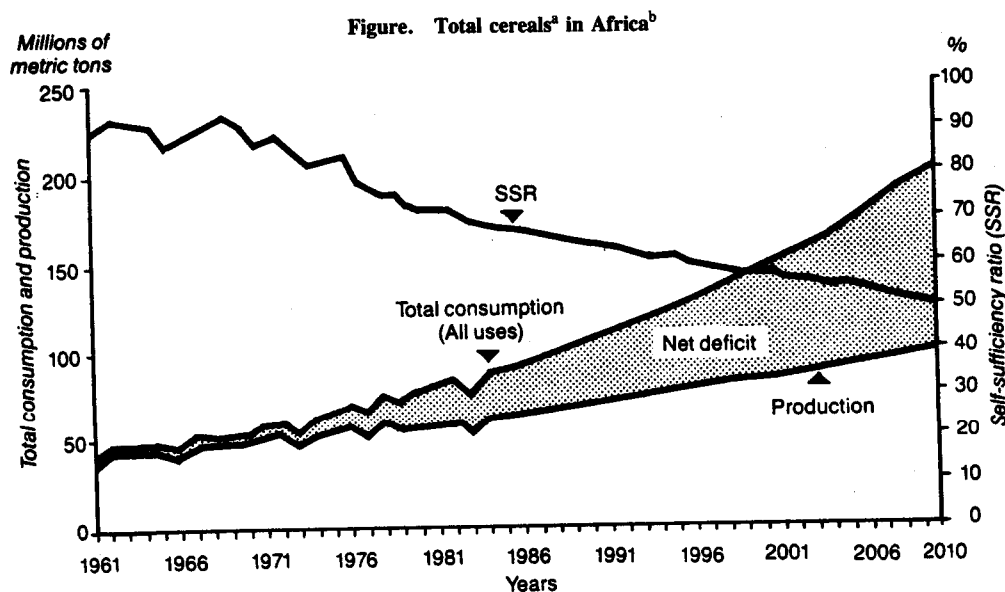
Past performance suggests that much of the potential may not be utilized. In the 1960s "new" arable land was developed at only 1½ per cent per year on average, and progress in the 1970s was considerably slower (table 2, cols. 5 and 6); with the exception of humid central and Sudano-Sahelian Africa, the rate was significantly slower than that of rural or total population growth.

Factors behind this slow development include:

- (a) Labour constraints arising from the migration of males from rural to urban areas;
- (b) Price and other producer disincentives that discourage farmers from growing more than their own needs;
- (c) Over-estimation of the suitability of undeveloped land for crop production using prevailing technologies.

Most of these constraining factors are reversible in the short-to-medium term, given appropriate political decisions and donor support. If labour and finance were available, it would be technically feasible in most countries to expand the areas under traditional cereals cultivation at or slightly faster than the rate of population growth. However, as noted above, in many countries the agro-ecological conditions are not favourable for wheat or, to a lesser extent, rice.

Fortunately, increasing cereal production need not depend on area expansion. National average yields are commonly several times less than they might be at the farm level. Moreover, policies aimed at increasing yields



<sup>a</sup> Rice in milled form.

<sup>b</sup> Past data and trend projections (preliminary).

TABLE 2. LAND AVAILABILITY FOR CEREAL PRODUCTION

Subregion	Population growth, 1980-2010 (percentage/year)	Present arable area (millions of hectares)	Potential <sup>a</sup> arable area (millions of hectares)	Potential <sup>b</sup> cereals area (millions of hectares)	Past increase in cereals area	
					1961-1963 to 1969-1971	1969-1971 to 1979-1981
Mediterranean and arid northern Africa.....	2.5	21.8	22	0	1.0	0.3
Humid and sub-humid western Africa .....	3.4	37.9	93	43	2.1	0.9
Humid central Africa.....	3.6	14.6	272	44	2.6	2.3
Sudano-Sahelian Africa .....	2.7	30.2	110	56	1.3	2.6
Sub-humid and mountainous eastern Africa..	3.4	23.6	72	27	1.1	-0.8
Sub-humid and semi-arid southern Africa ....	3.5	22.3	225	81	2.3	0.3

<sup>a</sup> Potential for rain-fed production, including present area.

<sup>b</sup> Additional area, assuming that cereals occupy the same proportion of the total as in 1979-1981 and excluding the amount of land made available in arid areas by irrigation.

per hectare may entail lower investments and produce quicker results than those aimed at area expansion. And, since much of the potential arable land is already used for grazing or forestry, they may help to reduce land degradation from overgrazing or badly managed (or uncontrolled) forest clearance.

However, as with land development, past performance does not hold much promise for the future. During the 1970s average cereal yields per hectare generally rose at a fraction of the population growth rate (table 3, cols. 1 and 2), largely because of the same constraints that held back area expansion—i.e., labour constraints and inadequate producer incentives—but, in some areas, also from the lack of suitable technologies. Nonetheless, during various periods in the past 20-30 years most African countries have sustained high 10-year average growth rates (table 3, col. 3)—in fact, growth rates several times greater than the average for the 1970s and well above population growth. It is technically feasible in most countries to achieve similar growth rates in the short-to-medium terms. Current average yields are very low (table 3, col. 4) and generally well below the potential (table 3, col. 5), but in the longer term a number of research gaps need to be filled.

As with land resources, aggregation hides the poor yield prospects of some countries, which fall into three main and commonly overlapping groups:

(a) Semi-arid countries where inadequate and uncertain rainfall and limited possibilities for low-cost irriga-

tion make the application of even modest amounts of fertilizer a risky and generally unprofitable action;

(b) Countries where population growth is faster than past growth rates for cereal yields, though the potential for higher cereal exists;

(c) Critical countries with populations that already exceed the carrying capacity of the land, or may do so about the end of this century, given existing technology and present relative prices for crops and production inputs such as fertilizers and pesticides.

The first group consists largely of countries in the Sudano-Sahelian zone, such as Mali, Mauritania and Chad, but also includes countries in southern Africa which are primarily arid or semi-arid, such as Botswana and Namibia. The second is dominated by the countries of humid central Africa which have large arable land reserves (table 2), such as Angola and Zaire. The last group suffers from high population growth rates, limited arable land reserves relative to the projected population, or agro-ecological constraints. It includes Cape Verde, Kenya, Lesotho, Mauritius and Rwanda.

#### WHAT IF POPULATION GROWTH SLOWS DOWN?

Few African countries have implemented measures to lower fertility rates. If the remainder did so now, it is possible that population growth would slow down sufficiently to follow the projection given by the low variant of the 1982 United Nations population assess-

TABLE 3. POTENTIAL FOR IMPROVEMENT IN CEREAL YIELD

Subregion	Average annual rate of population growth, 1971-1980 (percentage)	Average annual rate of growth in yield, 1971-1980 (percentage)	Best 10-year performance since 1961 in growth of yield (percentage/year)	Average yields, in 1979-1981 kilogram/hectare	Long-term potential yield <sup>a</sup> kilogram/hectare
Mediterranean and northern Africa .....	2.60	0.1	2.6	1 260	2 500
Humid and sub-humid western Africa	3.27	0.20	2.8	700	5 000
Humid central Africa .....	2.61	-0.91	0.8	800	4 000
Sudano-Sahelian Africa .....	2.84	0.2	0.9	590	1 500
Sub-humid and mountainous eastern Africa..	2.80	-0.1	3.1	1 290	4 000
Sub-humid and semi-arid southern Africa ....	3.38	1.7	4.1	900	4 000

<sup>a</sup> Rain-fed conditions only.

ment,<sup>3</sup> rather than the medium variant used so far in this analysis. Such a slowdown would be beneficial, but the principal gains would not arise until after 2010.

The medium variant gives Africa a population in 2010 of about 1,110 million, compared with around 1,030 million for the low variant—i.e., a difference of only 7.5 per cent. This difference is small relative to the 120 per cent and 103 per cent increase in population projections for the next 25 years by the medium and low variants, respectively. Nonetheless, slower population growth could have appreciable benefits for per capita incomes and general welfare, which would influence fertility, as well as for the environment and per capita food production and consumption.

Slower growth would reduce the competition for investment and recurrent expenditure between agriculture and social services such as education and health. Fuel-wood needs would be lower, hence over-cutting of trees and shrubs would likely be less severe, and consequently soil erosion would be less. Environmental benefits could also arise from a reduction in overgrazing.

If no allowance is made for possible per capita income differences between the two population growth variants, the reduction in the long-term food demand resulting from slower population growth is in the range of 6-9 per cent at the subregional level, with a slightly wider range at the country level. However, slower population growth would probably lead to slightly higher per capita incomes, and therefore greater food demand. So the difference in food demand between the two variants could be somewhat less than 6-9 per cent, and consequently, arable land and crop yield requirements would not differ greatly.

Nonetheless, lower demand for food could have some positive effects. At the national level it could mean the difference between a country being a net exporter or a net importer. At the farm level it could improve the profitability of food production. With the medium variant, some countries by the year 2010 could be pressing so hard against the maximum yield ceiling that the profitability of additional fertilizer and other inputs would be very low. Hence, a relatively small decrease in food demand could allow farmers to reduce input use and possibly increase their profits.

Unfortunately, in countries like Kenya with particularly high population growth rates, the difference between the two variants would have no appreciable impact on the size of the labour force or on the fragmentation of farms until some time after 2010. Hence, a major issue for such countries will be how to use additional entrants to the labour force productively in agriculture.

#### *Positive and negative factors affecting food production and population-supporting capacity*

The relevant factors may be classified as follows:

(a) Economic factors—such as improvements in the prices African countries receive for their exports, or in donor aid;

(b) Political factors—those that create internal insecurity or govern the nature of the economy, with state cap-

italism at one extreme and free market systems at the other;

(c) Social factors—such as the communal ownership of land;

(d) Technological—factors such as the drought tolerance of plants.

The impact of these factors is seldom simple. Depending on the circumstances, the same factor may have both positive and negative effects. For example, higher price incentives may encourage farmers to produce more food and to employ more labour, but they may also raise food prices and, therefore, limit the ability of low-income groups to purchase all the food they need.

Of the factors affecting population-supporting capacity, technological development and land degradation and their socio-cultural dimensions are among the most important.

#### *Technological development*

In most areas of Africa current technology could provide the means to raise food production and the number of people that could be supported by a given area of land. But eventually, that technological potential will be exhausted. For certain combinations of crops and agro-ecological zones, it may be in five years' time, if there is rapid uptake; for other combinations, the period may be 10 or more years.

Other areas are less fortunate, particularly arid and semi-arid areas where there is no potential for irrigation. Farmers in those areas are already constrained by the lack of suitable technologies and have few options for raising yields.

Technological development is, therefore, required throughout Africa, though the urgency varies from one crop and agro-ecological zone to another. If successful, it should have a major impact on population-supporting capacity. Increasing the prevailing grain yields in most countries—i.e., from 0.5-1.5 tons/hectare to 2.5 tons/hectare—could raise the supporting capacity up to 10 times if current consumption patterns are maintained.

Such yield improvements are possible. Various research centres in Africa have developed new technologies that are ready for use. The most successful are likely to be those that build on existing farming systems and reduce the need for large applications of fertilizer and other purchased inputs. Some merely require the farmer to use improved seed or planting materials—for example, new cassava varieties. Others involve simple mechanization for planting and weeding.

#### *Land degradation*

There is not a single country in Africa where land degradation is not reducing population-supporting capacity. Around the Sahara and in parts of eastern and southern Africa there is desert encroachment and desertification. In areas with higher rainfall, the dominant problem is water-borne soil erosion, particularly on slopes where there has been uncontrolled forest clearance. Almost everywhere there is steady soil degradation stemming from too frequent cropping of land without the use of fertilizer or manure to replace the

nutrients removed by crops. More often than not, the degradation is a direct result of population pressure.

When population densities were less, grazing pressure at the edges of the desert were not great. There was no need to cultivate marginal land on hillsides. Farmers could allow cropland to revert to bush after a few years of cultivation, and leave it fallow for 10 or more years to regain fertility before using it again. Population pressure has reversed all this.

However, the relationship between population pressure and degradation is not always simple. In some countries soil erosion is linked to labour shortages. Rural-to-urban migration has reduced the male agricultural labour force, and so there are insufficient men available to help the women with bush clearance and soil cultivation. Consequently, the same piece of land is cropped too frequently, and soil erosion is accelerated.

#### CONCLUSIONS

If one considers Africa's population and food production prospects in an accounting framework, the following picture emerges: agro-climate and land resources enter on both the debit and the credit sides. For about one third of the continent the agro-climate is favourable or very favourable; for another one third, it is adequate for good crops in most years; the remaining area is generally unfavourable, and irrigation is essential for reliable yields. Similarly, most subregions have sizeable land reserves remaining to be developed, but most of their soils are fragile and easily eroded.

Technology enters primarily on the credit side of the account. Current yields are generally very low and well

short of the levels achievable with present technology, given better access to inputs, credit and advice. Moreover, there are many opportunities for additional research to raise yield maxima.

The credits are at present more than offset by the debits, particularly by unfavourable agricultural policies and high population growth rates. The former starve agriculture of the investment it requires and discourage production. The latter implicitly call for production and productivity growth rates that are well above past performance and will be impossible to sustain in the future. Unless governmental policies are amended to address the debits, disaster seems inevitable. There are hopeful signs for agricultural policy but not for population policy. Many countries are dismantling or reforming the parastatal marketing organizations that have taxed farmers unduly or have given bad service, and are giving better price incentives to food producers. In contrast, there are very few countries with a clear population policy, and fewer still that are actually implementing such a policy.

---

#### NOTES

<sup>1</sup> Food and Agriculture Organization of the United Nations, *Agriculture: Toward 2000* (Rome, 1981).

<sup>2</sup> G. M. Higgins and others, *Potential Population Supporting Capacities of Lands in the Developing World* (Rome, Food and Agriculture Organization of the United Nations, 1983).

<sup>3</sup> *Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980* (United Nations publication, Sales No. E.82.XIII.5).

# POPULATION AND THE ENVIRONMENT\*

*United Nations Secretariat\*\**

## SUMMARY

The pressures created by increasing numbers of people and increasing migration have aggravated environmental and resource problems in many developing countries. To deal with those problems, there is need to formulate mutually supportive population and environmental policies. This is a matter of particular concern for the developing countries, where most of the world's population growth will occur and where there will be the greatest growth in urban centres, for it is those countries that are also at greatest risk of serious environmental degradation. Efforts to promote development in a way which preserves the resource base for future generations will have to take into account demographic factors, since excessive population pressure in specific geographical areas can pose serious ecological hazards, including soil erosion, desertification, dwindling supplies of firewood, deforestation and the degradation of sources of fresh water. Often the link between population pressure and those types of environmental stress is the growth in the relative and absolute number of persons living in poverty. The result is marginalization of small-scale farmers and pressure on larger numbers to migrate from distressed areas. In many cases the result is also the prevalence of environmentally related diseases. Population policies should also be formulated with due regard for environmental factors. Priority should be given to population activities in those geographical areas likely to experience acute environmental stress. Programmes for influencing the distribution of population should also consider the environmental impact. There should be a monitoring and forecasting of likely changes in the status of key natural resources; if that information is communicated to communities, population policies are more likely to have grass-roots support. Ultimately, however, the problems of population and the environment can be resolved only in the context of a comprehensive programme at the national and international levels to promote economic and social development.

## INTRODUCTION

The International Conference on Population, held at Mexico City in August 1984, recognized that a major immediate challenge for population policy was "the disequilibrium between rates of change in population and changes in population, resources, environment and development".<sup>1</sup> It also observed that "in many countries the population has continued to grow rapidly, aggravating such environmental and natural resource problems as soil erosion, desertification and deforestation, which affect food and agricultural production".<sup>1</sup>

Population growth is outpacing the capacity of a number of developing countries to provide for their economic and social well-being. The pressures thus generated are depleting natural resources faster than they can be regenerated, reducing their productivity and, hence, undermining development.

There is no simple correlation between population and the environment. Population, the environment and development factors interact in different ways in different places. Not only the pace of development, but its content, location and the distribution of its benefits determine, in good measure, the states of the environment. These factors also influence the growth and distribution of population. Environmental resources provide the basis for development just as environmental factors constitute part of the improvement in the quality of life that development is meant to bring about. Similarly, the size of population, the rate of its growth and the pattern of its distribution influence the state of the environment, just as they condition the pace and composition of development.

Population growth need not necessarily lower levels of living, impair the quality of life or cause environmental degradation. Global and historical assessments of the earth's capacity and people's ingenuity to produce goods and services have prompted some experts to project an optimistic outlook.<sup>2</sup> Growth of world population has, in the past, been accompanied by a steady increase in the world's capacity to provide for the necessities and ameni-

\* An excerpt from *The State of the Environment, 1985* (Nairobi, United Nations Environment Programme, 1985).

\*\* Prepared by the United Nations Environment Programme.

ties of human life. People have to be fed, clothed and provided for, and this is achieved by people themselves. In that process, they use and develop the resources of the environment. Yet, just as some patterns of development have improved the human environment, others have tended to degrade it, at times irreversibly.

In a large number of countries, notably in Africa, rapid growth of population over the past decade has been accompanied by a steady decline in average levels of living, as reflected in per capita incomes. It has also been accompanied by a decline in the quality of life, as measured by indicators such as per capita availability of food and nutrition, drinking-water and sanitation. Furthermore, the past decade has witnessed an increase in the number of people with adequate or no access to essential services (such as health care) or amenities (such as shelter) in Africa, Asia and Latin America.

On the other hand, even though over some stretches of the decade rates of economic growth appeared to be satisfactory in some developing countries, they did not necessarily bring about noticeable improvements in the levels of living of the majority of their peoples. Environmental conditions in rural as well as urban areas in many developing countries have deteriorated as their populations have grown. Generally speaking, the quantity and quality of their natural resources, which provide the foundation for sustained development, have steadily declined.<sup>3,4</sup>

Projections of population, development and environmental trends over the next 20-50 years make it clear that, in a number of developing countries, the intended demographic transition to stable populations, with low birth and death rates, may not come about unless co-ordinated measures are taken now, based on a recognition of the interrelationships between people, natural resources, the environment and development.

A fundamental concern shared by population, environment and development policy makers is the responsibility of present generations to provide for the well-being of generations that will follow them. Patterns of development have to be such as to meet this concern. A major goal of policy makers in all three fields is to achieve a better quality of life and rising standards of living, with sustainable use of the natural resource base. Recognition of the potential mutual support between population and environmental policies should facilitate earlier and smoother achievement of the demographic transition to population equilibrium as well as the chosen development goals.

Understanding of the relationship between population and environmental factors has grown since the United Nations World Population Conference (Bucharest, 1974).<sup>5</sup> An examination of the manner in which population and environmental policies have been evolving over the past decade or so reveals certain parallels as well as an emerging consensus on the nature and scope of interrelationships between people, resources, the environment and development, and on the best way of addressing them so as to improve the quality of human life in sustainable ways. Some countries have made definite progress towards their population goals and their environ-

ment and development goals alike. The experience they have gained needs to be extended, as appropriate, to other countries that could learn from it. The present report is guided by such a pragmatic approach.

#### ISSUES FACING POPULATION POLICY MAKERS

##### *Uncertainty in population projections*

Population projections are not predictions. Though they can be useful for the purpose of estimating likely environmental stress or development needs, they may not be borne out by actual events if the assumptions underlying them prove incorrect.<sup>6</sup> For this reason, demographers often make three sets of estimates (high, medium and low) to indicate the range of uncertainty involved. The likelihood of a reasonable correspondence between projected and actual trends depends on the time-scale of the projection, among other things. For example, present projections of population size for the year 2000 are likely to be very close to the mark, because all those who will be aged 15 and above at the time have already been born. Uncertainties in long-term projections also arise because greater awareness of the magnitude of the challenge implied by projected population growth may lead to implementation of demographic policies that would, in fact, render the projections invalid. Moreover, long-range population projections tend to be based on the assumption that fertility trends in all countries will converge upon replacement levels. This is an assumption that finds no support in current fertility trends in several developing countries. On the other hand, the very large future populations expected may not materialize because the resource base might not be adequate to support such large numbers and, consequently, the levels of mortality might be higher than estimated.

##### *Global outlook*

It took more than a million years for the population of the world to reach its first billion, whereas the second billion was added in only 120 years; the third billion in 32 years; and the fourth billion in 15 years.<sup>4</sup> Large additions are being made to already high levels of population over short periods of time: population growth during the past three decades has been larger than the entire world population in 1900.

The International Conference on Population (Mexico City, 1984) took note of the projection that, by the year 2000, the world population would be 6.12 billion (medium estimate); that is, it would increase by about another 1.36 billion from the 4.76 billion of mid 1984, having already increased by 770 million over the previous decade.<sup>7</sup> In fact, although the rate of population growth has been steadily falling over the past few years, the net absolute annual addition to the number of people is expected to increase from the present 78 million to about 90 million by the year 2000. Thereafter, with declining net annual additions, the world population may be 8.2 billion by 2025—according to the medium estimate—and reach a stationary level of 10.5 billion by 2110. The low and high estimates of the stationary popu-



lation level are 8 billion by the year 2080 and 14.2 billion by the year 2130, respectively.<sup>7</sup>

Population growth rates have steadily declined, both globally and in the developing countries as a group.<sup>8</sup> While birth, death and infant mortality rates have fallen consistently, life expectancies have risen in a large number of countries. Some developed countries have already made the demographic transition to population equilibrium, as defined by low birth and death rates and high life expectancies. Many other developed countries, and a few developing countries also, show definite movements towards stationary populations.<sup>7,9</sup>

In very many developing countries, both the rate and the momentum of population growth have been such as to produce continuous absolute increases in population every year. Even if it were possible to reduce fertility to replacement levels, the momentum of the population would be such that it would continue to grow for many years. This is due to the predominance of a young age structure in most developing countries, which means that the number of couples entering their reproductive years will, for a considerable time, remain greater than the number moving out of that age group. Thus the number of births will continue to be large and to exceed the numbers of deaths.

Fertility and birth rates in most developing countries have, in the past, been much higher than the rates in pre-modernization Europe and, although their mortality rates have fallen dramatically and consistently since the 1950s, their population growth rates are still sizeable and operate on a much larger total population than did the rate prevailing in the industrialized countries during the early stages of their modernization.<sup>3,4,9</sup>

### *Regional differences*

In terms of the availability of natural resources and the technology and investment needed, the world has the capacity to provide for the projected global population. In actual fact, however, there is not necessarily any correspondence between the projected population levels by regions, or by countries, and the physical or economic capacity to meet the requirements of those populations. Some consideration of interregional and intraregional differences in population trends is thus essential in order to identify the urgent needs for international co-operation in this field.

In East Asia, South-East Asia, Central America and the Caribbean, there have been marked declines in population growth rates. In Africa, by contrast, there has actually been an increase in the population growth rate over the past decade. Of the 58 countries and territories of Africa, 19 show annual growth rates of 3 per cent or more, which imply that populations will double every 23 years, or even earlier.

Population growth rates have continued to decline in tropical Latin America, apart from a few countries; but the declines have been small. In temperate South America, population growth rates have remained nearly constant—at a moderate level—over the past two decades.

In Asia, growth rates show significant differences from one subregion to another. China, with a quarter of the world's population, has dramatically halved its population growth over the past decade. The Republic of Korea has, likewise, markedly reduced its population growth rate. In South-East Asia and South Asia, the declines have been small. In view of the already large population sizes and decidedly young age structures, the populations of several of these countries are expected to continue to grow substantially. The population densities per unit of arable land, and of urban land, are already very high in most of these countries.

### *Spatial distribution*

Another factor that is relevant to international co-operation in both population and environment matters is the spatial distribution of the population.<sup>10,11</sup> Figure I shows the trends in the spatial distribution of the world's population in urban and rural areas. It is expected that the greatest growth in urban population will occur in the developing countries. If the present trends continue, by the year 2000 the urban population of the developing countries will have grown by 100 per cent. This growth would be the combined result of internal migration and natural increase. A remarkable, quite recent, phenomenon in the developing regions is the emergence of very large cities (4 million or more inhabitants). It is estimated that the proportion of the urban population residing in such cities will rise from 16 per cent in 1980 to 20 per cent in the year 2000. On the other hand, it is expected that the percentage of the urban population residing in intermediate-size cities will continue to decline significantly (see fig. II).

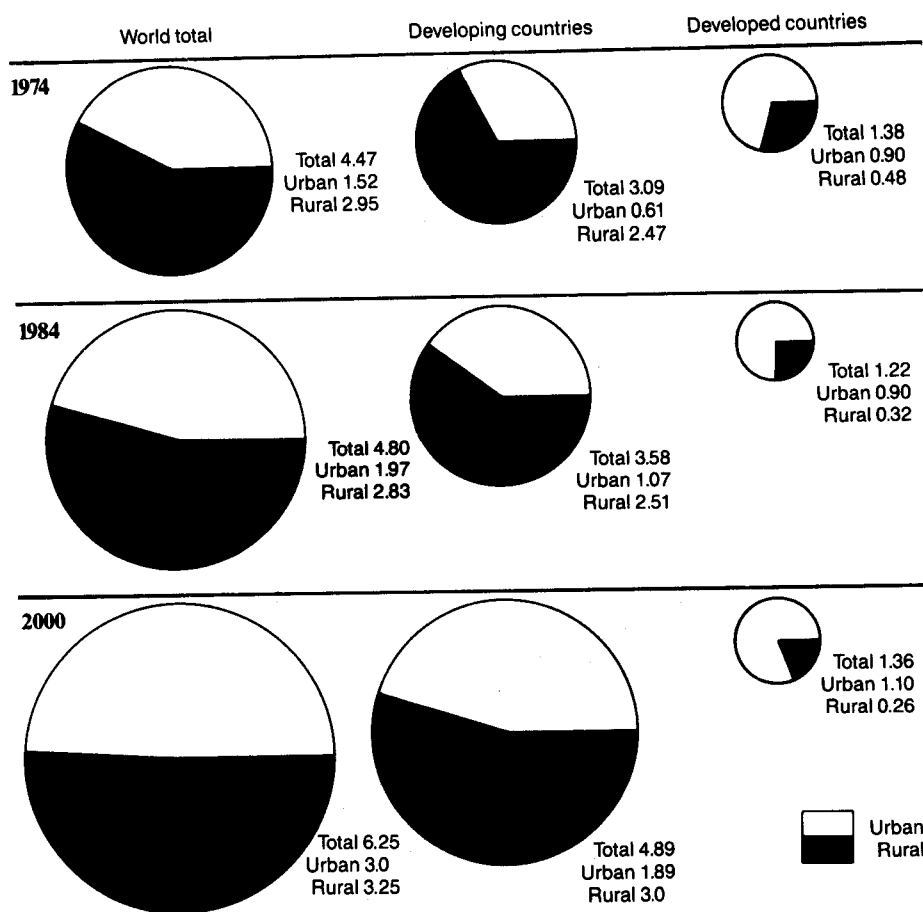
As for the global distribution, 80 per cent of the increase in the world's population during the past 30 years occurred in the developing countries.<sup>4</sup> What is more, 95 per cent of the entire projected growth to 2110—prior to reaching a stationary-level population of 10.5 billion at that date (medium estimate)—is expected to take place in the countries that are currently regarded as developing.<sup>9</sup> It is estimated that about 86 per cent of the world's people will be living in today's developing countries when the global population reaches its stationary level.<sup>7</sup> Several developing countries will double, triple or quadruple their populations over the next 50-60 years. Africa's relative share of the world population is expected to more than double during the same period.<sup>3</sup>

There is sufficient correspondence between the areas of high population density and the areas at serious risk of environmental degradation, particularly in the form of desertification, deforestation and poor access to fuelwood and fresh water (see fig. III). Areas showing signs of stress are the Sahelian countries, the Horn of Africa, East Africa, the Andes, north-western Brazil, El Salvador, Guatemala, Haiti, a large part of south-west Asia and Afghanistan, and parts of South Asia, Java and the Philippines.<sup>12,13</sup>

### *Consumption patterns*

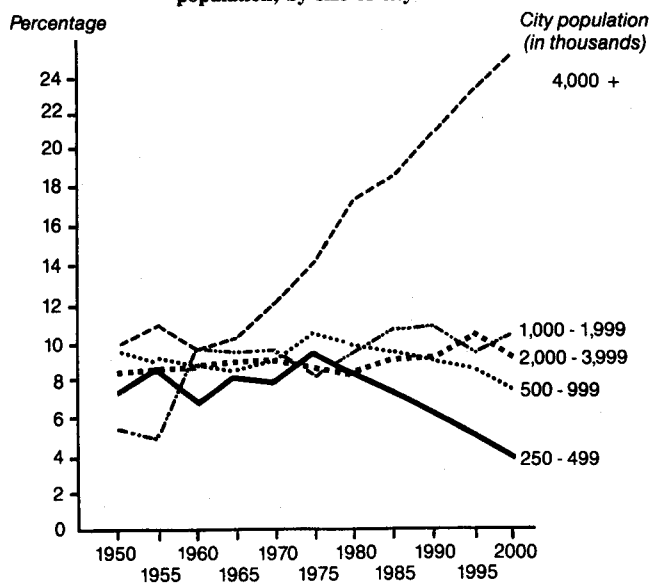
A significant factor which often fails to receive the attention it deserves in relation to population policy is

Figure I. Population distribution in urban and rural areas  
(Billions)



Source: Based on "Global review of human settlements—statistical annex", document presented to Habitat: United Nations Conference on Human Settlements, Vancouver, Canada, 31 May-11 June 1976 (A/CONF.70/A/1/1 Add.1), table 1.

