



Manuals on methods of estimating population

MANUAL VII

Methods of Projecting Households and Families

UNITED NATIONS

Department of Economic and Social Affairs
POPULATION STUDIES, No. 54

Manuals on methods of estimating population

MANUAL VII

Methods of Projecting Households and Families



United Nations

New York, 1973

NOTE

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

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 or territory or of its authorities, or concerning the delimitation of its frontiers.

ST/SOA/Series A/54

UNITED NATIONS PUBLICATION

Sales No. E.73.XIII.2

Price: \$U.S. 5.00
(or equivalent in other currencies)

FOREWORD

Following the recommendations of the Population Commission, the Secretary-General has prepared a number of manuals describing methods of demographic analysis needed for economic and social policy purposes. The manuals are suitable for use in many countries, including those where demographic statistics and methods of analysis are not yet adequately developed. Some of these manuals deal with the analysis and evaluation of basic population statistics and estimates, others with the projections of various population quantities such as sex-age distribution of population, economically active population and school enrolment, which are needed in various fields of economic and social planning. The present manual, concerned with methods of projecting the number of households and families, is part of this long-range programme. It is issued in response to the growing demands of many countries for future projections, not only of housing, but also of the production of consumer durable goods, urban and metropolitan planning, social welfare and mass communication.

The area of the analysis of households and families is one of the least developed in demography, and there is a

paucity of studies directly useful for demographic projections of households and families. Since this manual is the first effort of its kind on the part of the United Nations in this relatively unexplored area, some analytical studies are included which are essential for work on projections of households and families. In view of the deficiency of data in many countries, the evaluation of data is also discussed. The manual is also expected to serve as an inventory of the methodology of past projections of households and families. It does not recommend a single method or a single unified system of patterns to be applied in every situation of every country.

The United Nations is also preparing a related study on the demographic aspects of households and families, in which attempts are made to analyse patterns and trends in the size and composition of households and families, and the factors affecting them. In addition, projections of the numbers of households and families have been prepared by countries and regions of the world for the period from 1965 to 2000. Both studies will be published at a future date.



CONTENTS

	<i>Page</i>
INTRODUCTION	1
Part One. Ascertainment of basic household and family data	
I. CONCEPTS AND DEFINITIONS	5
Household and family	5
Family nucleus	10
Head of the household and family	10
II. EVALUATION OF DATA	12
Problems of definition	12
An example of change in definition	16
Part Two. Summaries of various methods used for projecting households and families	
<i>Introduction</i>	19
III. METHODS NOT USING HEADSHIP RATE	21
Simple household-to-population ratio method	21
Life-table method: the Brown-Glass-Davidson models	24
Vital statistics method	28
IV. HEADSHIP RATE METHOD	31
Development of the method	31
Sex-age specific headship rates	32
Choice of assumptions regarding prospective changes in headship rates	35
Constant rate method	36
Extrapolative method	36
Regression method	37
Normative approach	39
Part Three. Application of the headship rate method	
V. EXAMPLES OF METHODS OF PROJECTING FUTURE HEADSHIP RATES	43
Constant rate method	43
Extrapolative methods	44
Extrapolation by geometrical progression	45
Extrapolation by modified exponentials	49
Evaluation	52
Regression approach	55
The Swedish example: regression by stratified subpopulation data	55
The Japanese example: ecological regression	66
Normative approach	66
VI. USE OF MODEL HEADSHIP RATES	73
Headship rates by levels of economic development	73
Levels of development	73
<i>Per capita</i> income grouping	74

	<i>Page</i>
Correlation analysis of headship rates	76
Correlation between the headship rate and the degree of industrialization	76
Correlation between the headship rate and the economic activity rate	78
Correlation between the headship rate and the marital status structure	78
Correlation between the headship rate and the <i>per capita</i> income and the degree of urbanization	78
Use of regional model headship rates	78
Illustration by use of regional model rates	80
The case of El Salvador	81
The case of New Zealand	84
<i>Annex.</i> Synopsis of the past projections among countries calculated by the headship rate method	89

List of Tables

1. Availability of statistics on households and families and sex-age specific headship data in the 1960 round of population and housing censuses in countries and territories of the world	7
2. Definition of head of household (or family) in the 1960 round of censuses in 36 countries and territories where household (or family) data have been tabulated at least by sex and age	11
3. Percentage distribution of households and population by size of household in the 1960 round of censuses and sample surveys of selected countries and territories	12
4. Historical trends in the ratio of the number of households to the population aged 20-64: Sweden, Canada, United States of America, Denmark and Japan	22
5. An example of projecting households for Venezuela by using the ratio of the number of households to the population aged 20-64	24
6. The Brown model of stationary population by sex, age and marital status for the United Kingdom	25
7. The Brown model of stationary population by family unit for the United Kingdom.	26
8. The Brown-Glass-Davidson model of hypothetical population; comparison of family and household distribution for the United Kingdom	26
9. Computations of household projections for the United Kingdom on the basis of the Brown-Glass-Davidson model of stationary population and household distribution, 1970 and 1980	27
10. Estimated net family formation for Canada, 1950-1966.	28
11. Projected net family formation for Canada, 1967-1980	29
12. Estimated and projected households for Canada, 1950-1980	29
13. Calculation of sex-age specific headship rates for Finland, 1960	32
14. Sex-age specific headship rates for selected countries around 1960	33
15. Calculation of headship rates specific for sex, age and marital status for Sweden, 1960.	35
16. Enumerated and projected headship rates specific for sex, age and marital status for Finland in 1960, 1970 and 1980	38
17. Headship rates specific for sex, age and marital status for all rural districts and all towns in Norway, 1960 census and estimation for 1970	39
18. Illustrative projections of the number of households for Panama, 1965, 1970, 1975 and 1980, assuming constant sex-age specific headship rates	43

	<i>Page</i>
19. Illustrative projections of the number of ordinary households for Japan, 1970, 1975, 1980 and 1985, using constant sex-age specific headship rates	44
20. Illustrative projections of the number of total households and average size of household for Japan, 1970, 1975, 1980 and 1985, assuming a constant ratio of the total number of quasi-households to that of ordinary (family) households in the 1965 census	44
21. Illustrative projections of the number of households for Panama in 1970 and 1980, assuming one half of the ten-year change in the sex-age headship rates from 1950 to 1960 for 1960-1970 and one quarter of the change for 1970-1980	45
22. Illustrative projections of the number of ordinary households for Japan in 1970 and 1975, assuming one half of the five-year change in the sex-age headship rates from 1960 to 1965 for 1965-1970 and one quarter of the change for 1970-1975	46
23. Illustrative projections of the total number of households for Japan in 1970 and 1975, assuming for 1965-1970 one half of the change in the ratio of the quasi-households to the ordinary households observed in 1960-1965 and assuming for 1970-1975 one quarter of that change	47
24. Illustrative projections of the number of households for Panama in 1970 and 1980 with the rate of increase in sex-age specific headship rates declining in geometrical progression	47
25. Illustrative projections of the number of ordinary households for Japan in 1970 and 1975 with the rate of increase in sex-age specific headship rates declining in geometrical progression	48
26. Illustrative projections of the total number of households for Japan in 1970 and 1975, assuming for 1965-1970 one half of the rate of change in the ratio of the quasi-households to the ordinary households observed in 1960-1965 and assuming for 1970-1975 one quarter of that rate of change	48
27. Illustrative projections of the number of households for Panama in 1965, 1970, 1975 and 1980, extrapolating headship rates by modified exponentials	50
28. Illustrative projections of the number of ordinary households for Japan in 1970, 1975, 1980 and 1985, extrapolating headship rates by modified exponentials	51
29. Illustrative extrapolations of the headship rates for males aged 45-54 and females aged 35-44 for Japan, 1960, by exponential function	53
30. Illustrative projections of the total number of households for Japan in 1970, 1975, 1980 and 1985, extrapolating the ratio of quasi-households to ordinary households by an exponential function	54
31. Highest sex-age specific headship rates ever achieved by the developed countries and unweighted average headship rates among Denmark, Norway and Sweden around the year 1960	55
32a. Headship rates by specified income class, sex, age and marital status for Sweden, 1965: single persons	57
32b. Headship rates by specified income class, sex, age and marital status for Sweden, 1965: married males	57
32c. Headship rates by specified income classes, sex, age and marital status for Sweden, 1965: widowed and divorced	57
33. Computations of regression coefficients (<i>b</i>) and constants (<i>a</i>) in the linear regression equations for estimation of headship rates specific for sex, age and marital status for Sweden	65
34. Computations of median incomes specific for sex, age and marital status groups for Sweden, 1975, applying the same inflator 1.39447 to each group	66
35. Computations of headship rates specific for sex, age and marital status for Sweden, 1975, by each different regression equation	67
36a. Computations of the population projected by sex, age and marital status for Sweden, 1975, assuming as constant the 1965 percentage distribution by marital status at each age group: single and married	68