Figure II. Urban population as a percentage of total population, by size of city\*



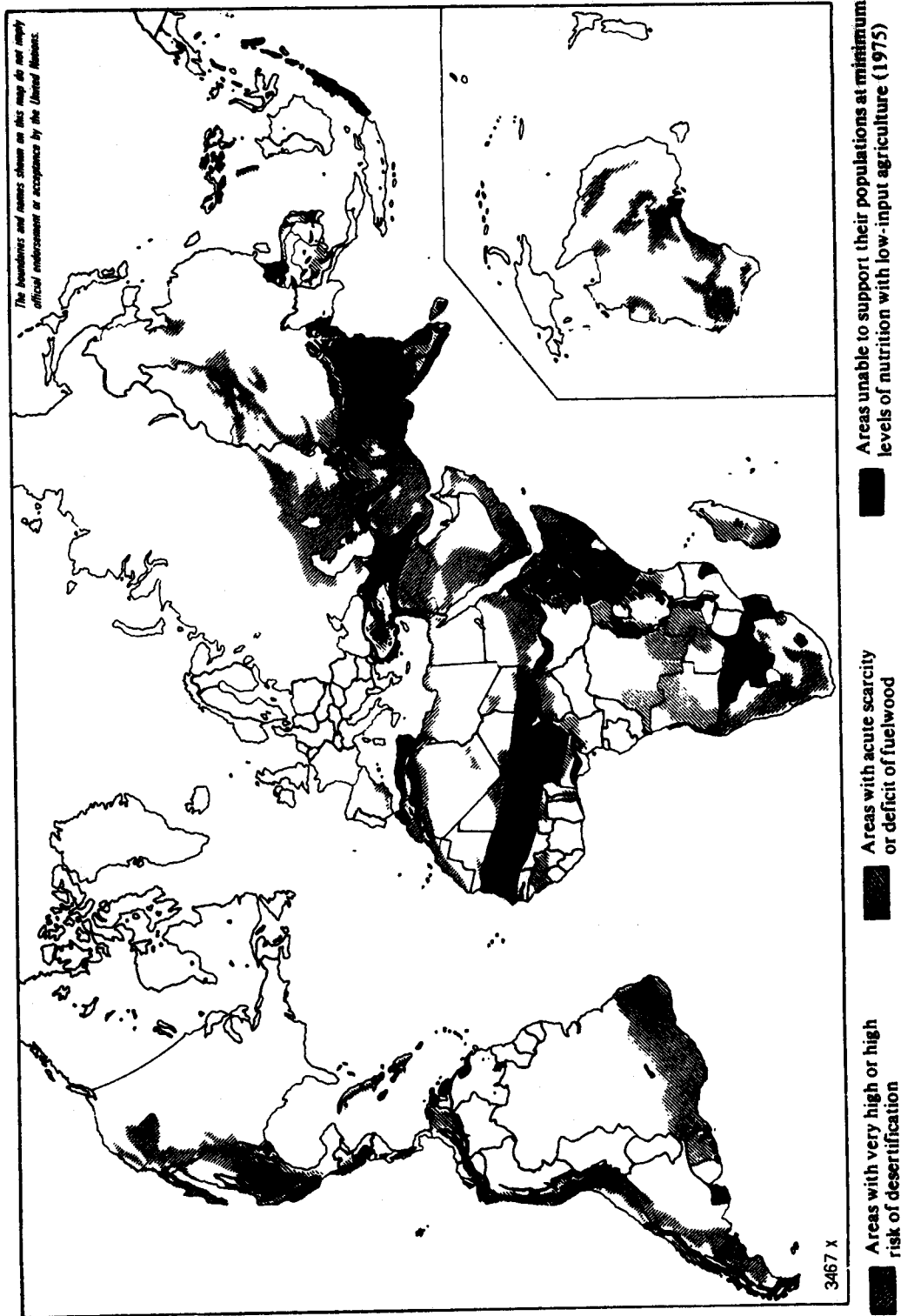
Source: Adapted from W. H. Weiche, "Life expectancy in tropical climates and urbanization", report presented to the Technical Conference on Urban Climatology for Tropical Regions, Mexico City, October 1984.

the extent of environmental stress, including over-use of scarce natural resources, caused by patterns of consumption.<sup>14</sup> Quite apart from the short-sighted exploitation of scarce natural resources as a result of the pressing need for immediate survival in situations of dire poverty, such resources may be wasted—or not used optimally in terms of a society's development objectives—through extravagant consumption by a few people. What is more, local environmental resources may be misused in response to the demands of resource-wasteful consumption patterns in another country. It does not necessarily follow therefore that, just because population sizes are large or population densities high, environmental stress will be intense, since the latter is determined not only by the size and density of the population but also by consumption patterns.

#### Key issues of population policy

Population sizes and the rates of their growth cannot be controlled independently of socio-economic development. Thus, at the Bucharest Conference, governmental positions tended mainly to fall into one or the other of two lines of policy: that family planning had a vital role to play in lowering the rates of population growth so that social and economic development might be accelerated;

Figure III. Environmental hazards



Source: Based on *Land, Food and People* (Rome, FAO, 1984).

and that an acceleration of social and economic development was urgently needed to lower population growth, because income levels and fertility were inversely correlated.<sup>5</sup> Since 1974, population policies have been increasingly adopted in the developing countries, and governmental and international interest in population programmes and family planning practices has become widespread. Greater access to knowledge and means of family planning has also contributed to progress towards the desired population goals, since the very personal decision regarding family size is reached largely on the basis of existing needs and future expectations of well-being in a given socio-economic and cultural context.<sup>15</sup> There is also a growing realization, however, that population policies are not a substitute for social and economic development policies and that socio-economic development has helped to change attitudes towards family size and fertility in many countries. Thus the Mexico City Conference recognized that appropriate population and development policies were mutually supportive.<sup>1,5</sup>

Developing countries are currently encountering serious obstacles to the achievement of the demographic transition. The developed countries achieved the transition to low rates of population growth over long periods of sustained socio-economic development, but most developing countries have not yet experienced any rapid or sustained socio-economic development. Moreover, these countries are, for the most part, already suffering from the environmentally and socially deleterious effects of widespread poverty.

The main reasons why the gap between growing populations and the environmental management capabilities needed to provide for them may be widening in several developing countries include the following:

(a) Major additions to large populations are occurring over short periods of time, making it hard for societies and countries to cope with the needs and demands of their people. Sizeable additional public outlays have to be made every year to provide for essential services and amenities for the extra numbers; and these are costly in terms of forgone opportunities to invest in enhancing the productivity of land and labour;

(b) In many developing countries, innovation, entrepreneurship, technological progress, savings and investment are sluggish. This is in part due to inappropriate domestic policies of economic, social and environmental management. The present world economic situation also renders it increasingly difficult for the developing countries to escape from economic stagnation;

(c) In a large number of developing countries, the benefits of economic growth have not spread as widely as would have been necessary to reduce the extent of absolute poverty. This, in its turn, had an adverse effect on the momentum of economic growth, environmental conditions and the effectiveness of population policies;

(d) As populations have grown, the marked inequalities in land ownership and in access to essential amenities and services on account of social stratification, together with the persistence of widespread poverty, have led large numbers of people to overexploit scarce natural

resources and facilities that are in the public domain. This has tended to undermine the environmental foundations of economic development;

(e) Many developing countries no longer have any good land in reserve which could be used to settle, or provide for, large numbers of extra people. What is more, even where significant untapped natural resources exist, the large amounts of public capital that would need to be invested in order to establish the infrastructure and facilities to use them are often not available;

(f) Today's developing countries, unlike the countries of nineteenth-century Europe, haven't the option of large-scale international emigration;

(g) Patterns of urbanization and area development in most developing countries have been such that any economies of scale in the use of infrastructure and public services have been increasingly overwhelmed by the social costs of congestion, noise, air and water pollution and insanitary conditions of living. The absence, in most countries, of a clear policy to guide spatial distribution of population, including rural-to-rural and rural-to-urban migration, and promote cities of intermediate size, has resulted in settlement patterns of a kind which are not conducive to sustainable development. A large number of small, widely scattered settlements and a small number of highly congested cities are common features in many developing countries;

(h) In view of the high rates of population growth and its momentum, many developing countries are faced with the challenge of urgently introducing, and sustaining, programmes aimed at achieving optimum population growth and distribution. On the other hand, the same facts require them to make urgent provision for the well-being—in terms of nutrition, health, shelter and employment—of much larger populations than those at present existing.

#### *Changing orientation of population policies*

A number of initiatives have been taken to come to grips with the dynamics of interaction between population growth and environmental degradation in the developing countries. National population policies and programmes themselves have constituted a major course of action. At present, 87 countries, representing 90 per cent of the people of the developing countries as a whole, provide publicly subsidized family planning programmes; about \$2 billion (1980 dollars) is spent each year on them. For every \$1 of external assistance, \$2-\$4 are spent by the Governments of the developing countries themselves on population programmes. Access to family planning knowledge and to contraceptives has been steadily growing. However, in many of the developing countries of Africa and western Asia, family planning programmes have not yet become widespread.<sup>9</sup> Moreover, in several of the countries of Asia and Latin America where such programmes have, in fact, become widespread, they have not been effective in bringing about rapid progress towards the desired population goals.

Family planning programmes are becoming increasingly responsive to the needs and preferences of the

potential users, to cultural and religious sensitivities, and to the significance of voluntary acceptance and popular participation. The programmes are extending their scope so as to encompass the spread of literacy and education, including health education and awareness-building among women.<sup>16,17</sup> Improvements in the social status of women and the expansion of paid employment opportunities for them have also begun to receive attention as part of population programmes. Attempts are being made to relate the dissemination of family planning information and services to the work of community development workers, co-operatives, health workers and teachers.<sup>15,18</sup> In many countries, such programmes have also begun to be designed and implemented as part of health and social services programmes.

Action on national development planning and international development co-operation has also been undergoing change, notably since the early 1970s. Special attention is now being given in some countries to the provision of basic health services, water and sanitation, basic education, and expansion of employment and income-generating opportunities in economically depressed areas. International assistance to projects and programmes of rural development and social development, including population programmes, has grown steadily in both absolute and relative terms. Attempts are also increasingly being made to design and monitor developing projects with an eye on their potential impact on productivity and on the income-earning capabilities of the poor and women. These development initiatives are expected to have second-order desired effects on the choice of family sizes and migration patterns and, consequently, on population growth and distribution.

Evidence concerning the direct co-ordination of population and environmental policies and programmes has, however, been rather meagre. Although the interrelationship between environmental change and socio-economic development has been discussed at length since the United Nations Conference on the Human Environment (Stockholm, 1972), and the connection between environmental change and population growth has been a subject of some recent writing,<sup>19,20</sup> there has been no definitive work to date on the practical application of our growing understanding of the interrelationships between people, natural resources, the environment and development.

In 1982-1983, the Population Division, United Nations Secretariat, carried out the fifth of a series of population inquiries, in the form of a questionnaire survey. About 40 per cent of the 109 countries that took part in the survey indicated that there was a need for discussion on how best to integrate population policies into social and economic development policies.<sup>21</sup> A total of 59 countries, of which 45 were developing countries, reported that they had designated a single agency to be responsible for the formulation and co-ordination of population policies, while 81 countries, of which 62 were developing countries, reported that they had some governmental arrangement to take population variables into account in the social and economic planning process. The survey did not, however, identify the ways in which population policies and programmes had been taking account of

environmental and natural resource factors. The Mexico City Conference urged Governments "in countries in which there are imbalances between trends in population growth and resources and environmental requirements. . . , in the context of overall development policies, to adopt and implement specific policies, including population policies, that will contribute to redressing such imbalances and promote improved methods of identifying, extracting, renewing, utilizing and conserving natural resources".<sup>1</sup> The Conference also recommended that "population distribution goals . . . should be pursued to the extent that they help to achieve broader societal goals, such as . . . protecting the environment and improving the quality of life".<sup>1</sup>

In short, while the linkages between population and development policies are increasingly being reflected in policy, efforts have only just begun to be made on integrating population and environment policies. The Third Members' Assembly of the International Planned Parenthood Federation (IPPF) recognized that the integration of population and environmental planning would enhance the effectiveness of family planning efforts. A resolution adopted at the sixteenth General Assembly of the International Union for Conservation of Nature and Natural Resources (IUCN) in November 1984 notes that, in most countries, no serious attempt has yet been made to introduce measures for the joint management of population and natural resources.<sup>22</sup> IPPF is now collaborating with IUCN, the World Wildlife Fund (WWF) and UNEP in preparing a supplement to the World Conservation Strategy which would reflect the linkage between population factors and conservative goals. The Mexico City Conference suggested giving an environmental orientation to population programmes by stressing that in order "to achieve the goals of development, the formulation of national population goals and policies must take into account the need to contribute to an economic development which is environmentally sustainable over the long run and which protects the ecological balance".<sup>1</sup>

#### POPULATION-RELATED ISSUES FACING ENVIRONMENTAL POLICY MAKERS

##### *Carrying capacity*

As populations grow, the task of providing for their needs and well-being through environmental management becomes more challenging. The concept of carrying capacity is relevant, in general terms, to consideration of the relationship of population growth to the natural resource base. It is a concept associated with the work of Malthus, which represents a general perception of the numbers of people that can be supported by the resources of the Earth. The carrying capacity would, of course, differ from area to area, and is determined, in part, by such factors as life-styles and patterns of consumption, the progress of—and access to—science and technology, and economic and social development. One aspect is the carrying capacity of animal and plant populations and their complementarity, or competition, with

the needs of human beings. When an attempt is made to apply the concept more specifically, to particular ecological zones, for example, several difficulties appear. The number of variables or choices involved can be very large, while other factors such as trade and the transfer of technology may significantly alter the estimates.

As population increases, there is a growth in demand for food, water, health, sanitation, housing, energy, transport, education, recreation and the like. What is more, demand also becomes more sophisticated, as expectations of levels of living and quality of life develop and knowledge and information about possible changes in consumption patterns become widespread.

The capacity of the developing countries to produce and distribute food has recently been examined in connection with the growth and distribution of population, in a study entitled "Land resources for populations of the future" conducted by FAO, the United Nations Fund for Population Activities and the International Institute for Applied Systems Analysis.<sup>12,13</sup> There are, of course, limitations to a study based on strong assumptions which are used to simplify reality for the purpose of interrelating ecological, economic and human factors and projecting likely outcomes of their interaction into the future, but the study is a significant one since the resource base of food and agricultural production in many developing countries has been showing signs of depletion and degradation. Moreover, most developing countries have been unable to transform their economies industrially, and are thus unable to import sufficient food in exchange for non-food exports.

The study finds that, in 1975, about 500 million people—or about 48 per cent of the people of the 117 developing countries studied—were excessive to the carrying capacity of the land with low-input agriculture. Even with the use of intermediate-level inputs, the total population of the developing countries that could not be supported at minimum levels of nutrition would rise from 76 million in 1975 to 486 million in 2000.

The study further shows that potentially excessive densities of population in relation to levels of development in certain geographical areas pose serious ecological threats to agriculture. In 1975, about 2,450 million hectares, or 38 per cent of the entire area studied, were supporting more people than could be sustained thereon with low inputs on a long-term basis. More than 1,100 million people were living in such areas.

Although the irrigated area in developing countries could be expanded from 95 million hectares to 148 million hectares by the year 2000, rain-fed cropland could shrink by 544 million. The former has steadily increased, but not as fast as population. There are marked differences between countries in respect of investments in improving and sustaining the productivity of land. Very large increases in population have often occurred in areas where there has been significant land degradation and loss of agricultural productivity. Such trends have been most pronounced in sub-Saharan Africa, where agricultural productivity and per capita food production have declined steadily over the past decade. They correspond closely to the trends in environmental degradation of

cropland and grassland in the region, as manifested in desertification and soil erosion.

Soil erosion now appears to have reached extraordinary proportions; it is estimated that 23 billion tons of soil are lost annually from croplands in excess of new soil formation. If the present trends continue, almost 20 per cent of the rain-fed cropland of developing countries could be reduced to poor pasture, while other areas could become even less productive. In Africa north of the equator, 35 per cent of such land is believed to be affected by wind or water erosion or salinization. In western Asia, the proportion is estimated at 65 per cent.<sup>3</sup> The irretrievable loss or serious degradation of land through desertification continues at the rate of 6 million hectares annually, and the rate at which land is declining to zero or negative net economic productivity has increased from 20 million hectares to 21 million hectares a year. Desertification of rangeland is on the increase: more than 3,000 million hectares are at present affected.

Another indicator of the association of population growth and environmental change is the availability of firewood. There are 1.3 billion people in the developing countries who depend on firewood for fuel. The evidence available indicates that firewood is being cut faster than its rate of replenishment, most notably in Africa and Asia, the result being severe hardship to families.<sup>4,23</sup>

Deforestation in the developing countries has assumed grave proportions which, if not seriously attended to, will greatly undermine the well-being of the countries affected in several ways.<sup>24</sup> High rates of deforestation entail tremendous social costs in terms of floods, soil erosion, landslides, waterlogging, siltation of reservoirs and loss of hydroelectric capacity. Moreover, they can upset the ecological balances (e.g., fresh water and soil moisture availability, changes in microclimate) of entire areas and subregions, thus depriving millions of people of their livelihood. The clearance of forests and nature reserves also eliminates species of plants, insects and animals, thus impairing biological diversity, whose contribution to human well-being, in medicine and agriculture for example, could be far-reaching, but is as yet little understood.<sup>25</sup> The economic and social impact of the loss of genetic reserves is suffered not only locally and nationally but also globally. This is made clear, for example, by the extent of the dependence of the developed countries on the developing countries for natural products such as dyes, resins, pectins, tannins, fats and waxes, and for pyrethrum and other natural pesticides.

The availability of fresh water for irrigation and industrial development has not kept pace with population growth in large areas of the developing regions. In terms of both its direct use and its role in agriculture, water availability is a constraint on the number of people that an ecosystem can support on a self-reliant basis.<sup>26</sup> In some developing countries, wells have been drying up and ground-water aquifers are not being recharged at adequate levels, on account of excessive run-off due to loss of vegetation and excessive withdrawal of limited supplies as a result of high demand. What is more, the availability of surface water has become distinctly irregu-



lar in some developing countries—with droughts and floods alternating—in the absence of direct action for the environmental management of soil, water and forests, and as a result of rapidly growing populations and a built-up of demand pressures.

Notwithstanding increased governmental attention to the broadly based provision of drinking-water and sanitation in the developing countries over the past few years, the target of the International Drinking Water Supply and Sanitation Decade—that clean water and sanitation should be provided for all by the year 2000—is unlikely to be attained, unless there are substantial changes in the attitudes of Governments, both nationally and globally, specifically aimed at its achievement.

#### *Increases in the number of "absolute poor"*

One consequence of the environmental impact associated with underdevelopment and rapid population growth is a reduction in the productivity and income-generating capacity of people in general and an increase in the number of "absolute poor". There are hundreds of millions of people today who are unable to live in dignity as human beings because they cannot acquire the necessary food, housing, health, sanitation and education. Their numbers have grown since the adoption of the World Population Plan of Action in 1974.<sup>27</sup> There were probably 750 million such people in the developing countries in 1980 and, even assuming rapid economic growth, there are likely still to be 630 million by the year 2000. If economic growth remains sluggish, the number of the absolute poor could rise to 850 million.<sup>3</sup>

#### *Increased inequality of access to productive resources*

Another consequence of rapid population growth leading to intense competition for environmental resources is the marginalization of small-scale farmers and landless labourers. Capital-intensive and technology-intensive forms of agriculture have tended to replace traditional patterns in some countries on account of their immediate effects on the productivity of the land. A few landlords with access to these inputs have tended to extend their land ownership in the process. Increased concentration of land ownership and the displacement of labour from the land have further accentuated the pressures of people on the natural resources in the public domain—e.g., woodlots, forests, mountain slopes and hillsides. The struggle for survival by the landless peasant and marginalized small farmers has also intensified social unrest and migration.

#### *Creation of environmental refugees*

Large-scale migrations of people in search of better economic opportunities from rural areas to the urban centres have made it practically impossible for the civic authorities to ensure adequate supplies of fresh water, sanitation and waste disposal facilities for the rapidly growing urban populations in many developing countries.<sup>28</sup> Serious environmental degradation and depletion of natural resources have also tended to create a group of people that is uprooted from its traditional habitat because it is no longer able to earn even a minimally

decent living there. Such situations can be a source of serious social and political conflict between the regions within a country, and also between countries.

#### *Increase in environmental diseases*

Major diseases and causes of death in the developing countries are mainly related to the inadequacy of clean water and environmental sanitation. Rapid population growth aggravates the pressures on limited public outlays for the improvement of environmental sanitation in rural and urban areas. The crowding of settlements exacerbates already unhygienic conditions, especially in the absence at the local level of organized programmes to improve the situation. Trachoma, elephantiasis, schistosomiasis, malaria, diarrhoea and river blindness are typical diseases. To these may be added typhoid, cholera, dysentery, gastro-enteritis and hepatitis, which are spread by contaminated water or dirty hands, as well as scabies, yaws, leprosy and conjunctivitis, diseases which are aggravated by insufficient water for washing purposes.

The conditions described above hamper efforts at economic development which might improve the productivity of land and of people, and reduce absolute poverty in sustainable ways. This is partly due to the fact that some public resources which could have been deployed to enhance the availability of natural resources and to purchase capital equipment are diverted to welfare measures to deal directly with the immediate effects of acute poverty. A vicious circle starts because, unless development results in an expansion of output, employment, incomes and productivity, the extent of "absolute poverty" cannot be reduced in a sustained manner, while the persistence of mass poverty places severe pressures on environmental resources, public amenities and services and infrastructure. There is thus a race between development and the destruction of resources for development, with an ever-increasing risk of irreversible damage to the resource base, as the number of the absolute poor grows in tandem with the rapid population growth.

To sum up the situation, in many developing countries today rapid population growth, mass poverty, environmental degradation, natural resource depletion and slow economic growth seem to be interacting with one another in ways that are harmful to both the immediate and the long-term well-being of the people.<sup>20</sup> Although most of the immediate costs of environmental degradation are borne by the weaker sections of society in particular, in due course they are also transmitted, in various forms (e.g., slow economic growth and social strife) to the other sections. Moreover, these costs do not remain confined to the countries or regions in which they originate but tend to be transmitted, directly or indirectly, to other countries. Conflicts relating to management of fresh-water resources, mountain ecosystems, tropical forests and coastal waters tend to have their origins in the nature and scope of the interaction between people and the environment arising from the search for a better life.<sup>29,30</sup>

The *World Environment 1972-1982*, prepared by UNEP to commemorate the tenth anniversary of the

Stockholm Conference, found that environmental concerns in general, and population and environment relationships in particular, had not been satisfactorily dealt with by development models.<sup>31</sup> The United Nations review and appraisal of the World Population Plan of Action<sup>7</sup> found that experience with integrating population factors into comprehensive econometric models of development was rather disappointing. Consequently, the Mexico City Conference declared that "priority should be given to action programmes integrating all essential population and development factors, taking fully into account the need for rational utilization of natural resources and protection of the physical environment and preventing its further deterioration".<sup>1</sup> Similarly, the General Assembly of IUCN decided at its sixteenth session (November 1984) that IUCN should actively promote policies designed to attain a balance between population and resources within national conservation strategies and, through field activities, to preserve nature and natural resources.<sup>22</sup> The environmental policy statement of the United States Agency for International Development reflects a similar recognition of the interdependence between population, environment and development factors.<sup>32</sup> The success of regional development planning in several centrally planned economies also reflects a recognition of the linkages between population, environment and development factors.<sup>33</sup>

#### THE INTERFACE BETWEEN POPULATION AND ENVIRONMENT POLICIES

##### *Lessons learnt*

The experience gained by a number of developed market economies, developed centrally planned economies and developing countries in dealing with the issues of the environment, population and development suggests some significant lessons. When looking to the further action that is needed, policy makers should first ascertain the suitability of the various standard approaches to their countries' specific resources, people, culture and social organization, in the light of the insights offered by the experience gained to date.

In the first place, population and the environment interact in terms of population size. The latter encompasses both natural growth and migratory movements, which often lead to uneven population distribution, including congestion. The need thus arises to manage population size and growth by means of family planning and other measures going beyond family planning, aimed at lowering fertility levels. There is also the need to manage and direct migratory movements with due regard for such environmental factors as natural resource availability, carrying capacities and person/land ratios. These policies have to take into account development needs, including priorities for resource allocation, land use allocation and the geographical spread of development projects.

Population and the environment also interact in terms of the behaviour of people and their endeavours to meet their needs. Production and consumption patterns have

an impact on the environment. They are influenced by social and cultural factors and by the prevailing levels of economic well-being or poverty. Also relevant are the processes, directions and rates of industrialization.

Furthermore, population factors also influence the environment in terms of the capabilities of the people. The physical qualities of strength, resilience and endurance, together with knowledge and skills, help to determine the levels of productivity and the ability to sustain the environment. Social and participatory awareness and responsibility can lead to practices of resource management and thus an increase in productivity through community-level action to bring about sustained improvements in the quality of life. Programmes designed and implemented at the community level may contain elements of family planning, conservation of natural resources and environmental improvement as well as measures addressed to social and economic reform—e.g., women's education.

##### *Strategic issues*

There are some strategic issues and factors which can exercise leverage for the more effective achievement of both environmental and population objectives. The aim of both population and environmental policies is to bring about lasting improvements in the quality of people's lives. In order to enhance their own effectiveness, both population and environmental policies have evolved in ways designed to relate better to the larger issues of social and economic development. In this evolutionary process, a certain interface between the two policies has emerged.<sup>34</sup>

Measures for improving the status of women, supplying drinking-water and sanitation, generating employment and providing basic education and health care, together with programmes designed to improve the productivity and quality of natural resources, can exert leverage in a system of dynamic interaction. Hence, measures to improve the effectiveness of population, environment and development policies need to take into account factors such as the following:

(a) The effects of basic education and literacy campaigns on opening up avenues of productive employment, on changes in total fertility rates, and on resource use practices;

(b) The effects of more equitable land ownership, and direct measures to improve the access of disadvantaged groups to essential services, on the conservation and productivity of natural resources, on improvement of environmental conditions on population capabilities, distribution and growth;

(c) The effects on natural resource use practices and the quality of life in rural and urban areas of government-sponsored incentives and disincentives relating to family size, settlement and territorial development patterns, and migratory movements;

(d) The effects on per capita incomes, efficiency in resource use (e.g., fuelwood), fertility rates and environmental conditions, including natural resource availability, of raising the status of women through increased oppor-

tunities for their paid employment, better education and legislative enactment of their rights;

(e) The effects on labour productivity, incomes, infant mortality, life expectancy, family size and the quality of the environment on improved provision of drinking-water and sanitation facilities;

(f) The effects of waste-land development and the relocation of settlements from densely populated fragile ecosystems to sparsely populated and underdeveloped areas on employment, incomes, levels of living and the spatial distribution of population densities.

In view of the large projected absolute increase in populations over the next 20-40 years and the simultaneous deterioration in natural resource availability and environmental conditions that is expected in many developing countries, there is an urgent need for making population and environmental policies more effective. Widespread conditions of drought and famine in large areas of Africa and the unprecedented starvation, migration in search of food, suffering and deaths that they have brought in their wake, constitute a harsh reminder of the urgency of co-ordinated action, at various levels, on the fronts of population, natural resources, the environment and development.

#### RECOMMENDATIONS FOR ACTION

##### *Action at the national level*

##### *Action in the short term*

Public works programmes which will generate employment and, simultaneously, enhance the availability and productivity of natural resources need to be designed and implemented in rural areas experiencing acute environmental stress and population pressures. The potential of food-for-work programmes needs to be fully realized in this undertaking. Such initiatives may include the reclamation of cropland and grassland; the plantation of wood-lots and forests; building canals, wells, dikes, reservoirs and water catchments; and terracing, bunding, levelling and draining land.

Efforts by governmental and voluntary organizations aimed at awareness-building and the popularization of family planning need to be reinforced, at the community level, by information on the nature and prospect of environmental degradation, its relationship to population pressures, its likely impact on people's lives, and how local action can improve the situation. Such an extension of population programmes will help place them more firmly, in the minds of the people, in a perspective of sustained, environmentally sound development.

Priority attention needs to be given to establishing programmes of basic education for women, especially in areas that are undergoing acute environmental stress. Women must develop a full awareness of the choices available to them as regards family size and life-style in their own environment. Legislative support needs to be provided, as appropriate, to facilitate the observance of women's rights. Improvement in the social status of women can play a pivotal role in accelerating the pro-

gress of societies towards their desired population, environment and development goals.

##### *Action in the medium and long term*

Developing countries need to identify critical areas which are experiencing or are likely to experience acute population pressures on environmental resources, in both rural and urban contexts. Specific development plans should be prepared and implemented for such areas, priority attention being given to the elements of population distribution and natural increase, capital investment to restore natural resources and develop infrastructure, and community-level involvement to improve health, sanitation and other environmental conditions.

Monitoring and forecasting of changes in the status of key natural resources—e.g., cropland, grassland, woodland, forests, ground water and surface fresh water—need to be undertaken with particular reference to the critical areas. In addition, economic and social appraisals of the anticipated changes in key natural resources must be fed back into national and subnational development plans, especially with regard to the allocation of public investment capital and expenditure among sectors and among geographical areas.

Physical planning (*aménagement du territoire*), with a view to bringing about a balanced, and broadly based, distribution of the benefits of development, should be given priority attention. Correspondingly, incentive systems for the appropriate location or relocation of industries, resettlement from fragile and vulnerable ecosystems, the development of intermediate-sized towns and the environmental management of desired modifications to relatively undisturbed ecosystems should, where warranted, be given close and careful attention.

Countries experiencing severe environmental stress connected with population growth and distribution need to re-examine carefully their commercial, technological, pricing and taxation policies, with particular reference to their bearing on sustained agricultural development. Factors such as the replacement of cash crops for export by food crops for subsistence, the use of efficient input mixes in agriculture (e.g., optimum use of the biological fixation of nitrogen for fertilizing purposes, employment-generating methods of tilling, sowing and harvesting rather than the use of big machines) and agricultural prices designed to ensure a reasonable return to the small farmer rather than provide unwarranted subsidies prompted by an uncritical urban bias, should be looked at again in the light of the impact that past policies has had on the patterns of population distribution, the use of natural resources and environmental stress.

Tenurial reforms to improve the access of the poor to land must be legislated, where needed, and implemented with a clear intent of sustaining the quality and availability of key natural resources for the well-being of populations at the projected levels.

Research and development, industrial licensing, product pricing, import taxation, economic and technical co-operation and economic incentive systems for producers and consumers need to be so designed, co-ordinated and monitored that high levels of efficiency in the use of

scarce natural resources can be attained. They should actively encourage consumption and production patterns that would, for example, promote recycling, multiple uses, minimum recourse to non-renewable resources, and high efficiency in energy use.

Efforts need to be intensified in all developing countries, at both governmental and community levels, to effect sustained improvements in both drinking-water supply and sanitation facilities, especially in markedly deficient areas.

Private enterprise, and industry in particular, may identify practical ways of strongly supplementing, and complementing, governmental efforts aimed at realizing the full potential of the inherent supportive relationship between population and environmental programmes.