	<i>Page</i>
36b. Computations of the population projected by sex, age and marital status for Sweden, 1975, assuming as constant the 1965 percentage distribution by marital status at each age group: widowed and divorced	68
37. Illustrative projections of the number of households for Sweden, 1975, estimating headship rates by the regression method (final results)	69
38. Percentage of the economically active population engaged in agriculture and related industries (<i>X</i>) and headship rates (<i>Y</i>) for males aged 35–44 in 46 prefectures of Japan, 1960	71
39. Illustrative projections of the number of private households for England and Wales in 1980 by a maximum schedule of headship rates	72
40a. Age-specific headship rates for males: current and past censuses	74
40b. Age-specific headship rates for females: current and past censuses	75
41. Unweighted average sex-age specific household headship rates in the countries with available headship data classified according to the level of development around 1960	76
42. Unweighted average sex-age specific household headship rates for 31 countries classified according to the three major levels of <i>per capita</i> income, around 1960	76
43. Zero-order correlation coefficients between the headship rate, on the one hand, and the percentage of labour force engaged in non-agricultural activities, economic activity rate and percentage married or not married, on the other, for 12 sex-age groups on the basis of 38 country schedules, around 1960	77
44. Partial correlation coefficients between the headship rate and the percentage employed in non-agricultural activities, holding constant marital status, for 12 sex-age groups on the basis of 38 country schedules, around 1960	78
45. Zero-order correlation coefficients between headship rate and <i>per capita</i> income and the degree of urbanization, for 12 sex-age groups on the basis of 38 country schedules, around 1960.	79
46a. Comparison of sex-age specific headship rates for Middle America (mainland) and Western and Northern European countries with those for the United States of America, Australia, Japan and India, around 1960: males	80
46b. Comparison of sex-age specific headship rates for Middle America (mainland) and Western and Northern European countries with those for the United States of America, Australia, Japan and India, around 1960: females	81
47. Computational steps for estimating headship rates for El Salvador, 1965	82
48. Computational steps for estimating future headship rates for El Salvador	83
49. Computational steps for projecting households for El Salvador, 1970–1985	84
50. Computational steps for estimating headship rates for New Zealand, 1965	85
51. Computational steps for estimating future headship rates for New Zealand, 1965–1985	85
52. Computational steps for projecting households for New Zealand, 1970–1985	86

List of figures

I. Age-specific male headship rates for Finland (1960), Japan (1965) and Panama (1960)	34
II. Age-specific female headship rates for Finland (1960), Japan (1965) and Panama (1960)	34
III. Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965	58
IV. Regression of the percentage of agricultural and related workers among the total employed upon the headship rate for males aged 35–44, Japan, 1960	70

INTRODUCTION

This manual is concerned with the methods of projecting households and families and the application of these methods to the actual situation in selected countries. It is particularly designed to aid demographic statisticians in developing countries who want to project numbers of households and families as an integral part of the economic and social planning in their countries.

The need for reasonable projections of the future number and composition of households and families has been growing since the end of the Second World War.¹ A quick survey of the literature indicates that in many countries, particularly in the developed ones, the demand for projections of the number and structure of households and families has been made by several government departments and several sections of private industry.

Traditionally, the biggest users of household and family projections have been the government agencies concerned with the planning of housing and building. Next are the government agencies and private industries planning the development of public utilities, and for the production and distribution of consumer durables such as electrical appliances and automobiles, for which the consumers are households rather than individuals.² For example, agencies concerned with housing problems continually need information on the formation and growth of households and families and on their demographic composition. It is partly an observation that in most of the world the rate of growth of households and families has been more rapid than that of population in recent years and, therefore, their future trends will be different from those of the total population.

The Population Commission has continually stressed the urgency and importance of producing household and family projections,³ and accordingly the present manual has been prepared in response to the recommendations of

the Commission. It is hoped that it will provide methodological tools and models that will be particularly useful for the developing countries.

More precisely, the manual undertakes to summarize and digest each of the methods of projecting households and families available so far and to provide practical examples to illustrate concrete steps of making projections. However, since there have been no previous United Nations manuals on methods of evaluating and analysing the census data on households and families,⁴ some preliminary work has been done to provide an inventory of the demographic data on households and families and to analyse patterns and trends of the sex-age specific headship rate, which are basic to modern methods of household and family projections. Part one deals with problems of ascertainment and evaluation of basic data on households and families and part two presents summaries of various methods used in the past by countries and institutions.

The manual regards the headship rate method as the standard approach usable for both developed and developing countries if there are data available for heads of households classified by sex and age. Because of its importance, a more detailed treatment is made of this method in the latter half of part two and in part three. Part three is in fact devoted to applications of the headship rate method to various situations of data availability with illustrative examples.

The countries which have made tabulations of heads of households and families by sex and age are rather limited in number, totalling only about 35, and they are mostly confined to Western European, Northern American and Latin American countries. The under-representation of Asian and African countries is obvious. For countries without relevant data, direct application of the headship rate method is not possible. Some efforts have therefore been made in the latter part of part three to describe the possibility of using regional model headship rates, or rates available from other countries in the region that have similar economic and cultural backgrounds.

It should be explained at this point why the title of this manual is *Methods of Projecting Households and Families*,

¹ Household and family projections have been prepared for 23 countries by Governments, institutions or research workers. In all, 42 sets of country projections have so far been located by the Population Division, Department of Economic and Social Affairs of the United Nations Secretariat.

² See also *General Principles for National Programmes of Population Projections as Aids to Development Planning* (United Nations publication, Sales No. 65.XIII.2), pp. 27-28.

³ See, for example, *Official Records of the Economic and Social Council, Twenty-seventh Session, Supplement No. 3* (E/3207/Rev.1, E/CN.9/156/Rev.1), p. 12; *Official Records of the Economic and Social Council, Thirty-first Session, Supplement No. 3* (E/3451, E/CN.9/165), p. 8; *Official Records of the Economic and Social Council, Thirty-ninth Session, Supplement No. 9* (E/4019, E/CN.9/202), pp. 46-47.

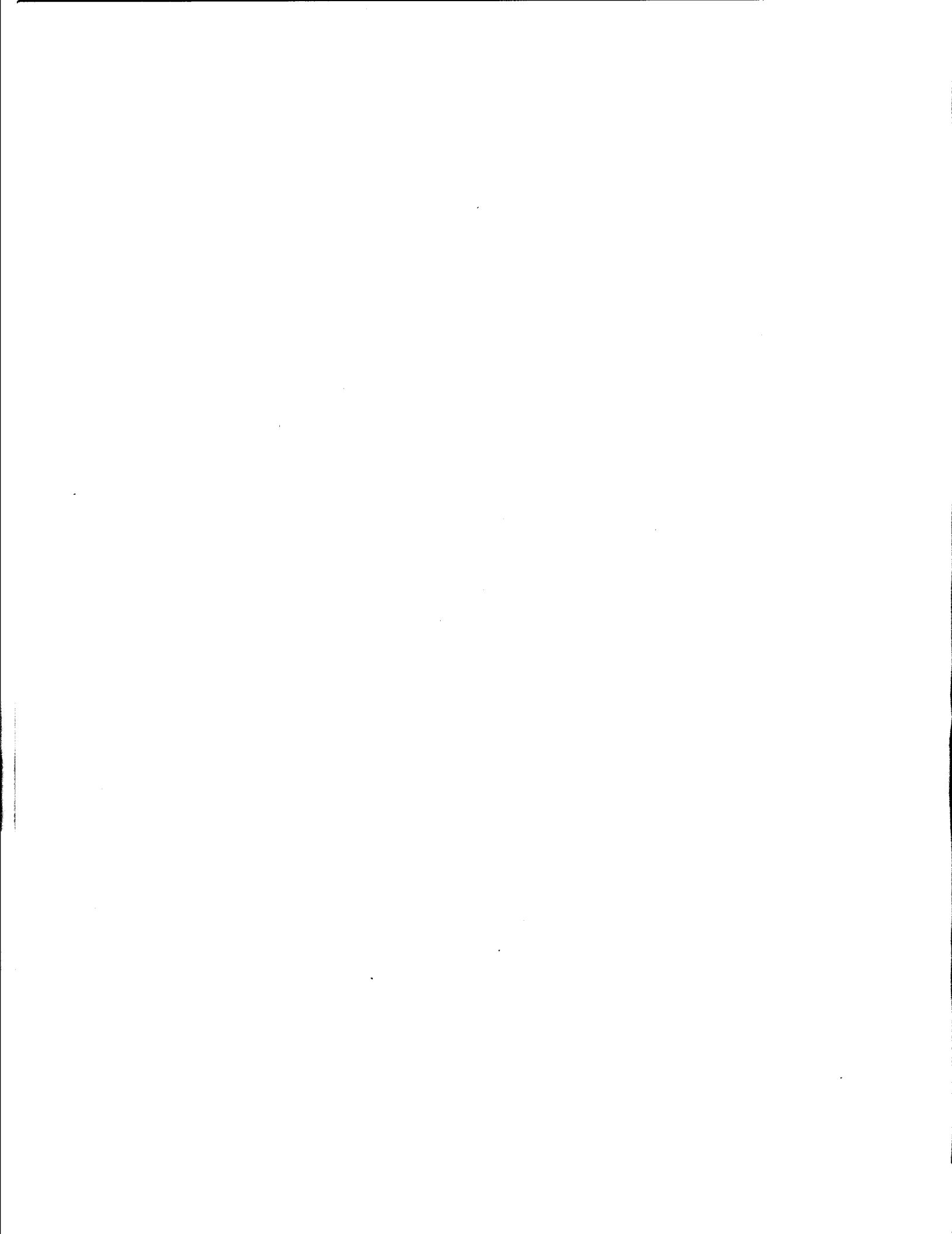
⁴ Concerning the labour force, for example, there are two manuals which supplement each other. One is *Methods of Analysing Census Data on Economic Activities of the Population* (United Nations publication, Sales No. E.69.XIII.2) and the other is *Manual V: Methods of Projecting the Economically Active Population* (United Nations publication, Sales No. E.70.XIII.2).