#### *Action at the international level*

Bilateral and multilateral development assistance agencies need to take into consideration the implications of their programmes for natural resource regeneration, environmental improvement and population growth and distribution, prior to determining their composition and location. Especially in areas experiencing environmental stress and population pressures, such programmes should provide for built-in mutual support between the elements of population, natural resources, the environment and development.

International economic and monetary problems, which have aggravated recessionary conditions in many countries, need to be addressed urgently in a spirit of global interdependence. This will facilitate achievement of the demographic transition, especially in geographical areas that are experiencing extraordinary population pressures and environmental stress. Sustained development of these areas will, in turn, further accelerate world economic development.

International agencies which provide support to population activities in developing countries need to give priority attention to those geographical areas which are likely to suffer acute environmental stress in the next 20-30 years. In addition, they should promote awareness of the linkages between population and environment factors and the need to design and execute population programmes which would respond effectively to such linkages.

International support to programmes aimed at arresting environmental degradation (e.g., desertification control) needs to be urgently intensified, with special emphasis on areas which are experiencing or are likely to experience acute population pressures. The success of environment programmes in these areas would help ensure the success of the corresponding population programmes.

#### NOTES

<sup>1</sup> See *Report of the International Conference on Population, 1984, Mexico City, 6-14 August 1984* (United Nations publication, Sales No. E.84.XIII.8 and Corr.1 and 3).

<sup>2</sup> Julian L. Simon, *The Ultimate Resource* (Princeton, Princeton University Press, 1981).

<sup>3</sup> World Bank, *World Development Report, 1984* (Washington, D.C., 1984).

<sup>4</sup> Robert S. McNamara, *The Population Problem: Time Bomb or Myth* (Washington, D.C., 1984).

<sup>5</sup> See *Report of the United Nations World Population Conference, Bucharest, 19-30 August 1974* (United Nations publication, Sales No. E.75.XIII.3).

<sup>6</sup> Mark Perlman, "The role of population projections for the year 2000", *The Resourceful Earth*, J. L. Simon and H. Kahn, eds. (Oxford, Blackwell, 1984).

<sup>7</sup> "Review and appraisal of the World Population Plan of Action: report of the Secretary-General" (E/CONF.76/4 and Corr.1).

<sup>8</sup> "Population: the Mexico Conference and the future", statement by Rafael M. Salas, Secretary-General of the International Conference on Population, Mexico City, 6 August 1984 (document UNFPA/ICP/84/E/2500).

<sup>9</sup> *A Concise Report on the World Population Situation in 1983: Conditions, Trends, Prospects and Policies*. Population Series, No. 85 (United Nations publication, Sales No. E.83.XIII.6).

<sup>10</sup> Statement by Dr. Arcot Ramachandran, Executive Director of the United Nations Centre for Human Settlements (Habitat), to the International Conference on Population, Mexico City, 6-13 August 1984.

<sup>11</sup> "Population distribution and migration: The impact on national and international development plans" (DESI.E.103).

<sup>12</sup> Food and Agriculture Organization of the United Nations, *Land, Food and People* (Rome, 1984).

<sup>13</sup> G. M. Higgins and others, *Potential Population Supporting Capacities of Lands in the Developing World*, technical report of a project on "Land resources for populations of the future" (Rome, FAO, 1982).

<sup>14</sup> P. J. Stewart, "An alternative to overloaded resources", *Ceres*, No. 98 (vol. 17, No. 2) (March-April 1984).

<sup>15</sup> Remarks by Bradford Morse, Administrator, United Nations Development Programme, to the International Conference on Population, 1984.

<sup>16</sup> Statement by James P. Grant, Executive Director, UNICEF, at the International Conference on Population, 1984.

<sup>17</sup> Angèle Petros-Barvazian, "Family planning: A preventive health measure", *World Health* (June 1984).

<sup>18</sup> Svend Brøgger, "Health, population and development", *World Health* (June 1984).

<sup>19</sup> Paul Harrison and John Rowley, *Human Numbers and Human Needs* (London, International Planned Parenthood Federation, 1984).

<sup>20</sup> Robert Repetto and Thomas Holmes, "The role of population in resource depletion in developing countries", *Population and Development Review*, vol. 9, No. 4 (December 1983).

<sup>21</sup> "The fifth enquiry: a summary", *Populi*, vol. 11, No. 2 (1984).

<sup>22</sup> Resolution 16 of 12 November 1984, entitled "Population and the World Conservation Strategy", adopted by the IUCN General Assembly at its sixteenth session.

<sup>23</sup> Phil O'Keefe and Lars Kristoferson, "The uncertain energy path—energy and the third world development", *Ambio*, vol. XIII, No. 3 (1984).

<sup>24</sup> Jean-Paul Lanly, *Tropical Forest Resources*, Forestry Paper No. 30 (Rome, FAO, 1982).

<sup>25</sup> Norman Myers, "Genetic resources in jeopardy", *Ambio*, vol. XIII, No. 3 (1984).

<sup>26</sup> Malin Falkenmark, "New ecological approach to the water cycle: ticket to the future", *Ambio*, vol. XIII, No. 3 (1984).

<sup>27</sup> See *Report of the United Nations World Population Conference, Bucharest, 19-30 August 1974* (United Nations publication, Sales No. X.75.XIII.3), chap. I.

<sup>28</sup> Dennis J. Mahar, "Population distribution within LDCs", *Finance and Development*, vol. 21, No. 3 (September 1984).

<sup>29</sup> *Population, Resources, Environment and Development: Proceedings of the Expert Group on Population, Resources, Environment and Development, Geneva, 25-29 April 1983*. Population Studies, No. 90 (United Nations publication, Sales No. E.84.XIII.12).

<sup>30</sup> Nazli Choucri, *Population and Conflict: New Dimensions of Population Dynamics*. Policy Development Studies, No. 8 (New York, United Nations Fund for Population Activities, 1983).

<sup>31</sup> Martin W. Holdgate, Mohammed Kassas and Gilbert F. White, eds., *The World Environment 1972-1982*. Natural Resources and the Environment series, vol. 8 (Dublin, Tycooly International, 1982).

<sup>32</sup> United States Agency for International Development, *AID Environmental Strategy* (Washington, D.C., 1983).

<sup>33</sup> Vinyu Vichit Vadakan and A. I. Rogov, eds., *Environment (Resources) Management and Development* (Bangkok, United Nations

Asian and Pacific Development Institute and USSR State Planning Committee (GOSPLAN) (1980).

<sup>34</sup> Address of Mostafa K. Tolba, Executive Director of UNEP, to the International Conference on Population, 1984.

# DETERMINANTS OF EXCESS FEMALE MORTALITY

*Eduardo E. Arriaga and Peter O. Way\**

## SUMMARY

Typically, males have higher levels of mortality than do females in a given society. However, several countries, most notably in South Asia, have the reverse mortality pattern: that is, the expectation of life for females is lower than that for males. This paper examines data for Sri Lanka, for which data on the causes of death, by age, are available.

Sri Lanka is an interesting case study in the analysis of the transition of patterns of differential mortality, by sex. As recently as the 1950s and presumably for some years before that time, males in Sri Lanka had an expectation of life at birth higher than that for females. By the mid 1960s, that differential had virtually disappeared, although it persisted among some population subgroups. Sri Lankan data for the 1970s and 1980s show females making continued gains in life expectancy relative to males: by the mid 1970s Sri Lankan females had an advantage in life expectancy at birth similar to that found in the majority of countries around the world.

Obviously, it would be of interest to trace the changes in levels and differentials in mortality, by sex, across the approximately 20-year period of the transition from excess female mortality to patterns of differential mortality by sex that are closer to the international norm. Of greatest utility would be data by cause of death, by age and sex, for several points in that period. Problems of data availability, however, limit the analysis by cause of death in this paper to the early 1960s, when, at the national level, life expectancies for males and females were nearly the same. Since the data are available for estate and non-estate areas, valuable comparisons can be made between areas which had and did not have higher female mortality.

Differentials by sex for the major causes of death are presented for estate and non-estate areas. Causes of large excesses of female mortality in estate areas include infectious diseases, anemias, diseases of the digestive system and kidney diseases. Virtually no differential between areas was found for accidents or causes specific to the newborn.

A variety of characteristics and cultural factors may have produced higher mortality in females than in males. Nevertheless, the analysis of the data on deaths in estate and non-estate areas, by cause, for the 1962-1964 period suggests that nutritional deficiencies are the main causes of the differentially higher mortality of females relative to males in estate areas than in non-estate areas. Causes of death related to child-bearing do not appear to contribute significantly to the higher female mortality.

## INTRODUCTION

In the majority of countries around the world, females hold an advantage over males in terms of their average length of life. Recent estimates indicate that females in Europe and North America have an expectation of life from 2 to 8 years greater than males, with an average difference of 6 years. Similar patterns have been observed in Latin America and in most of the Asian countries. And, although the data are more sparse, evidence from the African continent suggests that African populations generally exhibit the same tendency towards

longer life for females (see, for example, estimates in United States Bureau of the Census, 1983).

However, a number of mortality estimates spanning a considerable number of years suggest that in several of the countries of South Asia—namely Bangladesh, India, Nepal, Pakistan, and Sri Lanka—and in some of the countries of the Middle East, males have historically had and may continue to have an average expectation of life longer than that of females (see, for example, El-Badry, 1969; anonymous, 1970). Such a situation could plausibly be attributed to one of several factors:

- (a) Genetic differences;
- (b) Environmental factors;
- (c) Cultural factors;

\* United States Bureau of the Census.

(d) Deficiencies in the data, due to reporting patterns or errors.

In an attempt to identify the actual factors, this paper will examine the data on levels and causes of death, by sex, and for one country—Sri Lanka—in which the pattern of excess female mortality has been noted.<sup>1</sup>

Mortality data for Sri Lanka are more complete than those available for other South Asian countries. Vital events have been registered nationally since early in the century, and the level and quality of registration are considered good. Of course, any analysis of mortality differentials should include a study of causes of death, but accurate data on those causes, by age and sex, are more difficult to obtain. However, such data does exist for Sri Lanka, at least for some years.

#### HISTORICAL PATTERNS OF LIFE EXPECTANCY IN SRI LANKA

According to recent official life tables, Sri Lanka now exhibits, at least on the national level, a pattern of sex differentials in mortality which can be characterized as normal or expected: that is, a higher expectation of life at birth for females than for males. Historical data for Sri Lanka, however, suggest that this has not always been the case. As recently as 1963, there was virtually no sex differential in life expectancy, and only a decade before, males in Sri Lanka could expect to live at least one year longer on average than females (see table 1).

Although Sri Lanka has an acceptable vital registration system, the publication of the collected information has not always been consistent. For a detailed analysis of the reasons for females having higher mortality than males in the past, it is necessary to have information on cause of death. The information exists for Sri Lanka by sex, but unfortunately is not published by age except for the 1962-1964 period. Therefore, the analysis in this paper must be limited to the early 1960s, when virtually no sex mortality differential in life expectancy at birth existed for the whole country. Although the country did not present mortality differentials by sex at the time that detailed information on cause of death by age and sex existed, the available data for urban and rural areas, for the estate areas, and for some large cities were evaluated as possible information to be used in this study.

If the change from higher to lower female mortality relative to male mortality in Sri Lanka was related to a modernization process which could be observed by a change in cultural behavior, then a comparison of urban (more modern) and rural (more traditional) areas could

shed some light on whether female mortality in rural areas would remain higher than male. Unfortunately, an analysis of the 1962-1964 data shows that the urban/rural mortality data contain some degree of error. Rural mortality rates are extremely low, while urban rates are rather high. This seems suspicious, and it could be owing to possible classification of deaths according to place of registration (or occurrence) rather than by regular residence.

Another way of analysing mortality rates is to compare mortality for estate and non-estate areas. Estates are large plantations located in rural areas, with resident workers. From the early 1930s to the early 1940s, the population in those areas seems to have had the same mortality as the country as a whole (or even lower), because the estate medical facilities were generally better than those in the rest of the country (Meegama, 1967 and 1969). However, after the Second World War, while mortality on the national level declined sharply as a result of a number of factors (Meegama, 1981; Gray, 1974), on the estates it did not improve significantly.

Since the estates are relatively self-contained, it seems likely that deaths occurring in those areas are also registered there. Unfortunately, the necessary base population for calculating mortality rates, by age, are not given in the 1963 census (or any other source of available data); only totals are provided. Nevertheless, the age composition of the population living in the estates must have been nearly the same as the age composition of Indian Tamils in Sri Lanka at that time, since a high proportion of the estate population consisted of that ethnic group (82 per cent in 1963). In addition, among all Indian Tamils in Sri Lanka, 83 per cent lived in estate areas. Hence, the age composition of the estates will be assumed to be the same as that reported for the Indian Tamils in the 1963 Sri Lanka census for calculating mortality rates, by age.

#### LEVELS OF MORTALITY IN SRI LANKA, 1962-1964

Data on deaths by age and sex for the years 1962-1964 were used, in conjunction with population data, by age and sex, from the 1963 census to derive life tables for Sri Lanka. Life tables for males and females show, as stated above, a near parity between the sexes in the level of life expectancy at birth. Around 1963, females in Sri Lanka could expect to live only about 0.4 years longer than males (see table 1).

Life tables were then calculated for the estate areas using the reported estate deaths in the 1962-1964 period, together with the population age distribution assumed for the estates; as explained above. Those life tables indicate that, while in non-estate areas of Sri Lanka females had a slight advantage in life expectancy at birth over males (0.8 years), in the estates women had a nearly 3-year advantage (table 2).

In the rest of the country, female life expectancy at birth exceeded that of males by almost 1 year, indicating that outside of the estates females had made considerable progress over the situation of a decade earlier, when males could expect to live about 1.3 years longer. The difference in life expectancy at birth in 1962-1964

TABLE 1. HISTORICAL TRENDS IN LIFE EXPECTANCY AT BIRTH BY SEX, SRI LANKA: 1920-1922 TO 1970-1972

Year or period	Male	Female
1920-1922 .....	32.7	30.7
1945-1947 .....	46.8	44.7
1953 .....	58.8	57.5
1962-1964 .....	63.3	63.7
1970-1972 .....	62.9	65.8

Source: Report of the Registrar-General of Ceylon on Vital Statistics (Colombo, various years).



between estate and non-estate areas is 9.4 years for females, while that for males is only 5.8 years. Thus, although both sexes in the estate area had a mortality disadvantage, the relative position of females was worse than that of males.

TABLE 2. LIFE EXPECTANCY IN ESTATE AND NON-ESTATE AREAS. BY SEX, 1962-1964

Area	Male Female	
	Estate.....	58.5
Non-estate .....	64.3	65.1

Source: Population data and registered data on deaths as reported in Sri Lanka Department of Census and Statistics, 1967; *Census of Population, Ceylon, 1963*, vol. I, General Characteristics, Colombo; and *Report of the Registrar-General of Ceylon on Vital Statistics, 1962-1964*.

#### LIFE TABLES FOR 1973 AND 1974

Mortality rates, by broad age group and sex, for the estate areas for the years 1973 and 1974 (Meegama, 1981), may help to shed some light on the causes of the excess mortality there for females. From such rates, life tables by sex can be constructed and life expectancies at birth obtained. Although 1973 could be considered a normal year, the year 1974 was a period of famine, which would have a large impact on the estate areas. Life expectancies at birth, in years, calculated from those rates pertaining to the estates are shown below:

	1973 (Normal)	1974 (Famine)
Males.....	57.0	47.5
Females.....	55.5	48.1

In the normal year of 1973, as we also have seen for the 1962-1964 period, females had a lower life expectancy relative to males of 1.5 years. During the famine that occurred the following year (1974), however, the expected pattern was reversed. From the normal to the famine year, the male expectation of life increased by 9.5 years, while the female expectation declined by only 7.4 years. Unfortunately, we do not have data on deaths by cause for those two years with which to attempt an explanation of the change. Consequently, interpretations of the figures are rather speculative. A comparison of the 1973 and 1974 data would suggest that during the famine year, the factors producing higher female than male mortality in the estate areas of Sri Lanka were not operative, since the female advantage in life expectancy at birth emerged.

Since it is almost impossible to accept the notion that environmental conditions in the estate areas could change so much from one year to the next that they would reverse the mortality sex differential, and since the biological and genetic constitution of the sexes cannot change so rapidly, it may be concluded that famine affected males in the estates more strongly than it did females. This fact may suggest a hypothesis: nutritional differences by sex may have played an important role in producing higher female than male mortality in the past

in Sri Lanka. The larger relative increase of male mortality from the "normal" year (1973) to the famine year (1974) could suggest that under adverse nutritional circumstances, more females than males survive. This would imply that during a "normal" period, the nutrition of females might be worse than that of males and, hence, the mortality of females be higher than that of males. The assumption, of course, is that during the famine year, both sexes suffer malnutrition more equally. Famine has to affect the nutritional level of the population, and to assume that nutrition deteriorated more for males than for females during a famine does not seem as sound as to assume that both sexes underwent similar levels of deprivation, particularly since by that time, in the rest of the country, females already had a higher expectation of life at birth than males. In order to test the hypothesis that nutrition plays an important role in excess female mortality, data on cause of death were examined. The analysis focused on those causes of death directly or indirectly related to nutrition, in order to establish whether or not female mortality due to those causes is substantially higher than male mortality.

#### CAUSES OF DEATH

The ideal analysis would compare the trends of mortality sex differentials by cause of death from the early 1940s to the 1970s. The limitation of data to the 1962-1964 period restricts the analysis because, for the whole country, most of the age groups from 1 to 70 years still had higher female mortality. Nevertheless, although females had higher mortality than males in the estate areas, they had lower mortality in the remainder of the country. Therefore, a comparative analysis of causes of death in the estate and non-estate areas would reveal whether or not nutrition could be an important factor in producing excess female mortality.

The available data on deaths in 1962-1964, by cause, age, and sex, for estate and non-estate areas, contain information on 67 separate causes of death, including a residual category. The data were combined into 11 specific categories plus a residual. The classification of causes into major groups has the advantage of minimizing the effects of possible misclassification of deaths by a single cause. The categories used are broad enough so that only the most gross classification error would result in a transfer from one category to another. The groups are as follows:

- I Infectious diseases
- II Diseases of the digestive system
- III Anemias
- IV Pneumonia, bronchitis, and influenza
- V Deaths related to pregnancy
- VI Kidney diseases
- VII Neoplasms
- VIII Diseases of the circulatory system
- IX Diseases specific to the newborn
- X Senility and ill-defined or unknown causes
- XI Accidents
- XII Other specified causes (residual)

(For a more detailed list of causes, see figs. I and II and tables 3-6.)

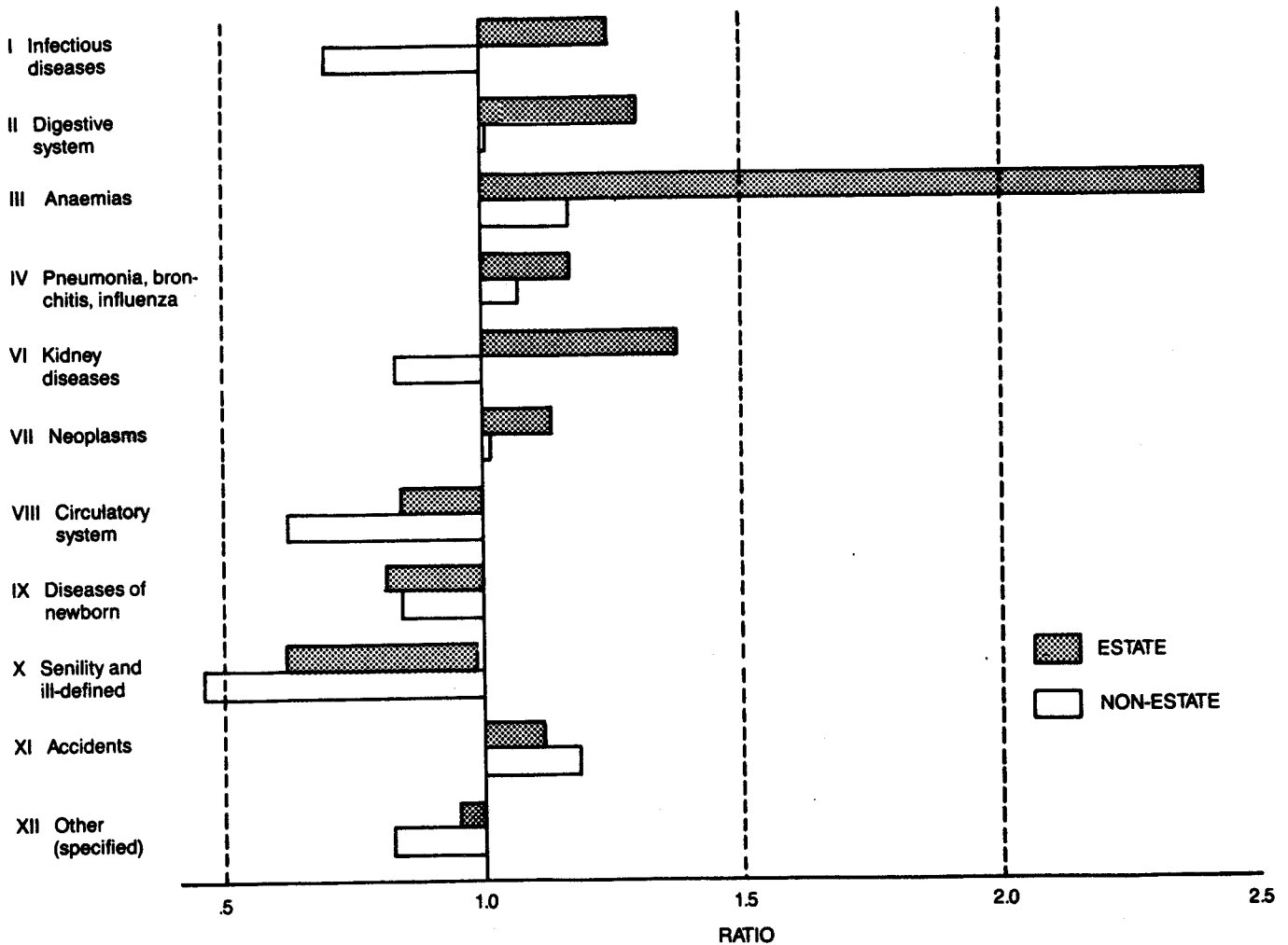
*Indicators of excess female mortality in estate areas*

Since this paper focuses on excess female mortality, the logical subject of comparison is the ratio of female

death rates for a particular cause (F) to male death rates for that cause (M), or F/M. For each area (estate/non-estate), the ratio indicates the relative position of females to males for that particular cause.

However, the most critical comparison from the standpoint of this analysis is the excess female mortality evi-

Figure I. Ratio of female to male mortality, by cause

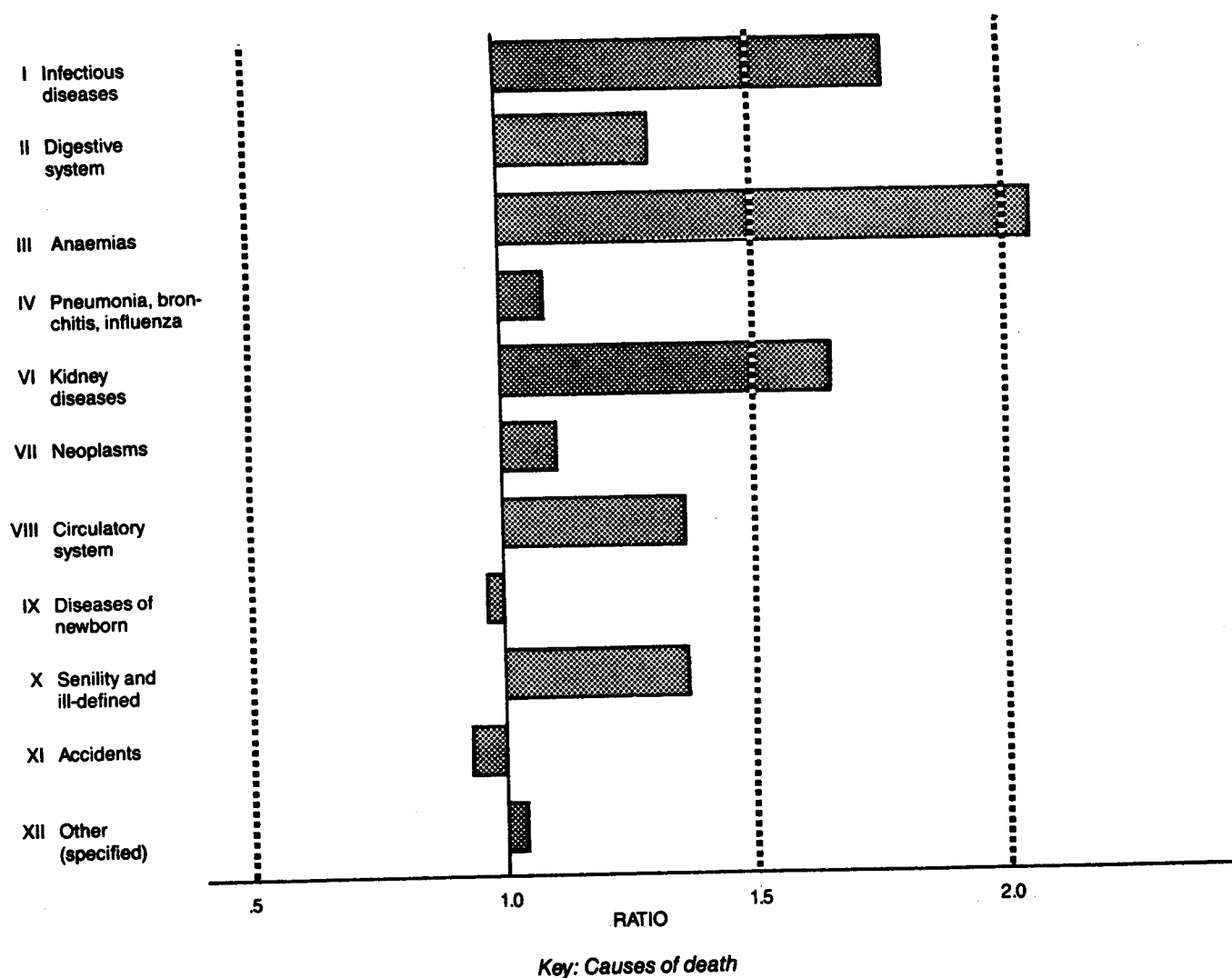


Key: Causes of death

- I INFECTIOUS DISEASES  
Tuberculosis, typhoid, cholera, scarlet fever, diphtheria, whooping cough, polio, infectious meningitis, smallpox, measles, typhus
- II DIGESTIVE SYSTEM  
Dysentery, gastritis, duodenitis, enteritis, colitis
- III ANAEMIAS
- IV PNEUMONIA, BRONCHITIS, INFLUENZA
- V PREGNANCY RELATED  
Complications of pregnancy, childbirth, and the puerperium
- VI KIDNEY DISEASES  
Nephritis, nephrosis

- VII NEOPLASMS  
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues
- VIII DISEASES OF THE CIRCULATORY SYSTEM  
Rheumatic heart disease, arteriosclerotic and degenerative heart disease, hypertension and other heart disease
- IX DISEASES OF THE NEWBORN  
Congenital malformations, birth injuries, infections of the newborn, other diseases peculiar to early infancy
- X SENILITY AND ILL-DEFINED OR UNKNOWN CAUSES  
Senility without mention of psychosis, dropsy, pyrexia, other non-specified causes
- XI ACCIDENTS  
Motor vehicle accidents, other accidents, suicide, homicide

Figure II. Ratio of estate to non-estate sex differentials, by cause



- I INFECTIOUS DISEASES  
Tuberculosis, typhoid, cholera, scarlet fever, diphtheria, whooping cough, polio, infectious meningitis, smallpox, measles, typhus
- II DIGESTIVE SYSTEM  
Dysentery, gastritis, duodenitis, enteritis, colitis
- III ANAEMIAS
- IV PNEUMONIA, BRONCHITIS, INFLUENZA
- V PREGNANCY RELATED  
Complications of pregnancy, childbirth, and the puerperium
- VI KIDNEY DISEASES  
Nephritis, nephrosis

- VII NEOPLASMS  
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues
- VIII DISEASES OF THE CIRCULATORY SYSTEM  
Rheumatic heart disease, arteriosclerotic and degenerative heart disease, hypertension and other heart disease
- IX DISEASES OF THE NEWBORN  
Congenital malformations, birth injuries, infections of the newborn, other diseases peculiar to early infancy
- X SENILITY AND ILL-DEFINED OR UNKNOWN CAUSES  
Senility without mention of psychosis, dropsy, pyrexia, other non-specified causes
- XI ACCIDENTS  
Motor vehicle accidents, other accidents, suicide, homicide

dent in a comparison of the sex differentials by cause for estate and non-estate areas, since there appears to be an excess of female mortality in the estate areas in the time period under investigation. Thus, the primary indicator to be used is the excess of female mortality relative to males in estate areas as compared to the same sex

differential in non-estate areas. The ratio of the sex differentials is as follows:

$$\frac{F_e/M_e}{F_n/M_n} \text{ or } \frac{F_e/F_n}{M_e/M_n}$$

TABLE 3. MALE AGE-SPECIFIC DEATH RATES ( $M_x$ ), BY CAUSE, ESTATES: 1962-1964

Cause	Total	Age group (years)							
		0	1-4	5-14	15-24	25-44	45-64	65-74	75+
Total .....	.009417	.111517	.007243	.001302	.001304	.001927	.008849	.076231	.311340
I.....	.000096	.000082	.000082	.000019	.000058	.000085	.000185	.000766	.000706
II.....	.000716	.003772	.001426	.000319	.000132	.000220	.000908	.005554	.010795
III.....	.000268	.000041	.000071	.000050	.000101	.000170	.000667	.002809	.004742
IV.....	.000907	.009152	.002704	.000288	.000147	.000157	.000580	.004820	.010391
V.....	.000259	.000062	.000191	.000082	.000064	.000072	.000450	.003639	.008878
VI.....	.000192	.000041	.000000	.000022	.000040	.000109	.000653	.001756	.002320
VII.....	.001048	.000021	.000060	.000070	.000196	.000433	.002228	.015802	.041465
VIII.....	.002436	.088471	.000011	.000000	.000000	.000000	.000000	.000000	.000000
IX.....	.000231	.000165	.000109	.000062	.000288	.000257	.000346	.000958	.001312
X.....	.002077	.000268	.000442	.000062	.000037	.000107	.001372	.032050	.210419
XI.....	.001185	.009441	.002147	.000328	.000242	.000320	.001460	.008076	.020581

Source: Population data and registered data on deaths as reported in Sri Lanka Department of Census and Statistics, *Census of Population, 1963* (Ceylon, 1963), vol. I, General Characteristics, Colombo; and Registrar-General's Office, *Report of the Registrar-General of Ceylon on Vital Statistics* (Colombo).

KEY: CAUSES OF DEATH

- I INFECTIOUS DISEASES  
Tuberculosis, typhoid, cholera, scarlet fever, diphtheria, whooping cough, polio, infectious meningitis, smallpox, measles, typhus
- II DIGESTIVE SYSTEM  
Dysentery, gastritis, duodenitis, enteritis, colitis
- III ANEMIAS
- IV PNEUMONIA, BRONCHITIS, INFLUENZA
- V PREGNANCY RELATED  
Complications of pregnancy, childbirth, and the puerperium
- VI KIDNEY DISEASES  
Nephritis, nephrosis
- VII NEOPLASMS  
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues
- VIII DISEASES OF THE CIRCULATORY SYSTEM  
Rheumatic heart disease, arteriosclerotic and degenerative heart disease, hypertension and other heart disease
- IX DISEASES OF THE NEWBORN  
Congenital malformations, birth injuries, infections of the newborn, other diseases peculiar to early infancy
- X SENILITY AND ILL-DEFINED OR UNKNOWN CAUSES  
Senility without mention of psychosis, drowsy, pyrexia, other non-specified causes
- XI ACCIDENTS  
Motor vehicle accidents, other accidents, suicide, and homicide

TABLE 4. FEMALE AGE-SPECIFIC DEATH RATES ( $M_x$ ), BY CAUSE, ESTATES: 1962-1964

Cause	Total	Age group (years)							
		0	1-4	5-14	15-24	25-44	45-64	65-74	75+
Total .....	.009959	.083129	.008806	.001641	.002379	.004609	.013157	.106236	.401160
I.....	.000119	.000179	.000138	.000032	.000059	.000211	.000201	.000053	.000553
II.....	.000933	.002526	.001698	.000392	.000331	.000679	.001647	.007471	.012847
III.....	.000648	.000060	.000080	.000068	.000496	.000970	.001731	.004027	.007183
IV.....	.001061	.006881	.003247	.000401	.000221	.000442	.001029	.005775	.011328
V.....	.000182	.000000	.000000	.000000	.000248	.000507	.000021	.000000	.000000
VI.....	.000357	.000020	.000207	.000079	.000088	.000218	.001145	.005828	.010499
VII.....	.000216	.000020	.000016	.000014	.000016	.000274	.000955	.002278	.001520
VIII.....	.000885	.000020	.000053	.000088	.000264	.000582	.002359	.016585	.046968
IX.....	.001978	.066146	.000011	.000002	.000000	.000000	.000000	.000000	.000000
X.....	.000141	.000099	.000122	.000118	.000219	.000082	.000137	.000371	.001243
XI.....	.002306	.000159	.000483	.000097	.000107	.000167	.002422	.055476	.293441
XII.....	.001131	.007020	.002753	.000349	.000331	.000475	.001509	.008372	.015610

Source: Population data and registered data on deaths as reported in Sri Lanka Department of Census and Statistics, *Census of Population, 1963* (Ceylon, 1963), vol. I, General Characteristics, Colombo; and Registrar-General's Office, *Report of the Registrar-General of Ceylon on Vital Statistics* (Colombo).

NOTE: For cause groupings, see table 3.

TABLE 5. MALE AGE-SPECIFIC DEATH RATES ( $M_x$ ), BY CAUSE, NON-ESTATE AREAS: 1962-1964

Cause	Total	Age group (years)							
		0	1-4	5-14	15-24	25-44	45-64	65-74	75+
Total.....	.008823	.060167	.008351	.001634	.001747	.003206	.011535	.041348	.138360
I.....	.000252	.000340	.000229	.000044	.000060	.000217	.000654	.001330	.001395
II.....	.000908	.005810	.002272	.000466	.000194	.000278	.000810	.002347	.004684
III.....	.000225	.000077	.000111	.000060	.000062	.000124	.000515	.001924	.002649
IV.....	.000536	.004792	.001301	.000139	.000091	.000143	.000458	.001546	.003123
V.....	.000037	.000045	.000045	.000016	.000024	.000031	.000058	.000170	.000198
VI.....	.000247	.000058	.000035	.000028	.000050	.000153	.000853	.001942	.001900
VII.....	.000908	.000041	.000074	.000055	.000149	.000542	.002911	.007667	.010846
VIII.....	.001043	.032849	.000010	.000002	.000000	.000001	.000002	.000000	.000000
IX.....	.000649	.000246	.000323	.000223	.000683	.000868	.001042	.001839	.002326
X.....	.001865	.001485	.000834	.000190	.000149	.000254	.001294	.010972	.086055
XI.....	.002152	.014424	.003117	.000412	.000285	.000595	.002938	.011612	.025184

Source: Population data and registered data on deaths as reported in Sri Lanka Department of Census and Statistics, *Census of Population, 1963 (Ceylon, 1963)*, vol. I, General Characteristics, Colombo; and Registrar-General's Office, *Report of the Registrar-General of Ceylon on Vital Statistics (Colombo)*.

NOTE: For cause groupings, see table 3.

where F and M refer to central death rates by cause and age for females and males, respectively; and the subscript indicates the geographical area (e for estate, n for non-estate). Whichever form is preferred, it can be seen that the ratio states the excess mortality of females relative to males in estate areas as compared to non-estate areas.

If the characteristics of the estates were the same as those of the non-estates, the levels and sex differentials in each area would be the same, and hence the ratio of the sex mortality differentials explained above would be 1. Furthermore, different levels but the same relative sex differentials would also produce ratios equal to 1. If the ratio is over 1, the mortality differentials between females living in estates and in non-estates is larger than the corresponding differential for males. This would indicate an excess of female mortality in the estates in relation to non-estates.

The two indicators—namely, the ratio of each area (area sex differential) and the ratio between the sex differentials of each area (estate and non-estate) were cal-

culated for each of the 96 age-by-cause groups available. Sex differentials in mortality rates for each of the 12 cause groups are presented in figure I. For all but two causes, the mortality sex differential for females in estate areas is higher than the differential for non-estate areas. It should be kept in mind that the levels portrayed in the figure are differentials between female and male mortality rates and not the level of the rates themselves. (Age-specific central death rates by cause, sex, and area of residence are provided in tables 3-6.)

The ratios of the sex differentials of each area (the ratios of the estate to non-estate sex mortality differentials) are shown in figure II. Clearly, females in estate areas experienced a larger mortality excess than females in the non-estate areas by most of the causes of death. This is shown in those estate/non-estate ratios in excess of 1.25 (base = 1.00). The causes with large excesses of female mortality in estate areas are: infectious diseases, diseases of the digestive system, anemias, kidney diseases, diseases of the circulatory system, and senility and ill-defined causes. Three of them—infectious

TABLE 6. FEMALE AGE-SPECIFIC DEATH RATES ( $M_x$ ), BY CAUSE, NON-ESTATE AREAS: 1962-1964

Cause	Total	Age group (years)							
		0	1-4	5-14	15-24	25-44	45-64	65-74	75+
Total.....	.008305	.050733	.010061	.001696	.001999	.003447	.008691	.037029	.149753
I.....	.000176	.000311	.000218	.000046	.000077	.000205	.000373	.000629	.000526
II.....	.000914	.005040	.002687	.000477	.000182	.000313	.000619	.002070	.004636
III.....	.000263	.000109	.000148	.000068	.000162	.000306	.000528	.001592	.001795
IV.....	.000574	.004370	.001514	.000167	.000119	.000189	.000499	.001514	.002977
V.....	.000198	.000000	.000000	.000001	.000303	.000586	.000028	.000000	.000000
VI.....	.000031	.000020	.000033	.000017	.000025	.000030	.000054	.000114	.000089
VII.....	.000251	.000042	.000035	.000026	.000038	.000229	.001032	.001721	.001559
VIII.....	.000560	.000073	.000057	.000068	.000186	.000397	.001562	.005003	.008717
IX.....	.000875	.026296	.000010	.000002	.000004	.000001	.000001	.000000	.000000
X.....	.000290	.000253	.000305	.000206	.000378	.000258	.000294	.000546	.000868
XI.....	.002202	.001365	.000989	.000192	.000224	.000380	.001421	.014448	.107975
XII.....	.001969	.012853	.004065	.000426	.000301	.000554	.002280	.009392	.020611

Source: Population data and registered data on deaths as reported in Sri Lanka Department of Census and Statistics, *Census of Population, 1963 (Ceylon, 1963)*, vol. I, General Characteristics, Colombo; and Registrar-General's Office, *Report of the Registrar-General of Ceylon on Vital Statistics (Colombo)*.

NOTE: For cause groupings, see table 3.

diseases, anemias, and kidney diseases—have index values over 75 per cent above parity. Neoplasms and pneumonia, bronchitis and influenza show a slight relative higher mortality of females than males in estates as compared to non-estate areas, while virtually no differential between areas was found in the groups of causes specific to the newborn, accidents, and other (specified) causes.

In any country, there are certain areas of higher or lower mortality in relation to other areas. However, in most of the cases, the sex differentials normally remain in the same direction in most of the sub-areas. In the case of Sri Lanka, not only do the estate areas have higher levels of mortality, but the ratio of female to male mortality increases, although the opposite would have been expected. Frequently, the higher the mortality level, the lower the sex mortality differentials.

#### AGE PATTERNS IN MORTALITY DIFFERENTIALS, 1962-1964

The analysis was extended to include differentials by age, in order to avoid possible biases due to different age structures in each area and the particular mortality pattern in relation to age. Although the focus was on the difference between the sex mortality differentials in estates and the rest of the country, it was also expected to incorporate an examination of the excess of female mortality over male in both areas. For instance, for anemias the ratio of the sex mortality differentials (ratio of estates to non-estates) does not differ much from the ratios pertaining to infectious diseases or pneumonia, bronchitis and influenza. However, anemias show an astonishingly higher mortality for females than males; over five times greater in child-bearing years in the estate areas (see tables 3 and 4). The high sex mortality differential from anemias is so great that it would support the hypothesis of different nutritional conditions between males and females.

Examining the causes of death showing the largest excess of female mortality—*anemias, infectious diseases, and diseases of the digestive system*—leads to a question of whether or not nutrition may be playing an important role, either directly or indirectly, in sex mortality differentials. For this reason, a second grouping of causes was made. A first group was formed from those causes which are likely to be directly related to nutrition, such as *anemias*, and those indirectly related, such as *infectious diseases, diseases of the digestive system, and pneumonia, bronchitis and influenza*. (Malnutrition may reduce the resistance of the body to the effects of exposure to those diseases.) A second group was formed from diseases related to the circulatory system (which may have some dietary component but are not likely to be causing the mortality differentials against females) and accidents (which in this case are likely to be related to working conditions rather than, for example, automobile accidents). Females in estates have a relatively higher mortality from accidents than those not in estates; young females in the estates at ages 5-14 years died from accidents at a higher rate than did males. Finally, those causes which are not strongly related to nutrition were grouped together. They included kidney diseases; neo-

plasms; diseases specific to the newborn; senility and ill-defined or unknown causes; and other causes.

Once the groupings were made, the sex mortality differentials (female over male majority) were calculated by age and area as well as the ratio of sex mortality differentials of estate to non-estate areas. The results indicate that in both areas the larger sex mortality differentials were found in the group of causes directly or indirectly related to malnutrition. Furthermore, the differentials were considerably larger in the estate areas. In the estates, mortality from the three large groups of causes of death is higher for females than males at almost all ages (fig. III), while in the rest of the country, males tend to have higher mortality than females at adult ages.

The mortality rates pertaining to each of the three groups strongly support the hypothesis that nutrition plays an important and crucial role in producing the excess female mortality. Mortality from causes related to nutrition in the estates (group I) is two to four times greater for females than males at ages 15-64 years. Ages 25-44 show the largest excess of female mortality from nutrition-related causes.

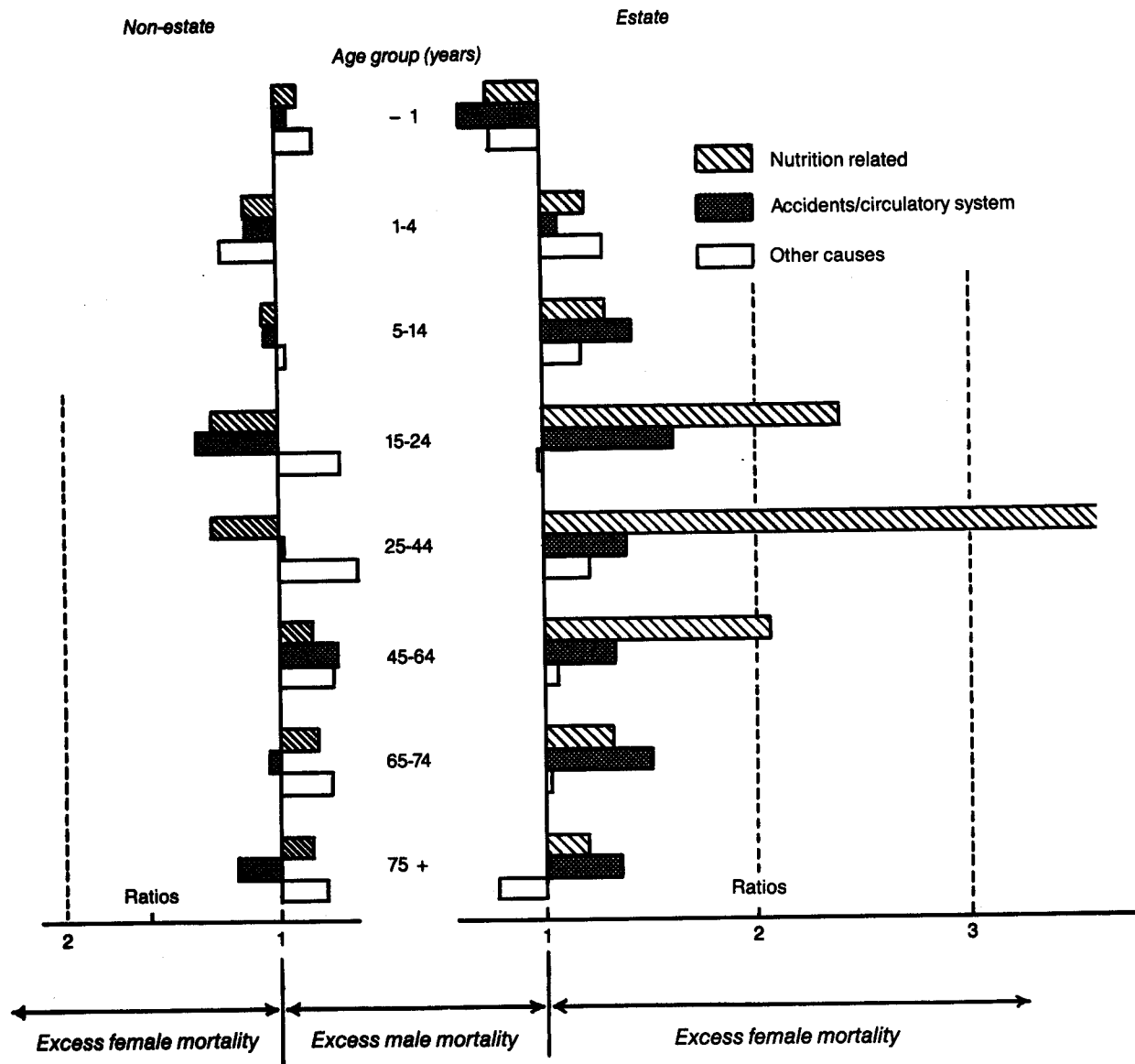
Mortality related to pregnancies obviously contributes to the excess female mortality. However, female mortality due to such causes may not have been the principal direct contributor to the excess female mortality in Sri Lanka, although it may have played an important indirect role. Female mortality from pregnancy complications was 19 per cent higher, per pregnancy, in the estates than in the rest of the country. Nevertheless, since fertility was lower in the estates than in the rest of the country, the mortality rate from pregnancy complications per woman was practically the same in both areas; 19 and 20 per 100,000 women at ages 15-44 in the estates and the rest of the country, respectively. Obviously, such equality of mortality in both areas cannot be contributing to the much higher female mortality in the estates than in the rest of the country, as was the case with other causes of death. However, indirectly, females will be more affected by the effects of malnutrition during periods of pregnancy than otherwise would be the case. This is supported by the fact that the largest excess of female mortality is registered during the female reproductive period of life.

Although in the rest of the country (non-estates) mortality from some of the three groups is also higher for females than males, the differentials in all ages (except under age 1 year) are larger in the estates than in the rest of the country. This can easily be seen by taking the ratio of the sex differentials of the estates to the rest of the country (fig. IV). In most ages (15-74 years) the excess female mortality from nutrition-related causes is 50 per cent higher in the estates than in the rest of the country; furthermore, in ages 25-64 years, that percentage reaches an astonishing 150.

#### CONCLUSION

Several societies in Asia have had and continue to have a sex mortality differential favourable to males. However, there are indications that the differential is

Figure III. Ratios of female to male mortality



smaller in urban areas and also decreases with increasing educational attainment. Several factors may produce the higher overall level of mortality for females than males (Langsten, 1985). Data from Sri Lanka, the only such country with data by cause of death, support the hypothesis that the higher female mortality is not due to biological, genetic, or environmental characteristics but rather to factors that may be related to nutritional or cultural practices.

The analysis of the available statistics for Sri Lanka in the early 1960s strongly supports the position that poorer nutrition among females may play an important role in producing excess female mortality. The reasons for the high nutritional deficiency of females may be connected to certain traditional factors—for example, the fact that women often have lower status than men in certain social groups, such as the family. Lower status is frequently

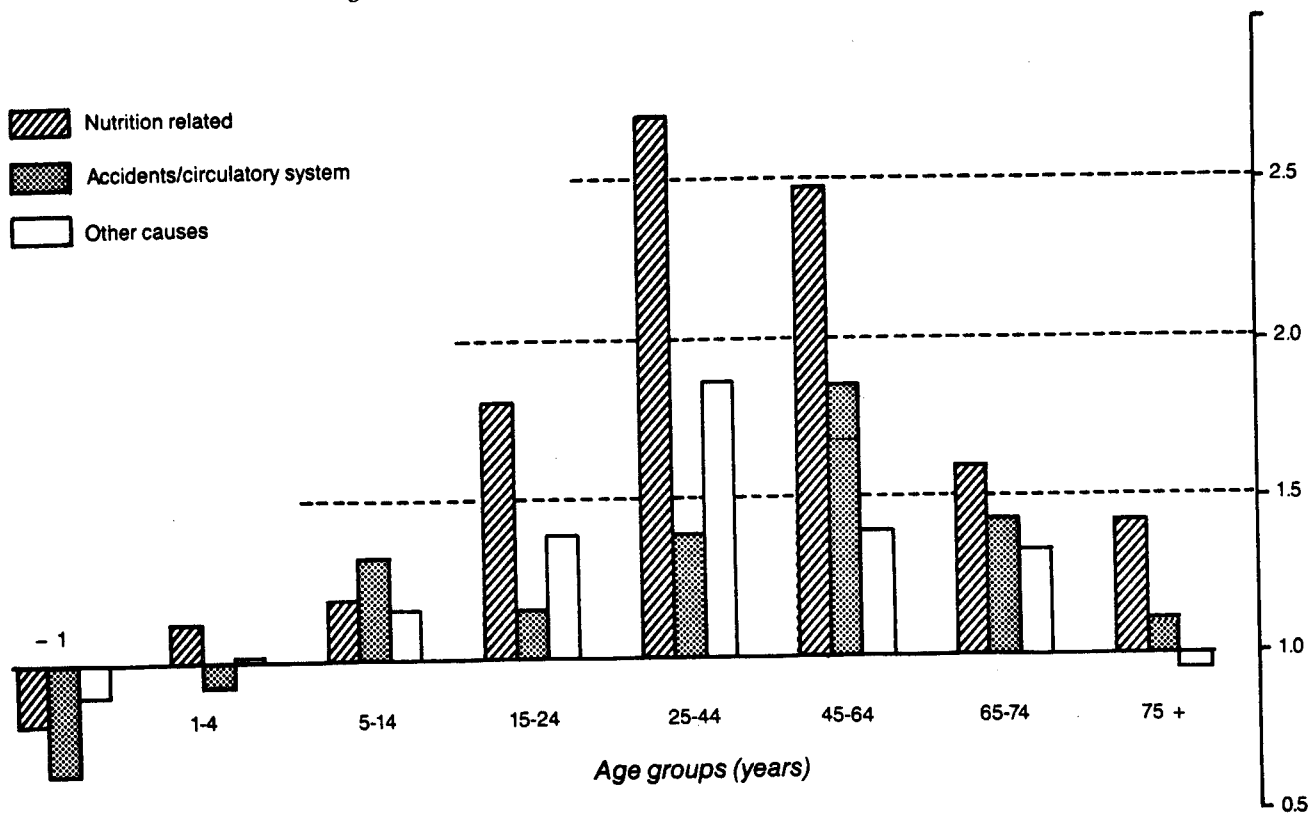
connected to patterns of food consumption among family members (men first, then women).

The cultural and traditional practices giving preference to men may have other effects connected to the excess mortality among females. Because men decide about labour division in the family, females may be placed in charge of household activities that may involve longer working periods than men. Furthermore, women may engage more frequently than men in activities performed in an environment with higher risk of infectious and contagious disease.

But there are other factors, too. It could be argued, for instance, that while males may use available medical facilities when they are ill, females may be reluctant to visit a doctor. Furthermore, if an adult male is ill, he will probably not report to work and will go to a hospital or remain at home under the care of his mother or



Figure IV. Ratios of estate to non-estate sex mortality differentials



wife. But if an adult female is ill, she still probably will have to take care of her family and home.

In order to reduce the excess mortality among females, the role of women in the society must change. Cultural preferences for males in certain societies should be reduced, and both sexes should share more equitably the rewards and burdens of social life. Since traditions are weakened by social development, one may expect that eventually the sex mortality differential against females will disappear in those countries where it currently exists. Indeed, the process already seems to be fairly well advanced in Sri Lanka and is rapidly changing in India. (However, it seems that in Sri Lanka, the process of modernization in the estate area has lagged in relation to the rest of the country.) One can only hope that current emphasis on the status and roles of women in societies around the world will help to call attention to their current mortality disadvantage in some countries, with the result that the process of social development may be hastened.

NOTE

<sup>1</sup> Although Sri Lanka had historically exhibited a pattern of excess mortality among females, since the early 1970s the situation has been reversed, and now males have higher mortality than females (Nadarajah, 1983).

REFERENCES

Anonymous (1970), "Sex differentials in mortality", *Egyptian Population and Family Planning Review*, vol. 3, No. 2 (June), pp. 19-28.

Ceylon Department of Census and Statistics (1967), *Census of Population, 1963*, vol. I. *General Characteristics* (Colombo).

Ceylon Registrar General (various years), *Report of the Registrar General of Ceylon on Vital Statistics* (Colombo).

El-Badry, M. A. (1969), "Higher female than male mortality in some countries of South Asia: a digest", *Journal of the American Statistical Association*, vol. 64, No. 328 (December), pp. 1234-1244.

Gray, R. H. (1974), "The decline of mortality in Ceylon and the demographic effects of malaria control", *Population Studies*, vol. 28, No. 2 (July), pp. 205-229.

Langsten, Ray (1985), "Determinants of high female mortality in South Asia: are the data consistent with theory?", paper presented to the Regional Conference for Asia on Women and the Household. New Delhi, 21-31 January 1985.

Meegama, S. A. (1967), "Malaria eradication and its effects on mortality trends", *Population Studies*, vol. 21, No. 3, p. 229.

\_\_\_\_\_ (1969), "The decline in maternal and infant mortality and its relation to malaria eradication", *Population Studies*, vol. 23, No. 2, pp. 293-294.

\_\_\_\_\_ (1979), "Cholera epidemics and their control in Ceylon", *Population Studies*, vol. 33, No. 1 (March), pp. 143-156.

\_\_\_\_\_ (1981), "The decline of mortality in Sri Lanka in historical perspective", *Proceedings of the International Population Conference, Manila, 1981*, vol. 2. Solicited Papers (Liège, International Union for the Scientific Study of Population), pp. 143-64.

Nadarajah, T. (1983), "The transition from higher female to higher male mortality in Sri Lanka", *Population and Development Review*, vol. 9, No. 2 (June), pp. 317-325.

United States Bureau of the Census (1983), *World Population 1983—Recent Demographic Estimates for the Countries and Regions of the World* (Washington, D.C.).

# PROJECTION OF AGE-SPECIFIC MORTALITY RATES\*

John H. Pollard\*\*

## SUMMARY

The projection of mortality rates by age has taken on added importance in recent years due to the increasing frequency of mortality changes that do not conform to generalized age patterns of mortality change implicit in model life table schema. In a number of developed countries and in some developing countries also, life expectancy has risen in spite of actual mortality rises in certain age/sex groups (most notably, adult males). Specific health interventions, such as measles immunization, pre-natal and post-natal community health services, or family planning, lead to declines in early-age mortality greater than would be "predicted" on the basis of mortality change at older ages.

The question therefore arises of how to project the age pattern of mortality for a specific country under a specific situation. The answer is clearly related to the type, the extent, and the quality of the data available at the moment of projection. This paper reviews a variety of methods that have been suggested, by actuaries and demographers alike, to project age-specific mortality rates: projection by extrapolation of mortality rates (or transformations of mortality rates) at selected ages; projection by reference to a "law of mortality"; projection by reference to model life tables, projection by reference to another "more advanced" population; projection by reference to an "optimal" life table attainable under ideal conditions; projection by cause of death; and combinations of these methods. Examples of the use of these various methods are given, and conclusions are drawn on their respective advantages and disadvantages.

### PROJECTION BY EXTROPOLATION OF MORTALITY RATES (OR TRANSFORMATION OF MORTALITY RATES) AT SELECTED AGES

#### Background

This is perhaps the simplest method of projection and the most widely used. Extrapolation may be graphical or by mathematical formula, and the two approaches are described separately.

The most commonly used formula for extrapolation by mathematical formula is

$$q_x^n = \beta_x \gamma_x^n, \quad (1)$$

where  $q_x^n$  is the mortality rate at age  $x$  experienced in year  $n$ ,  $\beta_x$  reflects the level of mortality at age  $x$  at a particular point of time, and  $\gamma_x (0 < \gamma_x < 1)$  takes account of improvements in mortality at age  $x$  over time. The equivalent formula for the logarithmic transformation of  $q_x^n$  is, of course,

$$\ln q_x^n = B_x + nC_x, \quad (2)$$

where  $B_x = \ln \beta_x$  and  $C_x = \ln \gamma_x$ .

Formula (1) allows the mortality rate at age  $x$  to decrease indefinitely towards zero. This is undesirable in the eyes of some workers who prefer to postulate an ultimate level of mortality at age  $x$ ,  $\alpha_x$ , and adopt the extrapolation formula

$$q_x^n = \alpha_x + \beta_x \gamma_x^n \quad (3)$$

The linear extrapolation formula

$$q_x^n = a_x - nb_x, \quad (4)$$

with  $a_x, b_x > 0$ , is not usually employed because of its obvious disadvantage that for larger  $n$ , a negative mortality rate is predicted. Other formulae which have been suggested or tried in earlier years may be found in Pollard (1949).

There is no reason why the function extrapolated (either graphically or by formula) should be the mortality rate  $q_x^n$ . Other life table functions or transformations of life table functions may be used. The logit transformation of Brass (1971), which is often used, is discussed separately below.

#### Description of method: graphical extrapolation

The graphical approach to the projection of mortality by extrapolation over  $n$  of the mortality rates  $q_x^n$  at selected ages  $x$  may be summarized as follows:

\* The present paper was prepared by the author in his capacity as a consultant for the Population Division, Department of International Economic and Social Affairs, United Nations Secretariat.

\*\* Macquarie University, Sydney, Australia.

(a) Representative ages are selected (e.g., 0, 1, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80);

(b) For each selected age  $x$ , the observed mortality rates  $q_x^n$  at recent epochs  $n$  are plotted against  $n$ ;

(c) A smooth curve is drawn representing the observed trend over  $n$  in  $q_x^n$  and extrapolated graphically to yield projected values of  $q_x^n$ ;

(d) The graphs for neighbouring ages  $x$  should be drawn on the same sheet so that trends at neighbouring ages can be taken into account in the extrapolation process;

(e) Projected mortality rates at intervening ages are found by interpolation or by multiplying the base mortality rates at those ages by the projected reduction factor at the nearest selected age.

The procedure is basically the same whether the function being extrapolated is the mortality rate  $q_x^n$ , some other life table function, or a transformation of a life table function. Figure I demonstrates the essential elements in the graphical projection of  $q_x^n$  using semi-log graph paper.

#### *Description of method: formula extrapolation*

The projection of mortality by extrapolation over  $n$  of the mortality rates  $q_x^n$  at selected ages by formula (1) may be summarized as follows:

(a) Representative ages are selected (e.g., 0, 1, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80);

(b) For each selected age  $x$ , the improvement factor  $\gamma_x$  is estimated for various recent periods using the following formula valid between epochs  $m$  and  $n$  ( $n > m$ ):

$$\gamma_x = (q_x^n/q_x^m)^{1/(n-m)} \quad (5)$$

Alternatively,  $\gamma_x$  may be found by log-linear regression on the  $q_x^n$  for various epochs  $n$ ;

(c) The estimated  $\gamma_x$  values at neighbouring ages are compared and reasonable  $\gamma_x$  values determined (chosen) for extrapolation purposes;

(d) Projected mortality rates at the selected ages are calculated via formula (1);

(e) Projected mortality rates at intervening ages are found by multiplying the base mortality rates at those ages by the appropriate powers of interpolated  $\gamma_x$  values.

The same type of procedure is adopted when other life table functions or transforms are used, and alternative projection formulae are involved.