instead of simply *Methods of Projecting Households*. As already indicated, the main interest of the manual lies in the "household" as the demographic and economic unit of housing, consumption, welfare and the like, rather than in the "family" as the socio-biological unit of the community. It does not, therefore, aim to make projections of both households and families at the same time, but rather to make only those of households, where the statistics for both characteristics are available. It does, however, treat "family" where there are no relevant household data, except as family data available in the censuses, as in the

cases of some Eastern European countries and Portugal.⁵ This is why both the term "households" and the term "families" are used in this manual, on the understanding that projections of families are prepared only when the necessary household data are not available.

⁵ In these countries a "family" actually means a "family household" and a person living singly in a separate housing unit is regarded as a separate family. As will be pointed out, the "family" in the sense prevalent in Western Europe and Northern American censuses refers mainly to the nuclear family-oriented concept and therefore excludes the one-person family.

Part One
**ASCERTAINMENT OF BASIC HOUSEHOLD
AND FAMILY DATA**



Chapter I

CONCEPTS AND DEFINITIONS

This manual does not attempt to consider details of the methodological problems of the statistics relating to households and families. Other publications of the United Nations have dealt more comprehensively with concepts, definitions and classifications of census data on households and families, presenting internationally recommended standards for these statistics and treating problems of the application of the standards in national census.¹

It will be assumed for the present purpose that a census or alternate national sample survey has been taken and that the tabulations of the results upon which projections are to be based are given. However, as an introduction to the discussion of projection methods, it would be appropriate to review some of the principal features of the internationally recommended standards and to note some of the important variations of national census practices concerning data on households and families and their structural components. It seems particularly necessary to do so, because there is no text that covers these points.

HOUSEHOLD AND FAMILY

The concepts of "household" and "family" are often confused because of their close relationship to each other and because of the lack of unambiguous definitions for either of them. According to the United Nations *Multilingual Demographic Dictionary*, the household is a socio-economic unit, consisting of individuals who live together.² On the other hand, the *Dictionary* defines the "family" primarily by reference to relationships which pertain to or arise from reproductive processes and which are regulated by law or by custom.³

There is no uniform and universally acceptable definition of the family as a sociological-anthropological concept, partly because of differences in the structure and function of family organization in various parts of the world and partly because of the many different approaches and

schools of thought among sociologists, anthropologists, social psychologists and others.⁴

According to one definition, the family is a social group characterized by a common residence, economic co-operation and reproduction. It includes adults of both sexes, at least two of whom maintain a socially approved sexual relationship, and one or more children born to the sexually cohabiting adults or adopted by them.⁵ This definition, which embodies the concept of the "nuclear family", has been the most widely cited definition in the sociological literature of the family, particularly in view of its emphasis on the morphological characteristics of the family, namely, its residential base and the fact that its coherent members are related to each other by blood, marriage or adoption.⁶

Despite the international recommendations in this field, fairly substantial differences exist in various censuses with regard to the basic notions of household and family and their components.