#### *Selected examples of use of the method*

Actuaries have long been interested in projecting mortality improvements, because of the adverse financial effects such improvements can have on insurance companies which sell life annuities (pensions). The Institute of Actuaries (London) annuitant tables of 1924 (Anderson and Dow, 1964), for example, based on life office annuitant mortality between 1900 and 1920, used mortality rates projected by formula (3). The ultimate future mortality rate was set, somewhat arbitrarily, at 63 per cent of the observed mid 1900-1920 value. Subsequent annuitant tables have been derived by the Institute of Actuaries and Faculty of Actuaries (1979), using similar

methodology. The Society of Actuaries (1981) used formula (1) in the derivation of the "1983 Table a" for individual annuity valuation.

These mortality projection techniques developed earlier this century by actuaries in relation to annuitant mortality were later adopted by national statisticians and others for projecting mortality levels in national populations. Two sets of projections were made in Canada in the 1950s, for example, by the Dominion Bureau of Statistics (1950, 1954) and each projected future mortality rates on the basis of formula (2), the logarithmic equivalent of equation (1). The rationale for the procedure, given in the 1950 report, is of interest:

"Mortality has followed a fairly stable downward trend in many countries during the past 50 to 75 years. Canadian rates by age and sex have fallen in the past 20 years in approximately the same proportion as those in Europe. Their projection over the next 25 years or so can therefore be undertaken with considerable confidence. The results obtained on the basis of the present population may be accepted as subject only to a relatively small margin of error."

The error, in fact, turned out to be much larger than the forecasters expected (Preston, 1974).

In the projection of the Actuary's Department of the United Kingdom (1965) of population from 1965 to the year 2000, the geometric progression formula (1) was also used. The ratio of the projected mortality rates in 2004 to those observed in 1964 varied from 0.40 for males and females under age 25 (2.3 per cent decline per annum) to 1.00 for the extreme aged of both sexes (those over 90). The rationale which led the Canadian and United Kingdom mortality forecasters to adopt the geometric progression extrapolation formula (1) is also evident in the work of Golulapati, De Ravin and Trickett (1984), who projected the mortality rates of the Australian population from 1981 to 2020 by that method among others.

#### *Comments on the method*

The following may be said of the method:

(a) The method is simple to apply in either its graphical or mathematical formula extrapolation form;

(b) A lot is left to the discretion of the forecaster, both in the graphical approach and in the formula extrapolation approach (e.g., final choice of  $\gamma_x$  ratios);

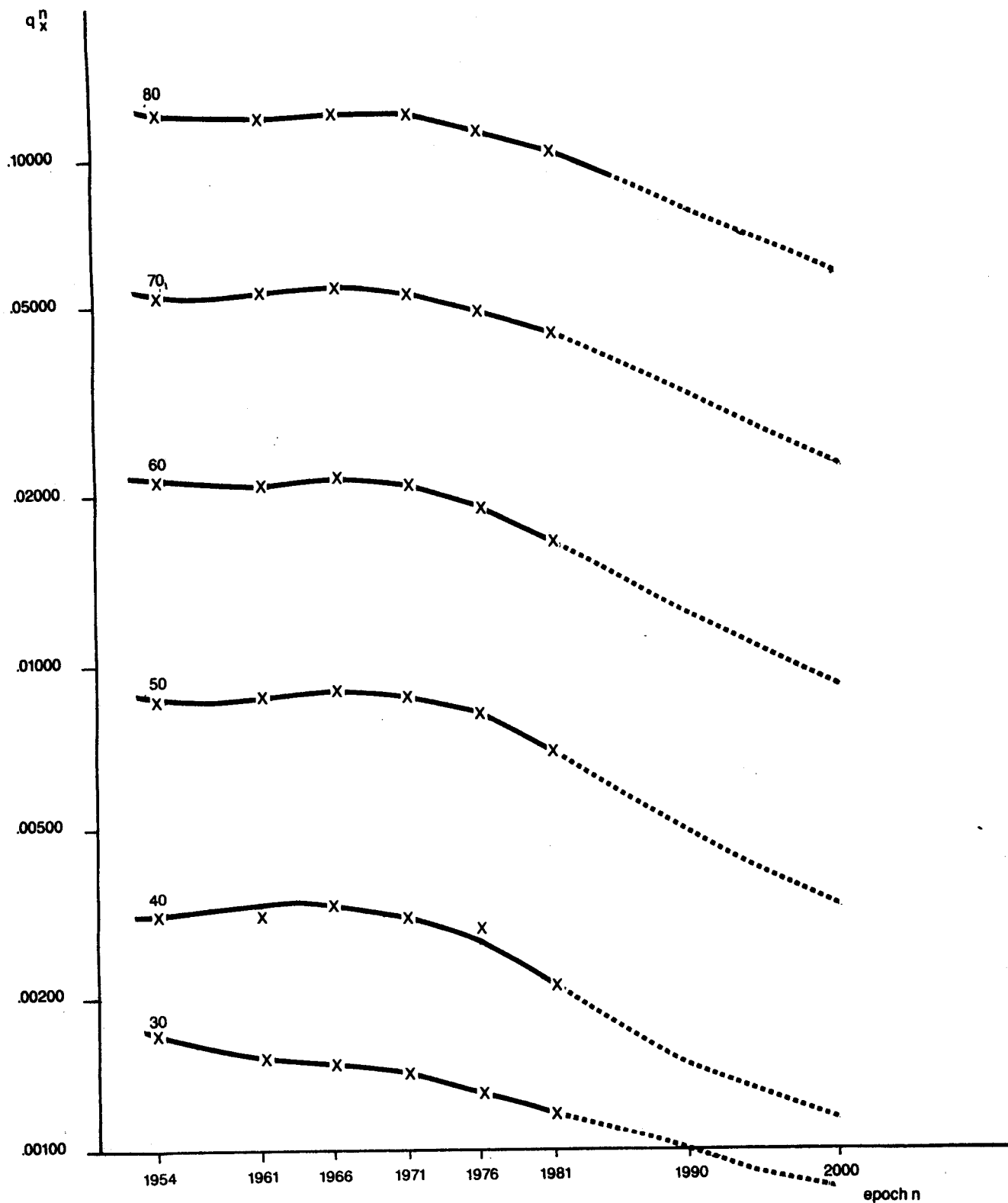
(c) Because of the uncertainty in sketching the extrapolated trend line in the graphical approach or in choosing future  $\gamma_x$  values in the formula approach, the forecaster has some idea of the large possible range of error;

(d) Logarithmic graph paper is convenient for the graphical extrapolation of  $q_x^n$  because it allows the graphs of  $q_x^n$  for neighbouring selected ages to be plotted on the same sheet;

(e) Extrapolation formulae (1), (2) and (3) are not usually employed with  $\gamma_x > 1$  ( $C_x > 0$ ), because of the danger of exaggerating deteriorating mortality if the projection is extended over more than a couple of years;

(f) The formula chosen for mathematical extrapolation should have few parameters and behave in a simple,

Figure I. Projection of Australian male period mortality rates  $q_x^n$  by the graphical extrapolation method



appropriate and well-understood fashion as the epoch  $n$  is varied;

(g) In some developed countries, mortality rates fell dramatically in the 1970s, implying  $\gamma_x$  values in (1) or

(3) considerably smaller than their historical values over a longer period. To avoid the danger of overestimating future mortality improvements, the forecaster may adopt  $\gamma_x$  values close to their current low values for the first

few projection years and then allow them to move towards their historical longer-term levels as the projection moves further into the future;

(h) Whether the graphical or formula extrapolation approach is adopted, it is important that the life table function or transform chosen to be extrapolated be sensitive to changes in mortality. The expectation of life  $e_x$  at age  $x$ , for example, is affected by mortality at all ages beyond  $x$ , but is sensitive to none; one can project  $e_x^n$  for future epochs  $n$  and selected ages  $x$ , but mortality rates deduced from the extrapolation are unlikely to be reliable. The same is true of projections of  $l_x^n$ ;

(i) The method of projection by extrapolation of mortality rates (or transformations of mortality rates) takes no direct account of collateral information which may be available to the forecaster—e.g., trends in population smoking habits, discernible trends in mortality rates by cause and known or suspected reasons for these trends, etc.;

(j) The method (as described) cannot be applied if data are only available at a single point of time.

#### Generation vs. period data

There is no reason why the method of projection by extrapolation of mortality rates (or other life table functions or transforms) at selected ages should not be applied to generation (cohort) data rather than period (cross-sectional) data. If the mortality function to be extrapolated is the mortality rate  $q_x^{(n)}$  at age  $x$  for the cohort born in year  $n$  and the graphical approach is to be followed, the curve for attained age  $x$  is identical to the age  $x$  curve in the period analysis, but when plotted on the same sheet as the curves for neighbouring attained ages, the curves are displaced sideways from one another compared with their relative positions in the corresponding period representation. The displacement is evident in figure II, which gives the generation representation of the same data as figure I. Because of this displacement, comparisons between the curves in the cohort analysis may lead the forecaster to adopt a different projection from that suggested by a period analysis. Early work by Derrick (1927) and Kermack, McKenrick and McKinlay (1934) suggested that generation curves exhibited a greater degree of regularity, which might be put to good effect for projection purposes. The regularity noted by those authors has not been observed, however, to the same extent in recent times.

To apply the mathematical formula method to the extrapolation of  $q_x^{(n)}$ , the mortality rate at age  $x$  in respect of the cohort born in year  $n$ , it is necessary to measure the improvement experienced in mortality at selected attained ages  $x$  from one cohort to the next. When summarized in tabular form by year of birth of cohort, the figures are the same as those tabulated in a cross-sectional analysis (by calendar year of experience), apart from being displaced sideways relative to each other. Examination of both period and cohort tables should indicate which effect is dominant. If the cohort effect appears dominant, the improvement projection factors  $\gamma_x$  chosen at neighbouring ages under formula (2)

are chosen in the light of the cohort table rather than the cross-sectional table.

Practical considerations often dictate that a period approach be adopted, because the long series of observations required for a proper generation analysis tend not to be available.

#### The Brass logit transformation

Among the transformations that are sometimes used to project mortality by the graphical or mathematical formula extrapolation method, the logit transformation of Brass (1971) is prominent, particularly when the data are prepared in cohort rather than period form. The transformation takes the form

$$\Lambda_x^{(n)} = \frac{1}{2} \ln \left[ \frac{l_o^{(n)} - l_x^{(n)}}{l_x^{(n)}} \right] \quad (6)$$

Proponents of the transformation argue that logits of successive birth-year cohorts should be linearly related (Brass, 1971; Golulapati, De Ravin and Trickett (1984)).

Application of the transformation requires a long sequence of mortality rates so that cohort survivorship functions  $l_x^{(n)}$  can be reconstructed, and a considerable amount of numerical work. The steps are as follows:

1. Survivorship functions  $l_x^{(n)}$  for the cohort born in year  $n$  are calculated for selected representative ages  $x$  and various years of birth  $n$ . The mortality rates used to reconstitute the  $\{l_x^{(n)}\}$  may be adjusted to remove abnormal excess mortality irrelevant for projection purposes (e.g., excess mortality due to war, epidemic etc.). The figures in normal type at the top of table 1 in respect of Australian males include such adjustments.
2. Logits are calculated (figures in ordinary type in the second half of table 1).
3. Logit trends for each attained age are studied and extrapolated (usually linearly). The linearly extrapolated logits for Australian males are shown in bold figures in the second half of table 1, the projected constant difference being given at the bottom of the table.
4. The inverse logit transformation

$$l_x^{(n)} = l_o^{(n)} / [1 + \exp(2\Lambda_x^{(n)})] \quad (7)$$

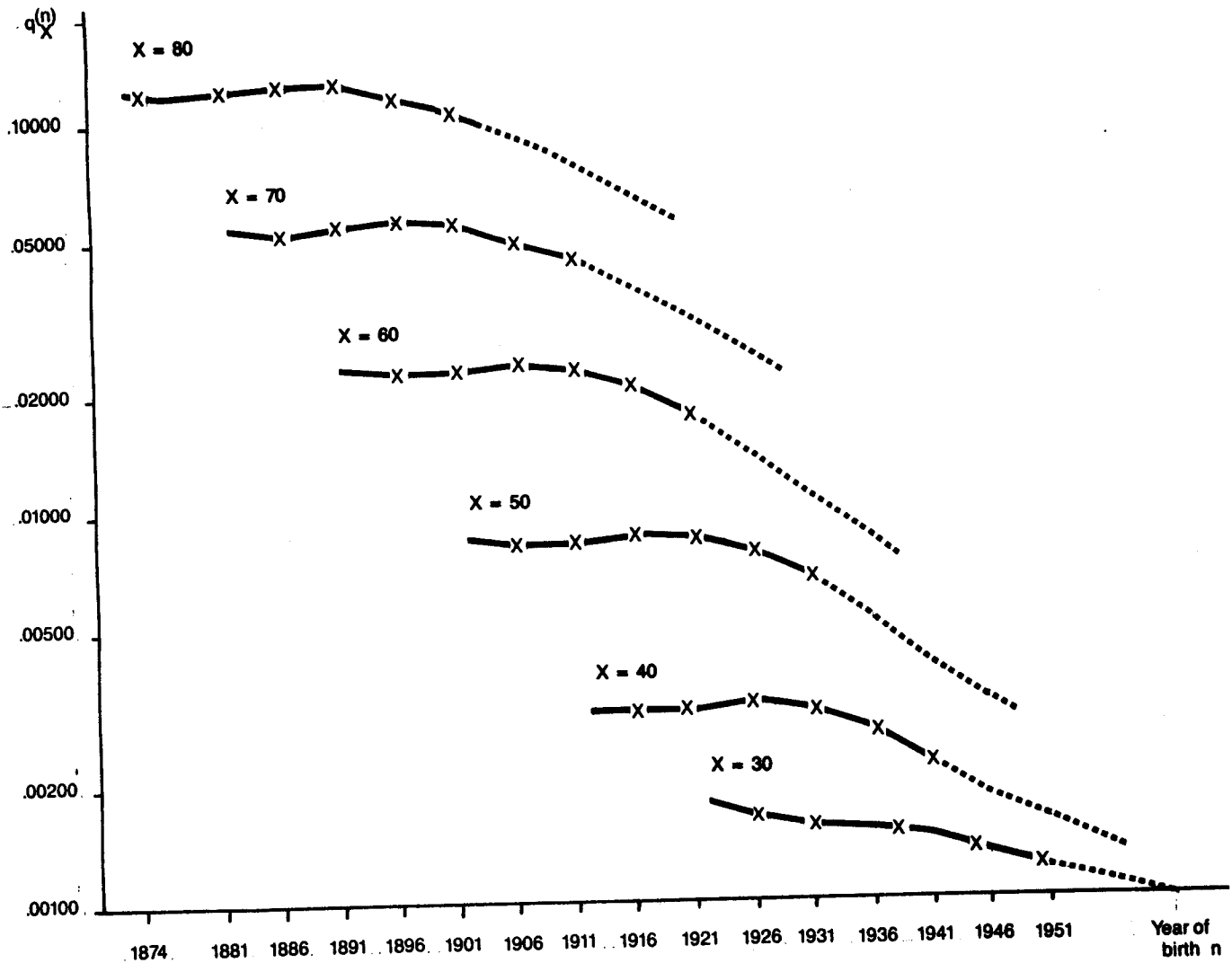
is used to calculate the projected  $\{l_x^{(n)}\}$  values (bold figures in the top half of table 1).

5. Mortality rates  $q_x^{(n)}$  and other life table functions are then calculated from the projected  $l_x^{(n)}$  values at the selected ages using abridged life table techniques.

As noted above, the method requires a considerable amount of work and an extensive data base. The age-specific logits do appear to follow reasonably linear trends from one birth cohort to the next, however, and this makes the forecaster's task easier.

The method, as outlined, does have some drawbacks. The transform is purely a function of  ${}_x p_o^{(n)} = l_x^{(n)} / l_o^{(n)}$ , and as such depends on mortality rates at all ages below  $x$ . In one sense, this is an advantage, as mortality rates at neighbouring ages tend to move in concert rather than

Figure II. Projection of Australian male cohort mortality rates  $q_x^{(n)}$  by the graphical extrapolation method



independently (Brass, 1971). It does mean, however, that the logit is not sensitive to mortality at any particular age, and this is a handicap when one attempts to reconstitute  $q_x^{(n)}$  values for individual ages from projected  $l_x^{(n)}$  values at selected ages.

The other danger of using the Brass logit transformation in this manner is internal inconsistency. Linear extrapolation of logits at different ages independently may lead to the absurd result that  $l_{x+j}^{(n)} > l_x^{(n)}$  (i.e.  $q_{x+j}^{(n)} < 0$  for some  $j$ ). While such a result can be avoided by modifying the differences in the linear extrapolations, the fact that it can occur indicates possible undesirable behaviour of the projected  $q_x^{(n)}$  even when it does not.

#### PROJECTION BY REFERENCE TO A "LAW" OF MORTALITY

##### Background

Since 1825, when Benjamin Gompertz proposed his famous "law of mortality"

$$\mu_x = Bc^x, \quad (8)$$

various authors have proposed alternative "laws".\* The better known include those of Makeham from 1860,

\* Some authors object to the use of the word "law". This paper will not enter into that debate.

$$\mu_x = A + Bc^x \quad (9)$$

$$\mu_x = A + Hx + Bc^x \quad (10)$$

various formulae due to Perks in 1932 of the general form

$$\mu_x = \frac{A + Bc^x}{Kc^{-x} + 1 + Dc^x}, \quad (11)$$

and one due to Barnett

$$q_x/p_x = A - Hx + Bc^x. \quad (12)$$

In each case  $c > 1$  and is approximately 1.08.

All the above formulae are applicable only to the adult ages above about 30. They take no account of the high but rapidly falling mortality at the early childhood ages, nor the "accident hump" in early adult life. Laws which have attempted to cover the whole age range include an early formula due to Thiele, from 1872,

$$\mu_x = a_1 \exp(-b_1x) + a_2 \exp[-b_2(x - c)^2] + a_3 \exp(b_3x) \quad (13)$$

and a more recent formula of Heligman and Pollard, proposed in 1980:

$$q_x/p_x = A^{(x+B)^c} + D \exp\{-E[\ln(x/F)]^2\} + GH^x. \quad (14)$$

In both these formulae, the first term takes account of early childhood mortality, the second term, accident mortality at the younger adult ages, and the final Gompertz term, senescent mortality.

A fuller account of all these and certain other laws, together with the relevant references, may be found in Benjamin and Pollard (1980).

#### Description of method

Projection of age-specific mortality rates is sometimes attempted by reference to one or other of the above laws. The procedure may be summarized as follows:

(a) A suitable law is chosen (for example, the Makeham formula (9) with parameters  $A$ ,  $B$  and  $C$ );

(b) The curve representing the law is fitted to the observed age-specific mortality rates at each of several different epochs (e.g., by minimum chi-square, least squares or maximum likelihood), and the values of the parameters at each epoch are noted. (In the Makeham case, parameter values  $A_t$ ,  $B_t$  and  $c_t$  are noted for various epochs  $t$ .);

(c) Trends in the parameters are extrapolated to provide estimates of the parameters at future epochs  $t$ . The extrapolation may be graphical or by mathematical formula;

(d) Projected age-specific mortality rates are obtained by substituting the projected parameters and the various ages into the formula describing the law.

#### Selected examples of the use of the method

The above approach with the Makeham law (9) was applied to the extensive Swedish national mortality data

TABLE 1. PROJECTION OF AUSTRALIAN MALE MORTALITY BY EXTRAPOLATION OF THE BRASS COHORT LOGIT TRANSFORM (Radix  $l_0^n = 100,000$ )

Birth-year $n$	Survivorship functions			
	$l_5^{(n)}$	$l_{10}^{(n)}$ ...	$l_{40}^{(n)}$ ...	$l_{80}^{(n)}$ ...
1880.....	81 281	79 700	69 990	17 258
1890.....	84 047	82 781	74 507	18 613
1890.....	87 585	86 662	79 288	20 156
1910.....	89 439	88 488	82 678	23 523
1920.....	90 954	90 149	85 019	25 506
1930.....	93 180	92 479	88 064	28 733
1940.....	94 837	94 355	90 909	33 035
1950.....	96 530	96 247	94 115	
1960.....	97 295	97 136	95 489	
1970.....	97 657	97 543	96 146	
1980.....	<b>98 172</b>	<b>98 096</b>	97 023	
1990.....	<b>98 576</b>	<b>98 527</b>		
2000.....	<b>98 891</b>	<b>98 861</b>		
2010.....	<b>99 137</b>	<b>99 120</b>		
2020.....	<b>99 329</b>			

Birth year $n$	Logit transforms			
	$\Lambda_5^{(n)}$	$\Lambda_{10}^{(n)}$ ...	$\Lambda_{40}^{(n)}$ ...	$\Lambda_{80}^{(n)}$ ...
1880.....	-0.7342	-0.6838	-0.4234	0.7837
1890.....	-0.8309	-0.7851	-0.5362	0.7377
1900.....	-0.9769	-0.9340	-0.6712	0.6883
1910.....	-1.0682	-1.0197	-0.7815	<b>0.5895</b>
1920.....	-1.1540	-1.1069	-0.8680	<b>0.5359</b>
1930.....	-1.3073	-1.2546	-0.9993	<b>0.4542</b>
1940.....	-1.4553	-1.4081	-1.1513	<b>0.3533</b>
1950.....	-1.6628	-1.6222	<b>-1.3861</b>	
1960.....	-1.7913	-1.7619	<b>-1.5263</b>	
1970.....	-1.8650	-1.8407	<b>-1.6084</b>	
1980.....	-1.9918	-1.9711	<b>-1.7421</b>	
1990.....	-2.1186	-2.1015		
2000.....	-2.2454	-2.2319		
2010.....	-2.3722	-2.3623		
2020.....	-2.4990			
Difference.....	-0.1268	-0.1304	-0.1337	-0.1109

Source: R. Golulapati, J. W. De Ravin, and P. J. Trickett, *Projections of Australian Mortality Rates*. Occasional Paper No. 1983/2 (Canberra, Australian Bureau of Statistics, 1984).

NOTE: Figures in bold print are projected rather than observed.

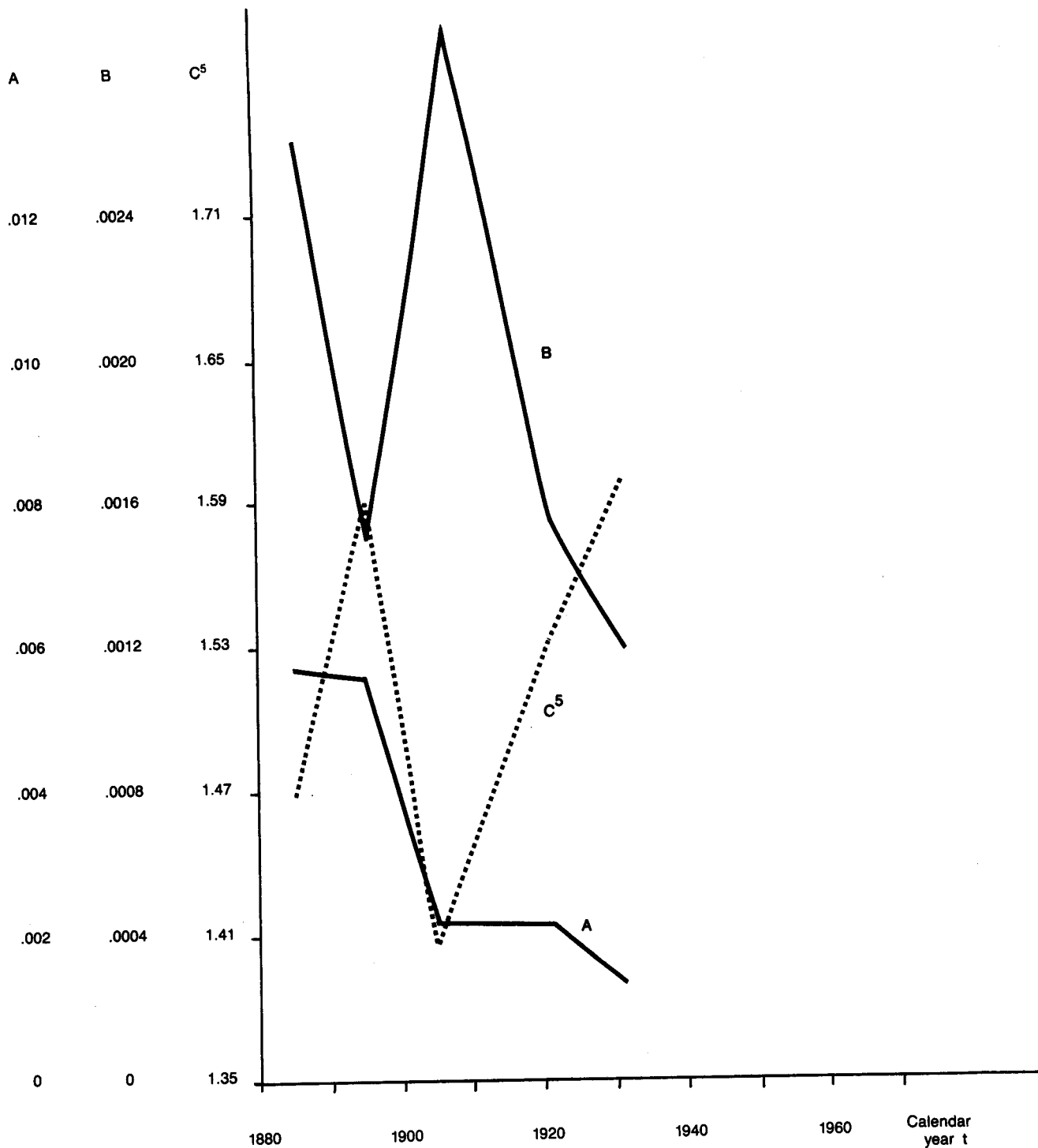
by Cramér and Wold in 1935. The method failed when it was applied in 1949 to the considerably shorter sequence of Australian mortality rates by Pollard (1949), because the small number of observations on the parameters provided no discernible time trend. Indeed, the Makeham parameters appeared to interact with one another (particularly  $B$  and  $c$ ).

The explanation for this phenomenon seems to be as follows: Observed mortality rates at a particular epoch, for example, might suggest spuriously a more curved  $\mu_x$  function than at previous epochs and hence a larger value of  $c$ . If the parameter  $B$  is not correspondingly reduced, mortality rates at the higher ages will be exaggerated. Thus, as a result of the largely spurious increase in  $c$ , a spuriously exaggerated fall in  $B$  is obtained, and conversely, if the observed  $\mu_x$  function becomes less curved. Figure III, which is taken from Pollard (1949), exhibits these features.

Heligman and Pollard (1980) fitted their eight-parameter curve to Australian mortality at three epochs: 1947, 1961 and 1971. Surprisingly, each of the eight



Figure III. Variation of Makeham parameters over time in Australian males aged 30-60



Source: A. H. Pollard, "Methods of forecasting mortality using Australian data", *Journal of the Institute of Actuaries*, vol. 75 (1949), pp. 151-170.

parameters seemed to exhibit an apparent trend, allowing perhaps reasonable extrapolation, although the authors were not actually attempting mortality projection. Davidson and Reid (1927) avoided the problem by fixing the Makeham constant  $c$  and allowing only the remaining two parameters  $A$  and  $B$  to vary.

*Comments on the method*

The following observations on the method may be made:

- (a) The method has a certain theoretical appeal;
- (b) The extensive numerical work involved in fitting

a particular law can usually be readily handled on a modern computer;

(c) It may be difficult to find a suitable law;

(d) The method may be limited to those ages for which the particular law is applicable;

(e) Even if a suitable law can be found, it may be applicable only to the data at certain epochs;

(f) Even when a clear trend is evident in mortality rates at all ages, variations in the law parameters over time may not follow a clearly discernible pattern;

(g) When very extensive data are available over a long period of time (as, for example, in Sweden), the method may be successfully applied because long-term trends in the parameters will still be evident, despite the apparent lack of discernible trends over shorter periods;

(h) Independent extrapolation of individual parameters may lead to projected mortality rates which are quite unreasonable;

(i) The method (as described) takes no direct account of collateral information which may be available to the forecaster—e.g., trends in population smoking habits, discernible trends in mortality by certain causes and known or suspected reasons for these trends.

(j) The method (as described) cannot be applied when data are available only at a single epoch.

#### *Generation vs. period data*

There is no reason why the formula for a particular law should not be fitted to the age-specific mortality experiences of successive generations, and trends in the parameters over generations extrapolated. Various authors have done so (e.g., Cramér and Wold, 1935; Davidson and Reid, 1927). The main difficulty is of course the practical one that statistics for well over a century are required if a trend is to be discernible by this method, and such data are rarely available.

#### *A few concluding remarks on the method*

Although projection by reference to a law of mortality has some intuitive appeal, the disadvantages listed above mean that the method is usually difficult to apply in practice and rates projected in this manner may be open to suspicion. Other methods described in this paper appear to be preferable.

It is interesting to note, however, that in a recent paper, Benjamin (1982) envisages the development of a number of key markers to describe the curve of deaths (the  $l_x\mu_x$  curve)—e.g., the location and height of its peak, the point of inflexion on the descent etc. If each of these key markers has a simple interpretation and as a group they allow an accurate reproduction of the curve of deaths, and if trends in each key marker over time (or over generations) are evident which allow extrapolation, then a method of projection by reference to key markers of the curve of deaths might be feasible.

### PROJECTION BY REFERENCE TO MODEL LIFE TABLES

#### *Background*

Various systems of model life tables have been developed over the past quarter century (Brass, 1971;

Coale and Demeny, 1966; Ledermann, 1969; Organisation for Economic Co-operation and Development, 1980; United Nations, 1955 and 1982). They are particularly useful for estimating complete life tables or abridged life tables from limited mortality data. They can also be employed for projecting mortality.

While the method of projection by reference to model life tables may be thought of as a special case of the method of projection by reference to a law of mortality (or vice versa), the approach is sufficiently different to warrant a separate discussion. Furthermore, when certain systems of model life table are employed, the model life table approach can also be thought of as an example of projection by reference to "more advanced" populations (see below).

#### *Description of method*

A system of model life tables may involve only a single parameter (Coale and Demeny, 1966, for example) or may involve two or more parameters. The simplest case is of course the one-parameter system, and we outline the approach in terms of such a system. The steps are as follows:

1. A system of model life tables is chosen which, it is believed, represents and will continue to represent the mortality of the population of interest (e.g., Coale and Demeny "West" tables (1966)).
2. The parameter of the system (e.g.,  $e_x$ ) is measured in the population at each of several epochs.
3. Any trend in the parameter is extrapolated graphically or by mathematical formula to provide estimates of the parameter at future epochs.
4. Projected age-specific mortality rates are obtained by entering the model life table system for the various projected values of the parameter.
5. To adjust for the fact that the observed base mortality rates in the population may not coincide with those in the model life table having the same parameter, the relative projected change on the model life table mortality rates is applied to the observed base mortality rates of the population.

#### *Selected example of the use of the method*

This method is one of several used by the Center for International Research at the United States Bureau of the Census. The single parameter normally used is  $e_x$ , which is extrapolated in many cases by using the logistic (Arriaga, 1984). The results obtained by this method are apparently very similar to those obtained by reference to an "optimal" life table attainable under ideal conditions (see below).

#### *Comments on the method*

The following observations may be made:

(a) Most model life table systems are based on collections of life tables from different countries and different epochs. Even if the model life table system fits the age-specific mortality pattern of the population reasonably well under current conditions, the extrapolation procedure assumes essentially that the population will

adopt, as times goes by, the mortality already experienced by other more advanced populations;

(b) In the case of a one-parameter system, a clear trend in that parameter will usually be evident. When two or more parameters are available, complications like those mentioned above in respect of Makeham's law may arise. It would appear, however, that a one-parameter system is usually used;

(c) The method (as described) takes no direct account of collateral information which may be available to the forecaster—e.g., trends in population smoking habits, discernible trends in mortality by certain causes, and known or suspected reasons for these trends;

(d) If detailed data are available only at a single epoch, the method can still be applied provided there is some evidence of the likely trends in the parameters. In this situation, a single-parameter system will usually be easier to apply;

(e) This approach is one of several commonly employed for projecting the mortality of less developed populations.

#### *Generation vs. period data*

The contexts in which this method is normally adopted usually dictate that a cross-sectional approach be adopted.

#### *The Brass two-parameter logit system*

The logit transformation

$$\Lambda_x = \frac{1}{2} \ln \left( \frac{l_o - l_x}{l_x} \right) \quad (15)$$

was introduced above. Brass has observed empirically that  $\Lambda_x$  can be expressed as a linear function of the logit  $\Lambda_x^s$  in a standard population. In other words

$$\Lambda_x = \alpha + \beta \Lambda_x^s \quad (16)$$

where  $\alpha$  and  $\beta$  are more or less independent of  $x$ . The relationship (16) "works remarkably well for broad descriptive purposes, in reproducing how mortality varies between populations and over time, although refinements of local deviations at particular ages are not delineated" (Brass, 1974).

For the purpose of projecting mortality, use of the Brass two-parameter logit system reduces the problem to the extrapolation of two times series,  $\alpha(t)$  and  $\beta(t)$ . "The approach is simpler than projecting separately for each age group, treating each specific death rate as a separate independent measurement, when they are clearly dependent" (Brass, 1974). For best results, the standard life table needs to be chosen carefully.

When applied to long series of generation data such as those of Sweden or the United Kingdom and when the standard table is actually one of the generation tables from the series, the parameter  $\alpha$  moves steadily with falling death rates, while  $\beta$  fluctuates about 1, but has a strong tendency to return to this central value. The method, however, is perhaps more useful for projecting developing country mortality, and then the long series of data for generation analysis is not available.

The drawback to the logit transformation described above still applies. However, the inconsistency mentioned does not arise, because the  $\alpha$  and  $\beta$  parameters apply to the whole life table rather than individual age ranges.

### PROJECTION BY REFERENCE TO A "MORE ADVANCED" POPULATION

#### *Background*

This is one of the commonest methods of mortality projection, adopted in respect of both developed and less developed countries.

#### *Description of method*

The method may be summarized as follows:

(a) A more advanced population with adequate mortality statistics is chosen, having a mortality history which, it is hoped, the population under consideration will emulate.

(b) The mortality characteristics of the population under consideration are compared with those of the more advanced population.

(c) Similarities are noted. For example, it may be that the mortality of the population under consideration is much the same as that of the more advanced population with a lag of, say, 20 years, which appears to be slowly shortening.

(d) Projections of mortality for the population under consideration are taken as those mortality rates already experienced by the more advanced population and (when necessary) projected for the more advanced population, taking account of the patterns noted under formula (3) (e.g., time lag and change in time lag).

#### *Selected examples of the use of the method*

The Central Statistical Office of Finland currently bases its medium "most probable" mortality rates on the experience of its neighbour Sweden (Niitamo, 1984). Observed mortality rates are reduced in the projection according to the trend in the age- and sex-specific development over the last 15 years to the recorded 1980 level in Sweden.

Wattelar (1984) and her co-workers involved in the updating of regional population projections for Belgium are using the mortality experience of the Netherlands with a time lag of 10 years for mortality projection purposes.

New Zealand mortality in the 1930s was the lightest in the world, and it was used in the period immediately after the Second World War as a model for projecting the mortality of other countries. A projection in 1954 of Japanese mortality by Okazaki (1954) assumed a smooth decline in Japanese mortality of 1948, age by age, until the level of the 1934-1938 New Zealand mortality was attained in 1965 (Preston, 1974). This involved a growth in expectation of life at birth for males of 10.1 years, from 55.6 to 65.7, and for females of 8.9 years, from 59.4 to 68.3. No improvement in mortality was projected beyond 1965.

### *Comments on the method*

A wide variety of approaches is possible within this general framework, varying from merely accepting as a projection of a nation's mortality the past experience of a "more advanced" population to accepting a "more advanced" population's current mortality as the ultimate possible for the population under consideration and moving towards that ultimate in a chosen manner. Some general comments may be made, however.

(a) It may be difficult to find a suitable "more advanced" population;

(b) A lot is left to the discretion of the forecaster—for example, whether the lag between the mortality experience of the two populations is permanent or how quickly it will shrink;

(c) The method may take indirect account of collateral information which may be available to the operator—e.g., discernible trends in mortality by cause, and known or suspected reasons for these trends, public health measures which are expected to have an impact on certain causes of death etc.;

(d) Great care must be exercised in choosing the "more advanced" population. One of the longest series of life tables is that of England and Wales, and these are sometimes used for projecting mortality in currently less developed countries. Preston (1976) urges extreme caution in the use of these tables because the mortality decline appears to be atypical when cause of death is analysed and compared with improvements elsewhere;

(e) With a considerable increase in uncertainty, the method can be applied when data are available only for the population under consideration at a single point of time. The forecaster then has to use considerable judgement in deciding how his population will emulate the more advanced population.

### *Generation vs. period data*

Once again there is no reason why the method of projection by reference to a more "advanced population" could not be applied to generation rather than period data. The method, however, is very often applied in respect of societies with limited data, and in this situation observed generation mortality data for the population under consideration will be non-existent. Even when the method is applied to developed populations with long series of mortality data, the cross-sectional approach is normally adopted.

### PROJECTION BY REFERENCE TO AN "OPTIMAL" LIFE TABLE ATTAINABLE UNDER IDEAL CONDITIONS

#### *Background*

Several writers have addressed the question: "What is the optimal life table one could expect in respect of a given population?" and a variety of approaches have been adopted in an attempt to answer it.

For example, in 1947, Whelpton, Eldridge and Siegel (1947) studied the age-specific mortality rates in each of the states in the United States, and noted that the mortal-

ity rates in states with low mortality at any given time indicated the likely death rates for the nation as a whole some years later. The data suggested that the lag was shorter for the younger ages (about a decade) than for the older ages. Armed with this information, they estimated expectations of life at birth of 68.4 and 71.8 for males and females, respectively, on the basis of individual state mortality rates in 1940. On the assumption that advances in public health and living standards would make it possible even to exceed these expectations, they concluded that the figures represented lower bounds for the year 2000. Using data from other nations rather than state data, and the same reasoning, they obtained remarkably similar expectations: 68.6 and 70.9, respectively. (Cause-of-death trends were also used less formally and on a regional basis to estimate attainable reductions in mortality.)

Bourgeois-Pichat (1952) asked a not dissimilar question: "Can mortality decline indefinitely or is there a limit, and if so, what is this limit?" He distinguished two categories of deaths: those that were exogenous (provoked by health conditions etc.) and those that were endogenous (coming from within). Using six broad groupings of cause of death and Norwegian data, Bourgeois-Pichat estimated ultimate expectations of life of 76.3 and 78.2 for males and females, respectively.

More recently, Benjamin (1982) has made some "extreme assumptions" about improvements in mortality by cause in an attempt to come up with a life table under optimal conditions. In brief, he assumed:

(a) Congenital/early infancy diseases reduced to one third;

(b) Smoking drastically reduced, eliminating 90 per cent of lung and bronchus cancer deaths and one third of pre-65 ischaemic heart disease deaths;

(c) Remaining heart disease deaths, cerebrovascular and other circulatory disease deaths deferred 10 years;

(d) Bronchitis, emphysema and asthma deaths prevented;

(e) Other cancer deaths eliminated;

(f) Accidental death unchanged;

(g) Small residual deaths from tuberculosis and diabetes;

(h) Unspecified causes of death deferred 10 years.

On this basis and using England and Wales data, he estimated an ultimate expectation of life at birth of 81.3 for males and 87.1 for females.

In determining an "optimal" life table, it is clear that causes of death need to be considered in two classes: those which are due to external environmental causes not associated with the aging process, and those due to aging. Hayflick (1981) argues that normal physiological decrements would still result in death on or about the 100th birthday and leave the human life-span unextended, even if cures were found for the exogeneous causes of death, because biomedical research has tended to concentrate almost exclusively on the disease-associated causes of death rather than on aging. Biological evidence in fact suggests that the underlying causes of biological aging act in clock-like fashion and dictate for each species a maximum life span.

With more and more persons living closer to the maximum life span, the  $l_x$  curve has tended to become more and more rectangular in appearance. Not all workers agree that age at death is being compressed in this manner, however. Myers and Manton (1984), for example, note that while the expectation of life has been increasing over time, the standard deviation of the age at death is also increasing, and they conclude that increased dispersal of ages at death is evident rather than mortality compression.

#### *Description of method*

The essential steps in this method are the following:

1. A suitable optimal life table attainable under ideal conditions is selected from those developed by other researchers or developed from the population's own cause-of-death data, taking account of optimal improvements for each cause along the lines suggested by Benjamin (1982).
2. A decision is taken as to how the population will approach the optimal mortality schedule and how quickly it will do so. A formula like (3) will often be adopted, with  $\alpha_x$  the optimal mortality rate at age  $x$ .
3. Once these two steps are complete, the calculation of the projected rates of mortality is straightforward.

#### *Selected examples of the use of the method*

The method of projecting mortality by reference to an "optimal" life table attainable under ideal conditions has been adopted by the Centro Latinoamericano de Demografía (CELADE) for projecting Latin American mortality (Arriaga, 1984; Organisation for Economic Co-operation and Development, 1980; Pujol (1982)). The optimal life table has been that of Bourgeois-Pichat (1952) and the logits at the various ages are assumed to move in a linear fashion over a given period of time from those of the base population to those of the ideal table.

#### *Comments on the method*

The following may be said of the method:

- (a) Once the ideal mortality table is available and the method of approach to that ideal mortality has been decided, the computations are straightforward;
- (b) A lot is left to the discretion of the forecaster in selecting or developing the "ideal" life table and in determining how the population mortality will approach the ideal;
- (c) In determining the manner in which the population will approach the deal, account may or may not be taken of collateral information about trends in population smoking habits, discernible trends in mortality rates by cause and known or suspected reasons for these trends, etc.;
- (d) Provided the ideal life table is appropriate, the method should produce reasonable and self-consistent results.

#### *Background*

Mortality rates for certain causes are now so small in many developed populations as to be negligible. In respect of these causes, the populations concerned are approaching an "ideal" mortality pattern. At the same time, mortality rates for other causes are very significant and may even be rising. It seems to be generally accepted, therefore, that accurate projections of age-specific mortality for developed populations require an analysis of mortality by cause (Vallin, 1984).

Mortality projections by the separation of causes of death have in fact been performed since the 1940s. How well have these projections fared? The answer, at least in certain cases, seems to be "quite well". Selected examples are given below.

#### *Description of method*

The method of projection by cause of death may be summarized as follows:

1. Cause-of-death statistics are used to calculate age-specific mortality rates by cause at each of several recent epochs for selected ages.
2. The age-specific mortality rates by cause are projected separately for the selected ages, using one of the methods already outlined in the sections above.
3. The projected age-specific mortality rates by cause are then combined to yield the projected mortality rates at the selected ages.
4. Projected mortality rates at the intervening ages are found by interpolation or by an abridged life table technique.

#### *Selected examples of the use of the method*

Various methods of projecting mortality were studied by A. H. Pollard (1949) using Australian data of only five experiences, centred in the years 1885-1886, 1895-1896, 1905-1906, 1921 and 1933. Among them was a period cause-of-death projection, which distinguished 13 cause groups: influenza, pulmonary tuberculosis, epilepsy, bronchitis and pneumonia, accidents, growths, intercranial lesions, diabetes, nephritis, appendicitis, diseases of the circulatory system, ulcers of the stomach and duodenum, and other causes. Mortality rates for these causes were calculated for selected ages for each of the years 1921-1938 and projected forward graphically towards 1970.

The projected age-specific mortality rates obtained by combining the projected age-specific rates by cause were appreciably higher than the rates obtained by any other method, reflecting the rapidly rising mortality rates from circulatory system diseases and, to a lesser extent, accidents. Indeed, the projection by cause indicated a levelling off of the mortality decline and a rise at the higher ages into the mid-1960s—a most unexpected result at the time and one which appeared most unlikely! None of the other methods predicted a rise. In the event, of course, the projection by cause turned out to be remark-

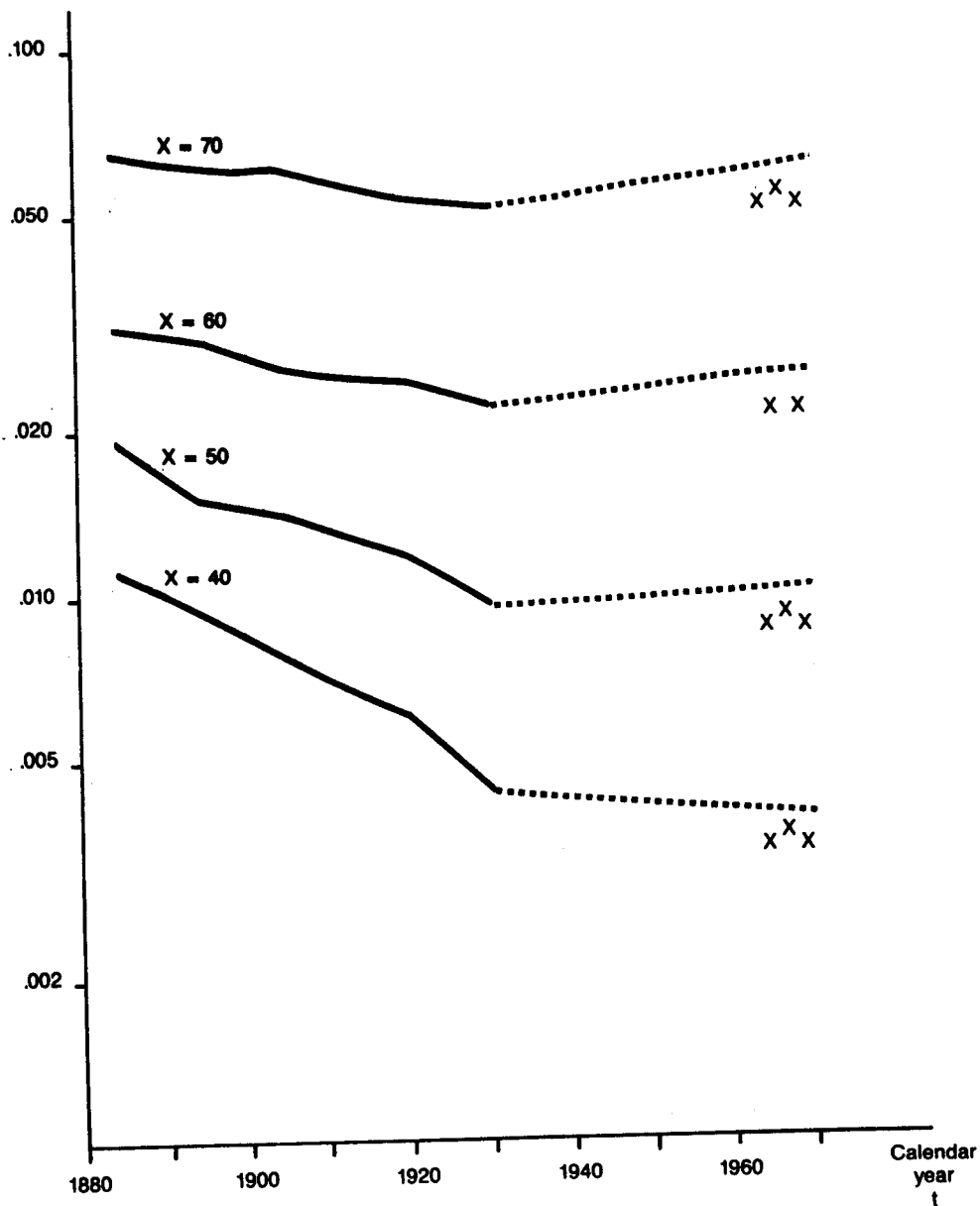
ably accurate over the 30-year period from 1938 to 1968 (figure IV).

According to Preston (1974), a similarly accurate projection of Canadian mortality would have emerged from the Dominion Bureau of Statistics, had cause of death been taken into account. Preston's comments are illuminating:

"It is interesting to note that the attenuated trend in male mortality in 1951-1960 might have been predictable had the projections taken causes of death into account. Male mortality from neoplasms was stable

and from cardiovascular diseases rising in the period 1941-1951. These trends were obscured in the overall figures by major declines in the mortality from infectious diseases. But these infectious diseases had reached such low levels by 1951 that the same rate of decline for them would have had relatively little absolute impact. The emerging degenerative diseases should thus have come to play a much more important role in the projections. The failure to discriminate among causes of death in the projections obscured these fundamental shifts that were occurring in the

Figure IV. Forecast of Australian male mortality over the 30-year period 1938-1968 by the cause-of-death method



NOTE: Actual 1961, 1967 and 1971 mortality rates for the various ages are indicated by crosses. Other methods produced projected mortality rates in line with the pre-1938 trends and failed to predict the levelling off of mortality in the 1960s.

structural determinants of mortality and were largely responsible for the errors in prediction."

Some of the more sophisticated recent work in projecting mortality rates has been done by actuaries in the United States Social Security Administration. These workers consider age-specific mortality rates by cause (in 10 broad categories) and project the mortality rates for each cause separately, using the geometric progression approach (formula (1)) (Faber, 1983; Spencer, 1984; United States Department of Commerce, 1977; Wilkin, 1983).

#### *Comments on the method*

The following observations may be made:

(a) The method requires reliable cause-of-death statistics at several recent epochs;

(b) Changes in the International Classification of Diseases, changes in medical diagnosis and medical "fashions" can make comparisons over a number of years difficult. These problems are minimized if fairly broad groupings of causes are used;

(c) A considerable amount of arithmetic is involved;

(d) In making projections of the rates of mortality by cause, the forecaster can take account of trends in factors known (or suspected) to affect the various mortality rates by cause;

(e) Cause-of-death statistics are non-existent or of dubious quality in most developing countries. For this reason, projection of mortality by separation of causes of death will rarely be attempted. It is interesting to note that Lopez and Hull (1982) have recently employed a technique due to Preston (1976) to estimate the cause-of-death structure in high-mortality populations. If their method, or one akin to it, proves reliable, mortality projections by cause may no longer be beyond implementation for developing regions.

#### *Generation versus period data*

For some causes of death, cohort plots appear to provide the soundest base for projection. For other causes, cross-sectional data appear to be more appropriate. Recent work, for example, in the Medical Statistics Division of OPCS in the United Kingdom (1984) suggests that in respect of diseases associated with smoking, the cohort or generation approach is preferable.

#### WHICH METHOD?

The choice of method must depend upon the data available and their reliability, the resources available for the project, and the purpose for which the projection is required. If an accurate projection of national age-specific mortality is required in respect of the population of a developed country with reliable detailed mortality statistics over a long period, the evidence seems to be that the cause-of-death approach is appropriate. The considerable work involved will usually be worthwhile.

In the case of a pensions actuary wishing to project mortality to determine annuity prices, the situation is rather different. One must not overestimate mortality or the company's financial situation may be endangered; at

the same time, an underestimate will undermine the company's competitive position. The mortality data one has at one's disposal will usually be extensive and accurate, but not subdivided by cause of death. Furthermore, and more importantly, the more remote survival rates  $\{l_x\}$  one determines on the basis of one's projected mortality rates will be discounted heavily at the rate of interest the company expects to earn. In this situation, projection by extrapolation of mortality rates at selected ages will probably be the more appropriate method. In choosing mortality reduction factors, the actuary will probably be guided by mortality trends in the national population for which cause-of-death statistics are available.

Demographers working with data from less developed countries probably have the same objective as their more fortunate colleagues in developed countries; they may have reasonably reliable estimates of current age-specific mortality but are unlikely to have a reliable series of such schedules. They will not have reliable cause-of-death statistics to work with, although very approximate figures for broad groups of causes which are major killers may be available. In this environment, they are likely to make their mortality projections by the model life table approach or by reference to the mortality experience of a more advanced population or by reference to an optimal life table attainable under ideal conditions. The method adopted will depend to some extent on personal preference but also on the extent to which the method allows the demographers to draw into their calculations the various pieces of collateral information they have at their disposal (e.g., very approximate figures of mortality by cause for certain major killers and possible trends in these figures). It would be dangerous for them to employ the methods of projection by extrapolation of mortality rates without reference to the mortality experience of a more developed population or an ideal life table.

Projected mortality rates for certain age groups are sometimes of prime importance—e.g., children aged 1-4, females of child-bearing ages and pensioners (those over 65). Not all the methods of projection by extrapolation of mortality rates handle these specific age groups equally well. We have already seen, for example, that the Brass two-parameter logit transformation and the related logit transformation method are fairly insensitive to mortality rates at individual ages, and as a result are unlikely to produce particularly reliable projected mortality rates at childhood and maternal ages. Better results will probably be obtained by basing the projection on the mortality experience of more advanced populations—e.g., those comprising the data base of a set of model life tables.

#### CONCLUDING REMARKS

The methods described above essentially look at current age-specific mortality rates for a particular population and extrapolate them in the light of recent trends which are evident in the population itself, or by reference to improvements which have previously been



observed in a more advanced population or in those populations contributing to a model life table data base.

If the forecaster wishes to address the problem of estimating how an exogenously determined overall mortality improvement might be expected to be distributed by age, and has little evidence of the underlying trends in the population under consideration, the best guidance available is the previous experience of a more advanced population or those more advanced populations comprising the data base of a set of model life tables. When trends are evident for the population under consideration and are not the result of direct health intervention programmes, then they should be taken into account in the projected age-specific effect of the exogenously determined mortality improvement.

If, on the other hand, the important question is the likely effect of a special intensive health intervention programme, the projection would need to take account as far as possible of mortality by cause.

#### ACKNOWLEDGEMENTS

Much of the writing on mortality projection appears in internal working papers prepared by official statisticians and demographers. Those articles which are more readily available tend to be published in a wide variety of journals. I am indebted to the following friends and colleagues who helped me in the task of tracking down some of the relevant material: E. E. Arriaga, H. Behm, B. Benjamin, A. M. Bolander, R. L. Brown, L. Heligman, A. D. Lopez, G. C. Myers, O. E. Niitamo, A. H. Pollard, G. N. Pollard, S. Preston, J. Qvist, L. Ruzicka, J. Vallin, C. Wattelar and G. Wunsch.

#### REFERENCES

- Anderson, J. L. and J. B. Dow (1964), *Actuarial Statistics*, vol. 2 (Cambridge, Cambridge University Press), pp. 183-192.
- Arriaga, E. E. (1984), Personal communication on mortality projection methods employed at the United States Bureau of the Census.
- Benjamin, B. (1982), "The span of life", *Journal of the Institute of Actuaries*, vol. 109, pp. 319-340.
- Benjamin, B. and J. H. Pollard (1980), *The Analysis of Mortality and Other Actuarial Statistics* (London, Heinemann), pp. 22-25, 299-320.
- Bourgeois-Pichat, J. (1952), "Essai sur la mortalité 'biologique' de l'homme", *Population*, vol. 3, pp. 381-394.
- Brass, W. (1971), "On the scale of mortality", in W. Brass, ed., *Biological Aspects of Demography* (London, Taylor and Francis).
- \_\_\_\_\_. (1974), "Mortality models and their uses in demography", *Transactions of the Faculty of Actuaries*, vol. 33, pp. 123-132.
- Coale, A. J. and P. Demeny (1966), *Regional Model Life Tables and Stable Populations* (Princeton, Princeton University Press).
- Cramér, H. and H. Wold (1935), "Mortality variations in Sweden", *Scandinavian Actuarial Journal*, vol. 11, pp. 161-241.
- Davidson, A. R. and A. R. Reid (1927), "On the calculation of rates of mortality", *Transactions of the Faculty of Actuaries*, vol. 11, pp. 183-232.
- Derrick, V. P. A. (1927), "Observations on (1) errors of age in the population of England and Wales and (2) the changes in mortality indicated by the national records", *Journal of the Institute of Actuaries*, vol. 58, pp. 117-159.
- Dixon, D. and C. White (1983), "A long-run assessment of Commonwealth income transfers to the aged", *Economic Papers*, vol. 2, No. 4, pp. 1-12.
- Dominion Bureau of Statistics (1950), "Memorandum on the projection of population statistics" (84-D-69) (Ottawa).
- \_\_\_\_\_. (1954), "Memorandum on the projection of population statistics" (84-D-69A) (Ottawa).
- Faber, J. F. (1983), *Life Tables for the United States: 1900-2050*. Actuarial Study No. 87 (Baltimore, United States Social Security Administration).
- Golulapati, R., J. W. De Ravin and P. J. Trickett (1984), "Projections of Australian mortality rates". Occasional Paper No. 1983/2. (Canberra, Australian Bureau of Statistics).
- Hayflick, L. (1981), "Biological aspects of ageing" in S. H. Preston, ed., *Biological and Social Aspects of Mortality and the Length of Life* (Liège, International Union for the Scientific Study of Population).
- Heligman, L. and J. H. Pollard (1980), "The age pattern of mortality", *Journal of the Institute of Actuaries*, vol. 107, pp. 49-80.
- Hobcraft, J. and W. Gilks (1984), "Age, period and cohort analysis in mortality studies", in J. Vallin, J. H. Pollard and L. Heligman, eds., *Methodologies for the Collection and Analysis of Mortality Data* (Liège, International Union for the Scientific Study of Population).
- Institute of Actuaries and Faculty of Actuaries (1979), *Tables for Annuitants* (Alden Press, for the Institute of Actuaries and Faculty of Actuaries).
- Kermack, W. O., A. G. McKenrick and P. L. McKinlay (1934), "Death rates in Great Britain and Sweden; expression of specific mortality rates as products of two factors and some consequences thereof", *Journal of Hygiene*, vol. 34, pp. 433-457.
- Ledermann, S. (1969), *Nouvelles tables-types de mortalité* (Paris, Institut national d'études démographiques).
- Lopez, A. D. and T. H. Hull (1982), "A note on estimating the cause-of-death structure in high-mortality populations", *Population Bulletin of the United Nations*, No. 14 (United Nations publication, Sales No. E.82.XIII.6).
- Medical Statistics Division, Office of Population Censuses and Surveys, United Kingdom (1984), "Projection of age-specific mortality trends in England and Wales", paper presented to a seminar organized by OPCS.
- Myers, G. C. and K. G. Manton (1984), "Compression of mortality: Myth or reality?", *The Gerontologist*, vol. 24, pp. 345-353.
- Niitamo, O. E. (1984), Personal communication on the projection techniques of the Central Statistical Office of Finland.
- Okazaki, A. (1954), "The present and future of Japan's population", paper prepared for the 12th conference of the Japanese Institute of Pacific Relations, Kyoto.
- Organisation for Economic Co-operation and Development (1980), *Mortality in Developing Countries*, vol. III. *New Model Life Tables for Use in Developing Countries* (Paris).
- Ortega, A. (1983), "Tablas limite de mortalidad preparadas en CELADE San José para su uso en proyecciones de población" in *Centro Latinoamericano de Demografía. Notas de Población*, Año XI, No. 31 (San José).
- Pollard, A. H. (1949), "Methods of forecasting mortality using Australian data", *Journal of the Institute of Actuaries*, vol. 75, pp. 151-170.
- Preston, S. (1974), "An evaluation of postwar mortality projections in Australia, Canada, Japan, New Zealand and the United States", *World Health Statistics Report. Special subject II* (Geneva, World Health Organization).
- \_\_\_\_\_. (1976), *Mortality Patterns in National Populations* (New York, Academic Press).
- Pujol, J. M. (1982), "Procedimientos de proyección de la mortalidad utilizados en CELADE", paper presented at the Population Projection Seminar, San José, October 1982.
- Qvist, J. (1984), Personal communication on the projection of Swedish national mortality rates.
- Rhodes, E. C. (1941), "Secular changes in death rates", *Journal of the Royal Statistical Society*, vol. 104, pp. 15-33.
- Society of Actuaries (1981), "Report of the Committee to recommend a new mortality basis for individual annuity valuation (derivation of the 1983 Table a)", *Transactions of the Society of Actuaries*, vol. 33, pp. 675-735.
- Spencer, G. (1984), *Projections of the Population of the United States, by Age, Sex, and Race: 1983 to 2080* (Washington, D.C., United States Department of Commerce, Bureau of the Census). Population estimates and projections. Series P-25, No. 952.
- Statistics Sweden (1983), *Population Projection for Sweden 1983-2025*. Forecasting Information 1983:2 (Stockholm).
- United Kingdom, Government Actuary's Department (1965), "Project-

ing the population of the United Kingdom", *Economic Trends* (May 1965), iii (London, H. M. Stationery Office).

United Nations (1955), *Age and Sex Patterns of Mortality: Model Life Tables for Underdeveloped Countries* (United Nations publication, Sales No. 1955.XIII.9).

\_\_\_\_ (1982), *Model Life Tables for Developing Countries* (United Nations publication, Sales No. 81.XIII.7).

United States Department of Commerce, Bureau of the Census (1977), *Projections of the Population of the United States: 1977 to 2050* (Washington, D.C., Government Printing Office). Population Estimates and Projections. Series P-25, No. 704.

Vallin, J. (1984), Personal communication on the projection of mortality in developed countries.

Wattelar, C. (1984), Personal communication on the mortality projection techniques used in the updating of regional population projections for Belgium.

Whelpton, P. K., H. T. Eldridge and J. S. Siegel (1947), *Forecasts of the Population of the United States 1945-75* (Washington, D.C., United States Department of Commerce, Bureau of the Census).

Wilkin, J. C. (1983), *Social Security Area Population Projections, 1983*. Actuarial Study No. 88 (Baltimore, United States Social Security Administration).

# INTERNATIONAL CO-OPERATION IN THE AREA OF POPULATION

*United Nations Secretariat\**

## SUMMARY

The Fifth Population Inquiry among Governments, conducted by the United Nations Secretariat in 1983, contained for the first time a section on technical co-operation in the population field. That section, which was ultimately answered by 118 countries out of the 166 originally addressed, queried Governments on the nature of technical co-operation received in the past; the specific need(s), if any, for co-operation in the population field in the future; and their policies, programmes or priorities in this area, as well as experiences with past technical co-operation activities. This paper analyses in detail the responses received, on a regional and inter-regional basis, and derives, *inter alia*, a pattern of past and future population technical co-operation priorities that correlates well across most regions as well as with the statement of priorities issued in the Report of the International Conference on Population. For example, all of the major developing regions except Asia and the Pacific assigned highest priority to basic demographic data collection, analysis, and associated training, leading to the formulation, implementation and evaluation of population policies and programmes, while the area of family planning programmes was ranked lowest in priority, except in the Asia and Pacific region.

## INTRODUCTION

A special section on the past and anticipated future activities concerning international co-operation in the area of population was introduced in the Fifth Population Inquiry among Governments, conducted by the United Nations Secretariat in 1983. The previous four Inquiries (the first organized in 1964), while focusing generally on governmental perceptions and policies in reference to population and, occasionally, on specific subthemes within that context, had never before addressed the issue of how Governments viewed the efforts of international co-operation in the area of population. In view of the growing importance attached to those activities by a number of countries over the past several decades, however, it was decided to include a section to the subject for the first time in the 1983 Inquiry. The following constitutes a preliminary analysis of the 118 responses received; the breakdown of countries by regions is given in annex I.<sup>1</sup> Some of the data presented here were summarized in an earlier, preliminary report covering 91 responses received by mid 1983 (E.CN.9/1984/3, pp. 39-41).

The section (8. International co-operation in the area of population) is reproduced in annex II. It comprises only three major questions, dealing with the receipt by the Government of any international technical co-

operation and its relative contribution to the achievement of progress towards population goals and policies and the promotion of knowledge and policies in specific fields; anticipation of the need for international technical co-operation in the next decade in areas of specific programme action, with attached priorities indicated; and a statement of the Government's policies, programmes or priorities, as well as its experience with such technical co-operation in the past.

More than the usual *caveats* apply here with respect to the accuracy of the analysis attempted and the findings that result. Since this is the first time that technical co-operation activities in the population field have been inquired into in this fashion by the United Nations and since there was no opportunity for a formal pre-test of the module concerned, it is particularly difficult to ensure fully cogent interpretations of many of the answers received. In addition, while the 118 responses received comprise a substantial proportion—71 per cent—of the total 166 addressed, any regional comparisons also have to be viewed with the missing 29 per cent of countries in mind. Also at issue was the question of who filled out questionnaires of this kind in each country concerned, based on what degree of complete, pertinent knowledge, and how correspondingly comparable responses really were, across national and regional boundaries. Finally, since at this state it is not possible to conduct the detailed comparison between the responses to section 8 and the other major sections of the Inquiry—comparisons that may well provide much additional insight, after they have in due course been performed—this, too, must be

\*Population Programmes and Projects Branch, Development Administration Division, Department of Technical Co-operation for Development.

viewed as a potential weakness in the analysis at this stage. Withal, however, it is axiomatic that analysis of the responses from the countries concerned, however flawed, is almost certain to provide a better view of present perceptions of the past and future role of technical co-operation in the population field than other, essentially *a priori* perceptions from afar.

#### ANALYSIS

##### *Receipt by the Government of international technical co-operation and its relative contribution*

Subsection 8.1 asked whether any past support had been received by Governments in the form of technical co-operation for population. Not unexpectedly, the answer from the developing regions and countries was for the most part overwhelmingly in the affirmative, with the ECLAC region leading the way (20 countries out of 20), followed closely by ESCAP (18 countries out of 23, of which only 20 are considered developing, however), ECA (34 out of 39, including two non-responses), and ESCWA (five out of eight, including two non-responses). The ECE/North American region was a different case: only seven of the 28 countries responded in the affirmative, but they were the only two countries—Cyprus and Turkey—in the group considered to be developing. Out of the 89 developing countries responding globally, thus, all but 10 responded in the affirmative to question 8.1, and only six in the negative.

Questions 8.1(a) and 8.1(b) invited Governments to consider the contribution of technical co-operation since 1974 towards the achievement of their population aims in two major sectors: (a) population goals and policies with six subsectors corresponding to those in the World Population Plan of Action—namely, population growth, morbidity and mortality; reproduction, family formation and the status of women; population distribution and internal migration; international migration; and population structure; and (b) promotion of knowledge and policies, with four subsectors, also corresponding to the Plan—namely, data collection and analysis; research; management, training, education and information; and development and evaluation of population policies. The following discussion concerns highlights revealed in each of the two major sectors.

##### *Population goals and policies*

Overall and, with the exception of the ESCAP region, in each major region the past contribution of technical co-operation received a somewhat lukewarm rating by the 89 developing countries responding. In the ECE/North American region, for example, which included two developing countries, the contribution was cited as “high” only once in each of three subsectors: population growth; morbidity and mortality; and reproduction, family formation and the status of women—and then only as “perceived effects . . . on the goals and policies of recipient countries” of the assistance given by a single donor country, by that donor country itself. Similarly, in

the ESCWA region there were only nine positive responses given: three for the subsector on population growth, two each for the subsectors on morbidity and mortality; reproduction, family formation and status of women; and international migration. For ECA only in the subsector on morbidity and mortality was the contribution of technical co-operation viewed as “high” by a significant number of countries (13); 14, however, saw the contribution as “low”; four answered “none” and eight provided no response at all.

The ECLAC region gave a similarly unenthusiastic reading, with the exception, as in ECA, of the morbidity and mortality subsector where 11 out of the 20 countries marked the contribution of technical co-operation as “high”. Only the ESCAP countries provided a reasonably positive ranking of technical co-operation’s past achievements, and then only for the first three subsectors: population growth (11); morbidity and mortality (10); and reproduction, family formation and the status of women (nine).

Overall, there were virtually no positive responses for the subsectors on population distribution and internal migration, and international migration (nine “highs” and two “highs,” respectively, out of 118 responses), and only one region, ECA, gave a relatively positive endorsement of the contribution of technical co-operation in terms of population structure: six positive responses out of 39 (but globally only 13 out of 118). The low readings in the area of migration activities were to be expected, since some countries have only recently made it an issue of national policies, much less of international technical co-operation activities. Similarly understandable was the ESCAP region’s more positive perception of technical co-operation’s contribution in at least the traditionally more “active” sectors of population goals and policies. For the rest, it is not clear whether the wording of the question—in particular, the use of possibly less familiar sector classifications from the World Population Plan of Action (WPPA) to structure the inquiry—itself resulted in the relatively poor showing of technical co-operation on a global basis, or whether this was indeed a genuine perception by the developing countries.

##### *Promotion of knowledge and policies*

Overall, as well as region by region, there was a more positive evaluation of the technical co-operation contribution in the substantive areas included under this heading, with particular regard to the item on data collection and analysis and, to a somewhat lesser extent, to management, training, education and information.

In the ECE region, both developing countries gave positive responses under the subsectors on data collection and analysis, and research, but only one under each of management, training, education and information; and development and evaluation of population policies. But in all the other regions, except ESCWA, there was a generally strong endorsement of technical co-operation’s contribution to data collection and analysis, and to management, training, education and information; a somewhat more equivocal reading on research; and a generally more negative report on development and

evaluation of population policies. Both the ECA and ESCAP regions, probably because of the strong emphasis historically placed on censuses and census data analysis there, ranked technical co-operation efforts highest in that subsector (15 "highs" out of 39, and 12 out of 20 [developing country respondents], respectively), with ESCAP also providing relatively positive readings for the subsector on management, training, education and information (12 "highs" out of 21 responses) and ECA only somewhat less so in percentage terms (12 out of 39). In both cases, only about a third of the responses were "high" for technical co-operation's contribution to research, and in each instance only six countries assigned such a rating to the subsector on development and evaluation of population policies.

The ECLAC pattern is almost the same as that of ECA and ESCAP, except that technical co-operation's contribution to research is seen as slightly higher than "management training . . .", and only two countries out of 20 provided a "high" response for the subsector on development and evaluation of population policies. The ESCWA pattern (only eight countries responding) is also similar, with half (four countries) providing a "high" rating for the subsector on data collection and analysis, and more than a third for each of the subsectors on research and management, training, education and information. No ESCWA country assigned a "high" reading to the subsector on development and evaluation of population policies.

Overall, one is tempted to speculate that the more positive evaluation of technical co-operation's contribution to the sector is, at least in part, a result of greater familiarity with the subsectors listed, by the respondent countries, than in the case of 8.1(a). And, in the case of the mere 13 (out of 118) "high" responses received globally for the "development and evaluation of population policies" subsector, this is again in accord with the informed observer's view of the more recent and correspondingly less complete evolution of comprehensive country population policies, with ESCAP and ESCWA "leading the field" in the area with respect to absolute numbers of perceived "high" technical co-operation contributions to such achievements thus far.

#### *Anticipation of future needs for technical co-operation*

Question 8.2 simply asks whether the Government anticipates a need for technical co-operation in the population field during the next decade, and here the response was overwhelmingly affirmative. All the ECLAC countries replied with a "yes", as did 19 of 23 ESCAP countries and 33 of 39 ECA nations responding. In the ESCWA regions there were five affirmatives and three non-responses, while all seven of the "no" answers in the ECE/North American region came from developed countries, and eight of the nine non-responses in that region were also, not surprisingly, provided by developed countries.

Question 8.2(a) posed a most important, multifaceted question, asking countries to indicate "the overall priority for future programme action areas in which international co-operation" might be requested. The seven areas

of programme action set forth are essentially those major programme areas used and designed by UNFPA—viz., basic data collection and processing; population dynamics, including analysis and training in demographic research; formulation, implementation and evaluation of population policies and programmes; family planning programmes; population communication and education; special programmes, including status of women, children and youth, the aged; and population redistribution programmes. This virtually ensured their familiarity to most, if not all, respondent countries. Finally, in addition to asking for the area to be identified at the appropriate level of priority chosen, the question asked that specific priority components of technical co-operation inputs required be identified, whenever relevant.

The preliminary analysis for this question, regionally, between regions, and globally, consists basically of three parts: a review of priorities assigned to each major area of programme action; a review of major technical co-operation components specified across all these major areas; and finally, a specific review of the most frequently identified components of technical co-operation required for each area of programme action that was identified by countries as one of priority for the next decade. (Annex III contains a pre-coding key of responses received under question 8.2(a), for the benefit of interested readers.)

#### *Priorities assigned to each major area of programme action*

Of perhaps greatest interest is the overall priority assigned to the various sectors themselves. Here, a majority of countries (68 of 118) assigned "high" priority to "population dynamics, including analysis and training in demographic research", closely followed by "basic data collection and processing" (63 countries) and "formulation, implementation and evaluation of population policies and programmes" (55). Slightly less than half of the respondent countries (55) also considered the "special programmes . . ." area of high priority, and a nearly equal number (54) assigned priority to "population communication and education activities". Forty-seven countries considered "population redistribution programmes" of high priority importance, while, finally, slightly under a third (38 countries out of 118), considered that "family planning programmes" would be a high priority sector over the next decade. Of the combined "low" or "none" priority responses, globally, only "family planning programmes" and "population communication and education" elicited a significant number of "negative" responses: 37 and 27, respectively.

It is interesting to note how closely, with only small exceptions, three of the four major developing country regions—ESCWA, ECA and ECLAC—patterns resemble each other, and the overall pattern, in this respect. In each case, priority primacy was given to the three areas of basic data collection, population dynamics, and population policies. ("High" ratings, respectively, for ESCWA were: four, five, and three out of eight respondent countries; for ECA: 28, 27, and 20 out of 39; for

ECLAC: 16, 17, and 14 out of 20). At the next level, there were some noticeable variations in the relative priorities assigned to "population communication . . ." and "special programmes", ECLAC assigning the latter significantly higher priority (18 of 20 responses) than the former (seven of 20), while in ECA the pattern was reversed (18 of 39 for the latter, 27 of 39 for the former). In all three regions, however, the area of family planning programmes was ranked lowest in priority: in ESCWA, no "high" response was received, while six of 20 were received from ECLAC and 15 of 39 in ECA.

As might again be expected due to the ESCAP region's relatively long and intensive experience with population programmes, and also with technical co-operation in the population field, the assignment of "high" priorities to the seven fields of programme action listed was virtually the same across the board, ranging from a "low" of 11 (out of 23) for "population redistribution . . ." to 15 each for family planning and population communication. The remaining areas received 14 "high" each, except for basic data collection and special programmes, each of which received 13, possibly again because of the region's relatively long experience with these areas of programme activity.

For the ECE region, the only significant trend (for developing countries) of "high" responses was to be found for the population dynamics and special programmes category (two "highs" each from both developing countries—and 28 countries altogether). None of the other categories received more than two "high" priority ratings from the developing countries, while one (family planning programmes) received none (except for two from donor countries).

#### *Specific components of technical co-operation*

An examination of the assignment of priority given to specific components of technical co-operation required by countries also reveals some interesting patterns, both in terms of the components themselves and their absolute distribution among the various areas of programme action.

On a global basis, counting all components cited among all programme areas, the leading components of technical co-operation required were advisory services, including consultants (130 citations from 39 out of 118 countries, across all categories; with population policies being the area most frequently cited, closely followed by population dynamics, basic data collection . . . and special programmes, population redistribution, and family planning programmes).

Next came general training, with 128 citations from 41 out of 118 countries, and a preponderance of these heaped under population dynamics (37 out of 128), with all the remaining categories receiving between 10 and 20 citations each.

Following training came general equipment and supplies, which received 84 citations from 33 countries, the largest elements of which were found under the basic data collection (23) and population communication (21) headings, the remainder being fairly evenly distributed (range: 4-11) over the remaining categories.

There was an appreciable drop in the absolute number of responses to 45 for the next major area, financial assistance, supplied by only 15 out of 128 countries, again in a fairly even pattern (range: 4-9) over all programme areas. Finally, miscellaneous and research received totals, respectively, of 28 (from 15 countries) and 19 (from 12 countries), primarily under family planning and population communication (six each) for the former, and, as might be expected, basic data collection and population dynamics (six and seven, respectively), for the latter.

For the rest, other priority components received relatively scant mention. Twelve countries out of 128 cited, under family planning, a need for family planning material, including contraceptives; eight countries mentioned a need for general technical assistance; and five countries mentioned a population unit as a priority need. The remaining responses were low, both in terms of their actual number and the number of countries providing them.

With the exception of only minor shifts in priority, the different regions displayed a marked homogeneity in the general pattern of priorities reported. One way or another, all understood the importance of technical co-operation in the form of advisory services, training, equipment and supplies and financial assistance.

#### *Specific priority components for each area of programme action*

The same general overall pattern is to be found if one examines the specific priority component of technical co-operation most often specified by countries that designated particular areas of programme action as of "high" priority to them for the next decade. Here, only the components advisory services and training were reversed, as were miscellaneous and research—by a very small margin—in ranking of overall importance. The same general pattern of overall priority obtains region by region, controlling for "high" priority, as it does, again with essentially minor variations (a principal and obvious one being the relatively high priority accorded family planning material within the family planning programme area of programme action), within each of the seven major programme areas designated as "high" priority by the respondent countries. (It will, of course, be of interest at a later time to specify more precisely such regional differences, however minor, as do occur in these patterns, and to attempt explanations for them.)

#### *Statement of policies, programmes or priorities and past experiences of technical co-operation*

The final question in the section gave Governments an open-ended opportunity to say anything they wished in reference to international co-operation in the field of population. (For a pre-coding of the responses, interested readers should consult annex IV.) On a global basis, and logically complementing the affirmative responses given to questions 8.1 and 8.2 (at least with regard to quantum, if not the quality, of past and future technical co-operation received or desired), the largest number of responses either cited the role of international technical

co-operation in the past without qualification or indicated its favourable impact (29 of 119 responses overall); cited a need for more or continued co-operation of this kind in the future (22 responses); mentioned the past importance of their own contribution to the process and/or plans to contribute to it in the future (15 responses; of which 11, however, came from more developed countries, leaving four for genuine technical co-operation among developing countries, a reading further supported by the fact that only five countries overall elaborated any plans for future offering of such co-operation); or stressed the need for technical assistance in the formulation and/or implementation of specific population policies (nine). Interestingly enough, nearly 8 per cent of the responses (nine) indicated that there were also specific problems with reduced and/or undependable funding for technical co-operation in population. In fact, considering the problem areas—including too-narrow orientation and/or the isolated/*ad hoc* nature of technical co-operation; reduced and/or undependable funding for it; and/or problems with changing and/or incorrect donor priorities—the responses (seven, nine, six, respectively) total 22, or (tied for) second in importance overall. (In addition, 16 countries out of 67—nearly 25 per cent—responding altogether contributed these readings.) What this appears to mean is that some countries give technical co-operation a generally favourable past reading, some a mixed review, and others—a minority—a mostly negative appraisal.

In the ECA region, allowing for the absence of responses arising from the lack of past "importance of our own contributions to technical co-operation" responses, the breakdown of 43 responses (from 22 countries) very much follows the global pattern, with one major exception, as noted below. First in importance, with 10 citations, is past technical co-operation activity, followed by the recognition of a future need for it (nine responses), followed at almost the same level by the three "problems" responses (reduced funding—six; general problems and changing/incorrect donor priorities, four and five, respectively), and by the need for more technical co-operation to help with specific population policies (five). The trend exception noted above, of course, is the predominance of essentially negative—or at least critical—reviews given to technical co-operation in the past—15 such citations provided by 10 countries, or over one third the 28 African countries providing responses at all in this area.

Obviously, it is difficult if not impossible to interpret the significance of these statements, beyond the national contexts from which they come, since nine countries cannot speak for a far from homogeneous region comprised of over 50. Excerpts from a sample of criticisms, however, are at least interesting, and may even be instructive to donors.

With respect to the problem of reduced funding, for instance, one country noted:

"Les difficultés que rencontre actuellement le programme . . . découlent des critères et priorité fixés par les instances internationales concernées en matière d'aide dans le domaine de la population. Les résultats encourageants enregistrés en \_\_\_\_\_ dans

ce domaine risquent d'être compromis faute de ressources disponibles en matière d'assistance en population d'autant que le pays doit répondre à d'autres besoins alors même que les apports publics externes dont nous bénéficions tendent à diminuer."

While another, with respect to a donor's priorities, observed:

"Or, ces données (démographiques) s'avèrent incomplètes—compte-tenu de la conjoncture actuelle, on ne peut se permettre, avec le seul budget national d'entreprendre une collecte d'envergure nationale. Par ailleurs, le (donor agency) ne considère plus la collecte des données démographiques comme activités prioritaires. Il y a donc un certain blocage des activités de recherche démographique. Les démographes et statisticiens se contentent d'ajustement et d'évaluation des données disponibles."

And another, tracing needs for technical co-operation through an entire system of priorities, stated:

"La collecte, l'analyse des données démographiques restent encore très importantes en de même que la recherche dans ce domaine. La formulation, la mise en oeuvre et l'évaluation des politiques de population restent également des priorités qui se heurtent à des manques de données sur la fécondité, la mortalité et les migrations. L'information et l'éducation de la population pour les programmes de planification de la famille et aussi l'organisation d'une distribution harmonieuse et rationnelle de la population comptent comme priorité également. Les moyens de financement et le manque de cadres qualifiés handicapent ces programmes. Le gouvernement souhaite une coopération internationale plus intense dans ce domaine. Une assistance technique financière pour renforcer les activités menées dans la domaine de la population et souhaitée par le gouvernement afin de poursuivre les activités de collecte, analyse, recherche, identification des problèmes démographiques (et) la formulation, la mise en oeuvre et l'évaluation des programmes et politiques de population."

A final example complains, even more bluntly:

"Les difficultés persistent dans ce sens qu'en matière de recensement par exemple on aurait pu s'attendre à une coopération internationale plus intense provenant de la part des pays développés amis.

"Au moment où nous nous débattons pour réaliser le premier recensement du-nous voyons les (donor nationals) débarquer pour financer l'enquête sur la prévalence contraceptive; alors que nous éprouvons d'énormes difficultés de financement de l'opération du Recensement."

It is interesting to note, in addition, that eight of the "negative" responses came from non-English-speaking background countries, all but one of which are Francophone (from the North, West, and East African regions). What if anything this means, of course, it is not possible to say at this juncture.

With respect to the ESCWA region, only one country responded and cited two areas of significance: the past



importance of and future need for technical co-operation in population, while there was no discernible heaping of responses in the ECE/North American region other than a detailing by eight countries (half of those responding to question 8.3, and all but one considered "developed") of intentions to contribute in the future to technical co-operation in this field. One atypical but tersely critical response from a developing country in the region is perhaps worthy of quotation in full: "Priorities of the Government in some cases are in conflict with those set forth by the agencies providing technical assistance. This, of course, is an impeding factor in the formulation and implementation of successful projects."

In the ECLAC region, where eight countries provided a total of 12 substantive responses, eight of them were divided equally between past assistance, "need for more", and three countries' stated intentions to provide increased amounts of technical co-operation in the future—hardly constituting a regional "trend", but certainly bearing out the conventional wisdom with respect to the region's development in certain areas of, *inter alia*, population, compared with other in general, such as ESCWA and ECA. (The remaining four responses were scattered into three separate categories, including two under "Other", and do not bear further discussion at this stage.)

Just over half of the 16 (developing) countries responding in the ESCAP region cited, for the most part with approval, the past role of technical co-operation in the population field, and this bears out the comparatively long history the region has had with such activities, at least insofar as comparable activity in the other developing regions is concerned. The fact that as many as seven developing countries cited the need for more or continued assistance in the future indicates the work is not finished, however, although three of the responses came from island countries in the Pacific region, and one from a country many consider more appropriate to include, for analytical purposes, in the ESCWA region. (One Pacific Island nation noted a problem that may very well be as general as was implied—to wit, that "the demographic problems encountered by countries other than small Pacific Island Nations differ considerably from those which affect (this country) in scale and intensity. Consequently, programmes geared more directly to these latter needs would be of the highest priority".)

#### SUMMARY AND CONCLUSIONS

Technical co-operation among developing nations in the area of population has been pervasive over the past 10 years, and it is overwhelmingly perceived as a need for at least another decade. Nevertheless, perception of its positive achievements in specific areas is not clear-cut: either the pertinent section of the questionnaire (8.1(a): Population goals and policies) was unclear, and/or technical co-operation did not or could not play a particularly important role in that area, and/or Governments did not wish technical co-operation to play an important role in that area. Its role was, however, considered generally more vigorous in the "promotion of knowledge

and policies" area, perhaps partly because of the relatively more familiar denotation conveyed to respondent countries by the four sub-headings employed.

The question on future priorities envisaged for technical co-operation in population elicited perhaps the most interesting responses, especially since—with only minor exceptions—the priorities assigned to specific substantive areas of activity corresponded so well across different regions of the developing world (except, for the reasons already given in this analysis and quite possibly some others, in the ESCAP region). As underscored, *inter alia*, by recommendation 81 of the International Conference on Population, all of the developing regions except one, ESCAP, gave highest priority to basic data collection, demographic analysis and associated training, leading to the formulation, implementation and evaluation of population policies and programmes. Given the highest priority assigned by the World Population Plan of Action to "the importance of the interrelationships between population and socio-economic development",<sup>2</sup> this sequence of priorities in programme action is hardly surprising, although it is interesting to note that not all major funding agencies in the population field observe the same priorities.

Also of interest were the responses, and their relative homogeneity, again across regional lines, to the questions regarding perceptions of priority components of technical co-operation required to assist in the further development of each substantive area (and, later, each such area viewed as a high priority). It would appear, from these responses at least, that the familiar pattern of "institution-building" approaches—training of national personnel accompanied by advisory inputs of a long- and/or short-term nature, assisted by judicious inputs of critical *matériel*—is seen as desirable for the future, too, although the questions are not so finely tuned nor the open-ended responses to the final question generally sufficiently on point in this area, to address questions such as "More short-term or long-term advisers?", "Training of what kind, and where?", and "What kinds of *matériel* are of greatest priority?".

The final section correlates well, in general, with the pattern of previous responses, although only 67 countries chose to respond to the question, and of them 14 were members of the more developed world. Technical co-operation has been widely needed, or at least employed, and will be in the future. Although it has generally had a favourable impact, there was a *leitmotif* of criticism observed, perhaps particularly in the Francophone African region. While the criticisms vary from country to country and region to region, they were most often of three kinds: too-narrow orientation and/or isolated/*ad hoc* nature of technical co-operation; reduced and/or undependable funding for it; and/or problems with changing and/or incorrect donor priorities, including occasionally a suggestion of insufficient regard for national decisions.

While even at this relatively crude stage of questioning and analysis of responses it can be expected that some valuable guidance may be received by those concerned with funding and co-implementing international technical

co-operation in the field of population, it is clear that future inquiries of this sort are likely to elicit even more valuable and more specific responses, if based on the experiences of this inquiry. And, in this connection, it is again worth noting the strong support provided both by the International Conference on Population, and the Population Commission at its twenty-third session (February 1985) to a continuing role to be played by the United Nations Secretariat in monitoring, *inter alia*, the multilateral population programmes of the United Nations system. Meanwhile, at a minimum, the past and future role of technical co-operation has been reaffirmed as one of importance, some insight has been gathered into perceptions of the developing countries of when it works to greatest effect, and even some inklings have been furnished as to "why" and "how".

#### NOTES

<sup>1</sup> The regions, as defined, comprise countries belonging to the regional commissions for Africa (ECA), Asia and the Pacific (ESCAP), Western Asia (ESCWA), Latin America and the Caribbean (ECLAC), and Europe (ECE); the ECE/North American region includes the United States of America and Canada.

<sup>2</sup> *Report of the International Conference on Population, Mexico City, 6-14 August 1984* (United Nations publication, Sales No. E.84.XIII.8).

#### ANNEX I

##### List of responding countries, by region and subregion

##### AFRICA (Total, 39)

##### Eastern Africa (Subtotal, 13)

Burundi  
Comores  
Djibouti  
Ethiopia  
Madagascar  
Mauritius  
Mozambique  
Rwanda  
Somalia  
Uganda  
United Republic of Tanzania  
Zambia  
Zimbabwe

##### Middle Africa (Subtotal, 7)

Cameroon  
Congo  
Central African Republic  
Equatorial Guinea  
Gabon  
Sao Tome and Principe  
Zaire

##### Northern Africa (Subtotal, 5)

Algeria  
Egypt  
Libyan Arab Jamahiriya  
Morocco  
Tunisia

##### Southern Africa (Subtotal, 3)

Botswana  
Lesotho  
Swaziland

##### Western Africa (Subtotal, 11)

Benin  
Burkina Faso  
Côte d'Ivoire  
Gambia  
Guinea-Bissau  
Liberia  
Mali  
Mauritania  
Senegal  
Sierra Leone  
Togo

##### EUROPE (Total, 29)

##### Eastern Europe (Subtotal, 6)

Bulgaria  
Czechoslovakia  
German Democratic Republic  
Hungary  
Poland  
Romania

##### Northern Europe (Subtotal, 5)

Denmark  
Finland  
Norway  
Sweden  
United Kingdom of Great Britain and Northern Ireland

##### Southern Europe (Subtotal, 7)

Greece  
Holy See  
Italy

Malta  
Portugal  
Spain  
Yugoslavia  
*Western Europe* (Subtotal, 6)  
Austria  
France  
Germany, Federal Republic of  
Luxembourg  
Netherlands  
Switzerland

##### Western South Asia (Subtotal, 2)

Cyprus  
Turkey

##### Union of Soviet Socialist Republics (Subtotal, 3)

Byelorussian SSR  
Ukrainian SSR  
USSR

##### NORTHERN AMERICA (Total, 2)

Canada  
United States of America

##### LATIN AMERICA (Total, 20)

##### Caribbean (Subtotal, 5)

Bahamas  
Cuba  
Dominican Republic  
Haiti  
Jamaica

##### Middle America (Subtotal, 8)

Belize  
Costa Rica  
El Salvador  
Guatemala  
Honduras  
Mexico  
Nicaragua  
Panama

##### Temperate South America (Subtotal, 2)

Argentina  
Uruguay

##### Tropical South America (Subtotal, 5)

Bolivia  
Colombia  
Ecuador  
Paraguay  
Peru

##### WESTERN ASIA (Total, 8)

Bahrain  
Iraq  
Jordan  
Kuwait  
Qatar  
Syrian Arab Republic  
United Arab Emirates  
Yemen

##### ASIA AND THE PACIFIC (Total, 21)

##### Eastern Asia (Subtotal, 2)

Japan  
Republic of Korea

##### Eastern South Asia (Subtotal, 5)

Indonesia  
Malaysia  
Philippines  
Singapore  
Thailand

##### Middle South Asia (Subtotal, 8)

Afghanistan  
Bangladesh  
India  
Iran  
Maldives  
Nepal  
Pakistan  
Sri Lanka

##### Oceania (Subtotal, 6)

Australia  
Fiji  
Kiribati  
New Zealand  
Papua New Guinea  
Vanuatu

#### ANNEX II\*

##### Section 8. International co-operation in the area of population

8.1 Has the Government received any support in the form of international co-operation for the achievement of its goals in the area of population?

Yes

No

8.1a What does the Government consider to have been the relative contribution of technical co-operation since 1974 in achieving progress towards its goals and policies in each of the following areas?

\* Taken from the Fifth Population Inquiry among Governments, conducted by the United Nations Secretariat in 1983.



# RECENT DEVELOPMENTS IN POPULATION TRENDS AND POLICIES\*

*United Nations Secretariat\*\**

## SUMMARY

A review of recent trends in world population growth indicates that the rate of growth continues to decelerate. However, there are marked differences in the pattern among regions and among individual countries. Furthermore, it is expected that the annual increments will increase for some time to come. There are and will continue to be differential growth rates among various age/sex groups with rapid increases in the working-age population and women of child-bearing age. There will also be an increase in the number and proportion of elderly persons.

Though the declining rate of population growth is largely due to fertility trends, there remains a substantial unmet need for family planning in developing countries. Furthermore, desired family size is likely to fall as more women find employment in modern occupations. While fertility has been declining, so also has mortality, though there is great variation in levels and trends among regions and individual countries.

Many developing countries are experiencing rates of urban growth which greatly exceed the overall growth rates of their populations. Though that growth is increasingly concentrated in the largest cities, it is but one aspect of a complex pattern of population movements within individual countries. Furthermore, there continue to be substantial flows of workers and refugees across international borders.

Those demographic trends have taken place against a background of depressed economic conditions which have made it difficult for developing countries to meet the needs of their growing population for more employment, educational opportunities, agricultural land and industrial capital. The juxtaposition of static economies and rapidly growing populations was recognized in the statements of Governments at the International Conference on Population in 1984. They affirmed the need to implement population policies in the context of respect for human rights and cultural values. Action was especially necessary if the status of women were to improve. Recognizing the linkages between demographic and development trends, the Governments proposed a variety of approaches for reducing fertility and mortality and achieving satisfactory age/sex and spatial distributions of their populations, thereby conserving resources, protecting the environment and promoting development.

## DEMOGRAPHIC TRENDS

### *Population growth*

Since the most recent assessment of global population trends, undertaken by the United Nations in 1982,<sup>1</sup> more than 35 countries have released new census results and many more have published detailed accounts of the latest census findings. Analyses of the data so far indicate that the gradual slowdown of global population growth is still holding. For example, in 1984 the representative of China at the International Conference on Population reported that China's rate of population growth for 1983

was reduced to 1.15 per cent, which was very close to the estimated 1.17 per cent growth for the period 1980-1985 in the United Nations 1982 assessment.

The present rate of global population growth is estimated at 1.65 per cent per year, down from 2.0 per cent during the 1960s. Declines in growth rates have occurred both in the developed and in the developing countries. But the regional diversity of population trends has been so large that such a global assessment seems almost irrelevant for policy consideration at national and regional levels. In the East Asia region, in which the annual growth rate declined from 2.5 per cent during the period 1970-1975 to 2.0 per cent during the period 1980-1985, the decline observed in China was the most significant (from 2.4 to 1.2 per cent per year during the same period). If China is excluded, the decline in the rate of growth of the region would be far less significant—from 2.5 to 2.4 per cent per year. Africa as

\* From a report of the Secretary-General of the United Nations to the Economic and Social Council at its first regular session of 1985 and to the General Assembly at its fortieth session (A/39/128-E/1984/35).

\*\* Population Division, Department of International Economic and Social Affairs.

a whole had a growth rate of over 3 per cent during the period 1980-1985, which is still rising; Western Asia had a similar high growth rate, of 2.9 per cent, with no sign of significant change. The South Asian and Latin American regions had growth rates of 2.1 and 2.4 per cent, respectively, during the period 1980-1985, but the rates have been declining over the past decade.

The diversity in population trends is more pronounced among individual countries. Of the 123 countries in the developing world (including territories and areas), 58 showed an increase in growth rates between 1970-1975 and 1980-1985, 49 showed a decrease and 16 showed practically no change. Those countries with increasing growth rates are comparatively small in population size, amounting to 16 per cent of the total population of the developing world in 1984. In contrast, the countries with declining growth rates accounted for 73 per cent of the population of all developing countries (or 61 per cent if China is excluded from the calculation). Among the 33 developing countries, 25 experienced a decrease in their growth rate between 1970-1975 and 1980-1985, and six had no change.

As to the future, the growth rate of population in the world is expected to decline more slowly than it did during the past 15 years, unless Governments' population policies change significantly. Despite the expected declining growth rate, the annual increments to the world population will continue to increase, from 79 million at present to 89 million by 1995-2000, according to the medium-variant projections. By the end of the twentieth century the world's population will be close to 6.1 billion, of which nearly 80 per cent will be in the developing countries.

#### *Population structure*

During the period 1980-1985 the working-age population (15-64 years) in the developing countries is estimated to have increased, on the average, at an annual rate of 2.8 per cent, the elderly population (60 years and over) at 3.0 per cent and women in the reproductive ages (15-49 years) at 2.9 per cent. Those rates are significantly higher than the comparable growth rate of the total population—2.0 per cent. The differential growth rates among various age/sex groups of the population are expected to continue in the coming years.

Perhaps the most urgent problem for many developing countries in the immediate future will be the continuing very rapid increase in the working-age population. In terms of aggregate numbers, the average annual increment of 44 million in the early 1970s rose to 57 million during the period 1980-1985, and is expected to become even larger in the years to come.

The youth population (15-24 years) in the developing countries also grew, on the average, at an annual rate of 2.8 per cent during the 1980-1985 period; that rate is expected to decline to 2.3 per cent during the period 1985-1990, reflecting fertility reduction during the 1970s. In the developed countries, the youth population, which grew at 0.6 per cent during 1980-1985, will begin to decrease at an annual rate of -0.7 per cent per year during 1985-1990.

The number of women in the reproductive ages, 15-49, has been and will be increasing rapidly in the developing countries, especially in Africa, Latin America and South Asia during the next 30 years. For example, during the period 1985-1990 the rate of increase for that group of women will be 3 per cent in Africa, 2.6 per cent in Latin America and 2.5 per cent in South Asia. Those increases will have a profound effect on the rate of population growth in those regions unless the levels and patterns of fertility undergo significant changes. The number of women in the reproductive ages in the developed countries will be increasing at a low rate of 0.4 per cent during the period 1985-1990.

The aging of the population, which bears significant policy implications, is among the most salient features of population change in the world, except for Africa. For the present, the aging problems are most sharply felt in the developed countries, where the median age of population in 1984 is estimated to have been 32 years. For the future, however, the process of an aging population appears to be the most rapid in Asia, where the present median age of 21 years is expected to increase to 27 years by the year 2000, and to 34 years by 2025. In Latin America the median age is projected to advance from the present 21 years to 24 years in 2000 and to 30 years by 2025.

If the elderly population is defined as those aged 60 years and over, as recommended by the World Assembly on Aging in 1982,<sup>2</sup> there were 411 million people in that category, or 8.6 per cent of the total population of the world, in 1984. In the developed countries, the percentage was 16 per cent, whereas the percentage was 6.3 per cent for the developing countries. By 2025 those percentages will likely increase to 24 and 12, respectively.

#### *Fertility trends*

Recent declines in the rate of population growth, described above, were largely a reflection of declines in fertility. The fertility declines were most marked in the developed countries and in China and other developing countries of East Asia. They were moderate in most of South Asia and Latin America and were slight or non-existent in most of Africa and West Asia. No new information has become available during the past year that would suggest any significant change in those patterns. However, there are several studies published or in progress at the United Nations and elsewhere that shed light on some socio-cultural aspects of reproductive behaviour.

In one recent United Nations study concerning levels and trends of contraceptive use,<sup>3</sup> it was found that in many developing countries there is a significant gap between the number of women whose current family size is at least as large as that desired and those who are currently using contraception. The gap appears to be narrow in those countries in which social and economic development is relatively advanced and family planning services are easily available, but the gap is rather large in other countries. The same studies also reveal that the gap widens progressively within each country from large cities to small cities and further to rural areas, and from more to less educated groups of women, indicating,

among other things, the existence of a substantial unmet need for family planning services in many developing nations.

According to the same study, as of 1980-1981 the prevalence rate among married, reproductive-aged women is estimated at 11 per cent for Africa, 24 per cent for South Asia, 43 per cent for Latin America and the Caribbean, and 68-69 per cent for East Asia and the developed regions.

Large families are still desired in a number of developing regions of the world, notably in Africa south of the Sahara and in certain countries of Western Asia, where the average desired family size is six or higher. In most of the other countries studied, desired family sizes are much lower and often exceeded by the actual number of children born. In a few countries there is evidence of a decline in average desired family size over time. It is estimated that in some developing countries, the total fertility rate could be reduced by 15-25 per cent if all needs for contraception were met.

With respect to the relationship between fertility and the status of women, a recently completed study of 34 developing countries showed a negative association between fertility and women's work participation in modern occupations.<sup>4</sup> The fertility of women working in traditional occupations, on the other hand, was found to be similar to the fertility of women who did not work.

#### *Mortality trends*

In view of the scarcity and the generally poor quality of mortality data from the developing world and the existence of significant annual fluctuations that do not necessarily reflect secular trends, there is no justification for a revision of the assessment presented in the last monitoring report.<sup>5</sup> The report noted an improvement in mortality in most countries since the World Population Conference, held at Bucharest in 1974 but also noted a continuation of the striking heterogeneity in the levels and trends of life expectancy among the countries and the regions of the world.

A question that has generated considerable discussion in recent years is whether the supposed slowing of the pace of mortality decline in developing countries during the 1960s and early 1970s has continued. Two recent United Nations reports found evidence of renewed mortality decline in a number of countries during the late 1970s, although heterogeneity in mortality change appears to be the general rule. The recent rapid mortality declines recorded in China, some countries of the Western Asian subregion and elsewhere demonstrate that it is possible for other countries to improve their chances of survivorship when political commitment and adequate resources are devoted to the problem. Mortality rates in most developed countries continued to improve in recent years.

The causes of death which underlie mortality levels and trends are known with varying degrees of accuracy. Infectious, parasitic and respiratory diseases remain the major causes of death through most of Africa and in the higher mortality countries of Asia and Latin America. Malaria remains a formidable problem in much of

Africa, and early eradication seems unlikely. Cardiovascular diseases have become a more prominent problem in lower mortality countries in the developing world, such as Mauritius and Sri Lanka, especially in the urban areas. In the developed countries, diseases of the circulatory system and neoplasms account for about 70 per cent of all deaths.

#### *Population distribution and internal migration*

The very high rate of urban population growth currently experienced by many developing countries is perhaps the most vivid display of current population change. For example, the rate of urban population growth is estimated at 6.9 per cent for eastern Africa and more than 5 per cent for western and middle Africa. In other subregions of Africa, as well as in Latin America and South Asia, the current urban population growth is estimated at between 3.4 and 4.5 per cent. On the other hand, in the developed regions and in East Asia, urban population growth is relatively moderate at 1.1 and 1.8 per cent, respectively, owing partly to the low level of natural growth of population.<sup>6</sup>

The urban structure of developing countries is changing rapidly, increasingly concentrating in the largest cities. It is estimated that the number of cities of 4 million and above in the less developed regions increased from 22 in 1980 to 28 in 1985. In most developed countries, no further concentration of urban population into the largest cities occurred in recent years. The proportion of urban population in cities with 4 million and more inhabitants has remained about 14 per cent since the 1970s.

Another aspect of urbanization in the developing countries which bears important policy implications is that the rising level of urbanization is only a partial reflection of more complex movements of population within each country. Such movements include not only permanent rural-to-urban migration, but also urban-to-rural, urban-to-urban and rural-to-rural migration, circulation, seasonal migration and regular commuting. Rural-to-rural migration accounts for the majority of the migration in many regions of Africa and is quite common in some Asian and Latin American countries (such as Bolivia, Brazil, Ecuador, Indonesia, Malaysia and the Philippines).

#### *International migration*

The few countries that had admitted sizeable numbers of immigrants on a permanent basis in the late 1970s are still doing so in the early 1980s. In the United States of America and Australia, preliminary figures show that the average number of annual admissions increased, respectively, from about 487,000 and 69,000 during the period 1975-1980 to 587,000 and 107,000 during 1980-1983. In contrast, Canada and New Zealand experienced relatively slight decreases (from 130,000 during 1975-1979 to 120,000 during 1980-1983 for Canada, and from 14,000 to 12,000 between 1975-1980 and 1980-1982 for New Zealand), and Israel experienced a relatively larger decline in the mean number of immigrants and potential

immigrants received (from 25,000 during 1975-1979 to 16,000 during 1980-1982).

In Europe, the number of foreign workers present in the main receiving countries—namely, Belgium, France, the Federal Republic of Germany, the Netherlands, Sweden and Switzerland—declined slightly, from 4.9 million to about 4.8 million between 1980-1982. But the total foreign population living in those countries is estimated to have increased by slightly more than 500,000 between 1980 and 1982, reaching almost 11.9 million in 1982. The latest figures are not available from Austria, Luxembourg and the United Kingdom of Great Britain and Northern Ireland, which had nearly 1.2 million foreign workers in 1980.

The paucity of data regarding the foreign labour force present in the resource-rich countries of Western Asia and Northern Africa preclude the accurate estimation of trends in labour migration in those regions. However, data from the sending countries suggest that the flows of Asian workers to Western Asia may have been greater than expected and, therefore, the number of foreign workers in the receiving countries was probably in the neighbourhood of 4 million in 1980-1981, rather than the 2.8 million previously estimated for 1980.

The 1980s have failed to witness a decline in refugee flows. In spite of the efforts made by the international community, resettlement and repatriation flows have been offset by new refugee arrivals. Between 1981 and 1984 the number of refugees in Africa remained nearly stable (changing from 2.9 million to 2.8 million). In Latin America, the change was proportionately greater and in the opposite direction (from 280,000 to 350,000 refugees between 1981 and 1984), while in Asia a sharp increase was registered (from 3.1 million to 5.3 million), according to the Office of the United Nations High Commissioner for Refugees. The refugee population in developed countries has been increasing, though at a slower pace.

#### *Social and economic implications*

While the pace and pattern of development can significantly alter trends in fertility, mortality, migration, population growth and age structure, those demographic variables also have a major impact on the prospects for development. Thus, population growth was one of the factors contributing to the persistence of large disparities between the per capita gross domestic product (GDP) of the developed and developing countries. The developed countries, as a group, have experienced rising per capita GDP as the rate of growth of output in 1983 substantially exceeded the rate of growth of their populations. In the developing countries, however, GDP growth continued to decline through 1983, falling well below the rate of population increase, thereby widening the relative as well as the absolute gap in living standards between the two groups of countries.

The early years of the present decade witnessed increases in unemployment in both the developed and the developing countries. The employment problem facing the latter is particularly severe. In addition to the world economic recession of the early 1980s and the spread of

labour-saving technologies, the developing countries faced the task of generating productive employment for a labour force that was growing at a rate of 2.3 per cent per annum. Large infusions of capital were required to maintain even their current low levels of productivity per worker and, in the absence of an adequate expansion of the formal sectors, additions to the labour force were absorbed in sectors characterized by underemployment and low incomes.

Depressed economic conditions have severely restricted the ability of the developing countries to pursue their educational goals, while at the same time, the requirements for resources are increasing as a result of continuing population growth. The magnitude of the task is indicated by the fact that in 87 developing countries an estimated 76 per cent of boys and 59 per cent of girls aged 6-11 were enrolled in schools during 1980.<sup>7</sup> Furthermore, to maintain in the year 2000 the primary school ratios attained in 1980, the developing countries would have to increase their primary school enrolment by some 25 per cent, according to the low-variant population projections, and by 40 per cent, according to the medium variant. The lower enrolment rates for females and their higher drop-out rates were a matter of particular concern, since female education is an important factor in reducing both fertility and mortality.

The incidence of many diseases common to the developing countries increased by the environmental degradation that accompanied the rapid growth of population and the persistence of widespread poverty. In 1980 almost three out of five people in developing countries (excluding China) lacked access to safe drinking water and even fewer had any kind of sanitary facility. Provision of the required facilities would involve annual investments of \$40 billion during the 1980s,<sup>8</sup> thus diverting significant amounts of capital from other development activities. That figure could be lessened by reducing rates of population growth or by altering its geographical distribution.

Although total production had increased, world per capita cereal production in 1982 was no greater than it had been in 1978 owing to the growth of population size. Though there are ample grain supplies at the global level, in the first two years of the decade the growth of agricultural production in the developing countries averaged 2.6 per cent per year, providing only a slight increase in production per capita.<sup>9</sup> In many countries of Africa, population continues to grow more rapidly than food production, thereby aggravating already serious problems of undernutrition. Even in regions where total food production is adequate, tens of millions in both rural and urban areas face chronic hunger because of their poverty. Of particular concern is the fact that women represent a disproportionate share of the undernourished. Pregnant and lactating women must nourish both themselves and their infants. Furthermore, in most rural areas women are required to combine family and child-bearing activities with full-time work in the fields.

The need to provide for growing populations has stimulated efforts to increase the population-supporting capacity of agricultural lands. But unless carefully



managed, those efforts may result in erosion, desertification, water-logging and the shortening of fallow periods. One effect of the response to rising food demands is that topsoil is being removed by wind and water at a rate considerably faster than new topsoil is being formed. Another effect is the continuing loss of forests to land-clearing for food production. Deforestation, overcultivation and overgrazing are direct causes of desertification, which threatens 20 per cent of the earth's surface, now populated by 135 million people.

#### DEMOGRAPHIC PERCEPTIONS AND POLICIES OF GOVERNMENTS

##### *General*

A systematic appraisal of the latest demographic perceptions and policies of Governments was presented to the Population Commission at its twenty-second session in section II of the concise report on monitoring of population trends and policies<sup>5</sup> and in the concise report on the fifth inquiry among Governments on the monitoring of government perceptions and policies on demographic trends and levels in relation to development as of 1982.<sup>10</sup> As an addendum to those documents, the sections below are based on the positions of Governments as expressed at the International Conference on Population by heads of national delegations at the plenary sessions of the Conference.

##### *National sovereignty, human rights, cultural values and peace*

Three essentially legal or ethical issues were frequently mentioned: national sovereignty; collective and individual values; and peace. With respect to national sovereignty, a large number of Governments explicitly reaffirmed that the formulation of population policies and their implementation were entirely within the national prerogative and should be universally respected, particularly when international co-operation was involved.

The attention of the Conference was also drawn to the ethical, cultural, religious and spiritual values of populations, as well as to individual and family rights, particularly with reference to governmental intervention in population matters. In addressing any seeming conflict between individual freedom and global concerns over rates of population growth or other population variables, recognition was given to governmental responsibilities for action through education, leadership and political will, but always and only in the context of respect for human rights.

Finally, it was widely agreed that peace was essential to the achievement of human population policies and for efforts to deal more effectively with economic, social and population problems.

##### *Population and the status of women*

A significant number of developing countries emphasized the importance of the close relationship between the status of women—in particular, their education and their involvement in social, political and economic activities—and population changes. It was gen-

erally affirmed that one essential step that should be taken to deal with population growth and fertility levels is to improve the condition of women. Measures to do so should be the cornerstone of any strategy towards socio-economic progress and the solution of population problems.

##### *Mortality and morbidity*

With regard to the review and appraisal of the World Population Plan of Action, many Governments expressed concern at the persistence of interregional and intraregional differences in mortality. Particular emphasis was placed on the need for measures to further reduce maternal and child mortality. The value of a primary health care strategy and of maternal and child health and nutritional and environmental measures related to health was frequently reaffirmed at the Conference. African countries emphasized particularly the benefits of a health population to social and economic development. It was pointed out that when both fertility and mortality are very high, a reduction in infant mortality is usually a necessary prerequisite for any change in fertility.

##### *Population growth and fertility*

Population growth and fertility were frequently discussed together. It was generally agreed that changes in the rate of natural population growth are largely determined by changes in fertility levels and that policy measures intended to influence fertility rates would be the only acceptable way to reduce growth rates. In numerous cases, very high or very low levels of fertility and growth rates were referred to as a matter of policy concern.

An almost universally accepted view expressed at the International Conference was that activities in the area of population and in socio-economic development were complementary and not competing. Emphasis was placed on the need to analyse further the complex interrelationships between population and development, but little attempt was made to suggest that either one or the other had any kind of absolute or intrinsic priority.

A large number of countries spoke about family planning. The great majority of them considered family planning to be one of the important elements of a global strategy to solve the problem of rates of population growth that were seriously out of balance with levels of social and economic development. For a great many countries, it was considered to be the responsibility of Governments to provide information and access to family planning, but it should be left to the free choice of individuals and couples whether or not to make use of them. It was recommended that the role and responsibility of Governments should include making people aware of the significance of their choices through education and information. Some representatives argued that the norm of the "small family", the concept of "responsible citizen", and public awareness of "population problems" should be disseminated by the authorities. It was also agreed that even in countries where fertility levels were viewed by the Government as being too low, (including those where the rate of natural increase was negative), freedom of

information and access to family planning should not be curtailed.

### *Population structure*

The issue of population structure was discussed by many Governments. The developing countries stressed the negative impact on their economies, education and employment of the large proportion of youth among the total population. The difficulties of generating sufficient employment opportunities for the working-age population were widely commented on. Governments also pointed out that the large number of women in the reproductive ages would contribute to higher rates of population growth if a significant decline of fertility level did not occur. The aging of the population was the concern of many developed countries and some developing countries. The phenomenon was a relatively new one in human history, and Governments would have to deal with its consequences for the economy and the social systems.

### *Migration and population distribution*

In general, problems of population distribution and patterns of internal migration were viewed by countries, as revealed through surveys and national development plans, as among the most acute population problems. In the plenary session of the Conference, however, a relatively small number of countries called attention to them, perhaps because many delegations considered them to be a matter of primarily domestic concern. Nevertheless, several countries expressed their concern about such problems as overly rapid urban and primate city growth, the rural exodus and the urgent need of rural development, and the need to redirect migration towards small towns or intermediate cities.

In the statements on international migration, the most frequently mentioned subject was the situation of refugees, particularly in Africa and in Asia. The issue of displaced persons was also discussed. International co-operation was called upon to help solve those problems. The brain drain, migrant workers and the difficulties faced by children of migrant families were also noted as problems of concern in regard to international migration.

### *Population and development*

The question of population and development was discussed, with almost equal emphasis on two different aspects. First, many countries argued that without improved North/South economic relations, the achievement of a new international economic order and the implementation of the International Development Strategy for the Third United Nations Development Decade, would not be possible to resolve population problems fully. Several representatives emphasized the fact that the world economic crisis was deeply affecting the ability of

the developing countries to deal effectively with their population problems.

The second aspect was the strong linkage between population policies and economic and social development planning. Both developed and developing countries called for a multisectoral or fully integrated approach to population problems. Population policies and social and economic development policies were viewed as mutually reinforcing and, indeed, as mutually dependent on each other.

Several countries referred to the complex interrelationship between population, resources, the environment and development, pointing out, particularly in relation to growing populations, the increasing scarcity and wasteful use of natural resources, the degradation of the natural environment and the threat that such degradation imposes on human life. Many developing countries called for the achievement of a better balance between population growth and general development, including the production of food and of goods and services.

### *International co-operation*

Another aspect of population policy frequently discussed at the Conference was international co-operation. Governments stressed the need to increase financial and technical co-operation between the developed and the developing countries and to increase technical co-operation among developing countries. It was emphasized that co-operation should not interfere with national sovereignty. Some Governments also asked for better co-ordination among the donors in order to avoid overlapping of activities.

### NOTES

<sup>1</sup> *World Population Prospects: Estimates and Projections as Assessed in 1982*, Population Studies No. 86 (United Nations publication, Sales No. 83.XIII.5).

<sup>2</sup> *See Report of the World Assembly on Aging, Vienna, 26 July to 6 August 1982* (United Nations publication, Sales No. E.82.I.16).

<sup>3</sup> *See Recent Levels and Trends of Contraceptive Use as Assessed in 1983* (United Nations publication, Sales No. E.84.XIII.5).

<sup>4</sup> *Women's Employment and Fertility: A Comparative Analysis of WFS Data* (United Nations publication, Sales No. E.85.XIII.5).

<sup>5</sup> "Concise report on monitoring of population trends and policies" (E/CN.9/1984/2).

<sup>6</sup> *Estimates and Projections of Urban, Rural and City Populations, 1950-2025: the 1982 Assessment* (ST/ESA/SER.R/58).

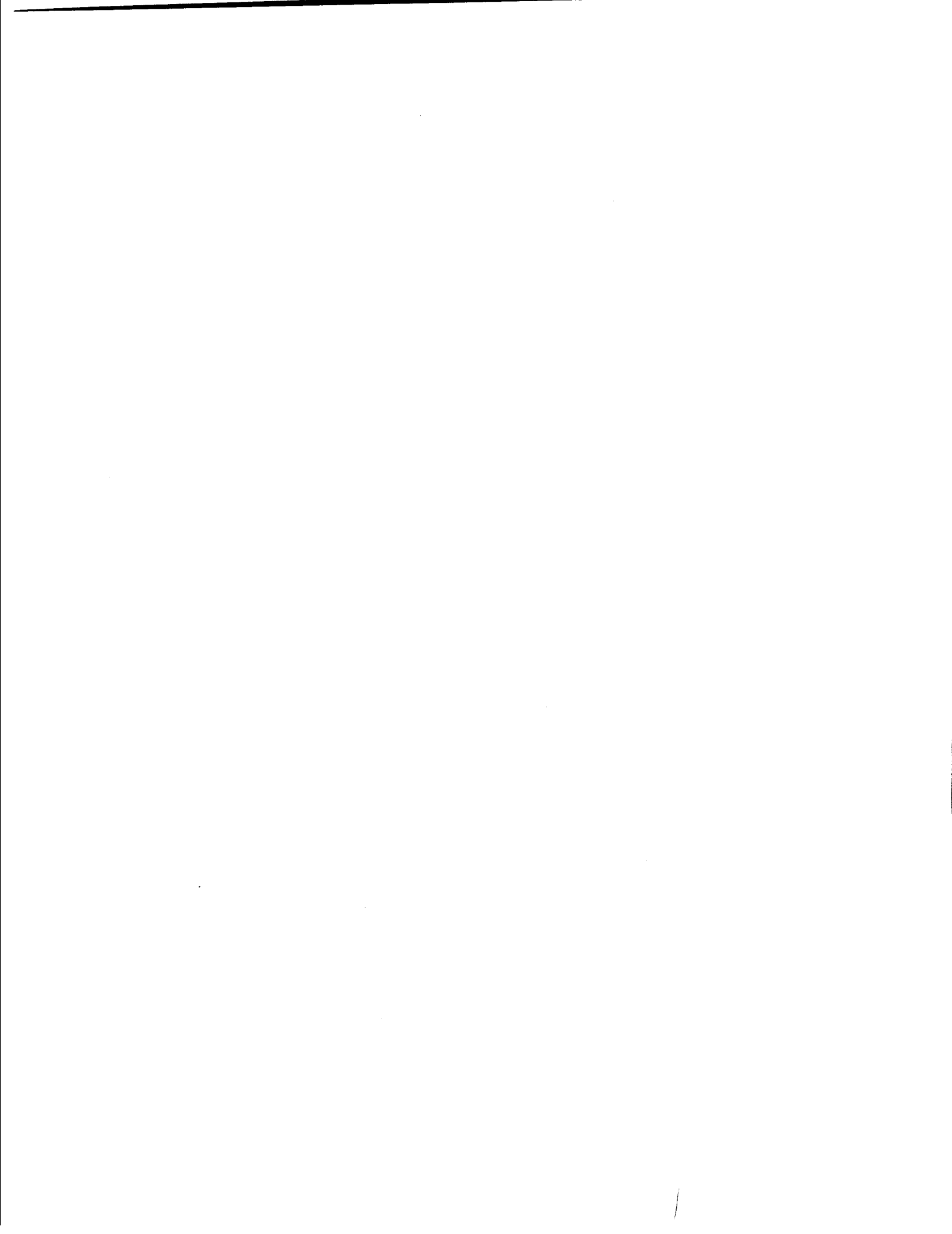
<sup>7</sup> "An overall socio-economic perspective of the world economy to the year 2000", prepared by the Projections and Perspectives Studies Branch, Department of International Economic and Social Affairs, United Nations Secretariat (May 1984), p. 93.

<sup>8</sup> *Ibid.*, p. 118.

<sup>9</sup> "Review and appraisal of the implementation of the International Development Strategy for the Third United Nations Development Decade", annex, (June 1984), p. 15.

<sup>10</sup> "Concise report on the fifth inquiry among Governments: monitoring of Government perceptions and policies on demographic trends and levels in relation to development as of 1982" (E/CN.9/1984/3).





---

### كيفية الحصول على منشورات الأمم المتحدة

يمكن الحصول على منشورات الأمم المتحدة من المكتبات ودور التوزيع في جميع أنحاء العالم. استعلم عنها من المكتبة التي تتعامل معها أو اكتب إلى : الأمم المتحدة ، قسم البيع في نيويورك أو في جنيف .

#### 如何购取联合国出版物

联合国出版物在全世界各地的书店和经售处均有发售。请向书店询问或写信到纽约或日内瓦的联合国销售组。

#### HOW TO OBTAIN UNITED NATIONS PUBLICATIONS

United Nations publications may be obtained from bookstores and distributors throughout the world. Consult your bookstore or write to: United Nations, Sales Section, New York or Geneva.

#### COMMENT SE PROCURER LES PUBLICATIONS DES NATIONS UNIES

Les publications des Nations Unies sont en vente dans les librairies et les agences dépositaires du monde entier. Informez-vous auprès de votre libraire ou adressez-vous à : Nations Unies, Section des ventes, New York ou Genève.

#### КАК ПОЛУЧИТЬ ИЗДАНИЯ ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ

Издания Организации Объединенных Наций можно купить в книжных магазинах и агентствах во всех районах мира. Наводите справки об изданиях в вашем книжном магазине или пишите по адресу: Организация Объединенных Наций, Секция по продаже изданий, Нью-Йорк или Женева.

#### COMO CONSEGUIR PUBLICACIONES DE LAS NACIONES UNIDAS

Las publicaciones de las Naciones Unidas están en venta en librerías y casas distribuidoras en todas partes del mundo. Consulte a su librero o diríjase a: Naciones Unidas, Sección de Ventas, Nueva York o Ginebra.

---