⁴ Reuben Hill and associates classify various approaches to the study of the family within a framework of sociology as follows: (a) the institutional approach; (b) the structural-functional approach; (c) the interactional approach; (d) the situational approach; (e) the developmental approach. Under the first, the family is dealt with as an institution, that establishes the practices by which societies control the association of the sexes in marriage and the family and sanction the reproduction and socialization of human generations. In the structural-functional approach, "family" usually means the "nuclear family" made up of husband and wife and/or their children. According to this approach the family is viewed as a social system, with constituent parts bound together by interaction and interdependence. In the interactional approach, the family is described as a unit of interacting personalities. It interprets family phenomena in terms of role-playing, status relations, communication problems and the like. According to the situational approach also the family is viewed as a unit of interacting personalities, that are further subject to external stimuli which influence the behaviour of family members. Finally, the development approach also views the family as a unit of interacting personalities, but its point of departure is the family cycle or the stages of development through which the family and its members travel. This approach deals specifically with the unifying theme of family change through the dimension of time. See Reuben Hill and Donald A. Hansen, "The identification of conceptual frameworks utilized in family study", *Marriage and Family Living* (Minneapolis, Minn.), vol. 22 (1960), pp. 299-311; Harold T. Christensen, ed., *Handbook of Marriage and the Family* (Chicago, Rand McNally and Company, 1964).

⁵ George P. Murdock, *Social Structure* (New York, Macmillan, 1949), p. 1.

⁶ For example, Marion J. Levy's recent work uses the statistical approach and the residential family, that is, a group of persons usually related by blood or marriage, living together in a common residence or dwelling. Therefore, his generalizations may not be taken to apply to family and kinship units defined in terms of interaction or reciprocal obligations among kin living in different households. See Marion J. Levy Jr., "Aspects of the analysis of family

¹ *Principles and Recommendations for the 1970 Population Censuses* (United Nations publication, Sales No. 67.XVII.3), paras. 144-149, paras. 213-221, paras. 266-270, para. 313, tabulations (4) and (5); *Principles and Recommendations for the 1970 Housing Censuses* (United Nations publication, Sales No. 67.XVII.4), paras. 249-254, 263-265 and 268-271, paras. 289-293, para. 354, tabulations (1), (2) and (3), para. 354, tabulation (12).

² *Multilingual Demographic Dictionary* (United Nations publication, Sales No. E.58.XIII.4), p. 4.

³ *Ibid.*, p. 5.

The United Nations definition of the term "household" recommended for use within the Organization is as follows:

The concept of "household" is based on the arrangements made by persons, individually or in groups, for providing themselves with food or other essentials for living. A household may be either: (a) a one-person household, that is, a person who makes provision for his own food or other essentials for living without combining with any other person to form part of a multi-person household; or (b) a multi-person household, that is, a group of two or more persons who make common provision for food or other essentials for living. The persons in the group may pool their incomes and have a common budget to a greater or lesser extent; they may be related or unrelated persons, or a combination of both.

Households usually occupy the whole, part of, or more than one housing unit, but they may also be found in camps, in boarding houses or hotels, or as administrative personnel in institutions, or they may be homeless. Households consisting of extended families which make common provision for food, or of potentially separate households with a common head, resulting from polygamous unions, may occupy more than one housing unit.⁷

Three recent seminars, the Seminar on Housing Statistics and Programmes for Asia and the Far East,⁸ the Latin American Seminar on Housing Statistics and Programmes,⁹ and the Seminar on Housing Statistics and Programmes for Africa,¹⁰ drew attention to the importance of separating the concepts of "household" and "living quarters" in carrying out housing censuses in order to permit the identification of the persons or groups of persons in need of a separate dwelling.

On the other hand, the term "family" is defined by the United Nations recommendations as follows:

The family is defined as those members of the household who are related to a specified degree, through blood, adoption or marriage. The degree of relationship used in determining the limits of the family is dependent upon the uses to which the data are to be put and so cannot be precisely set for world-wide use.

A family cannot comprise more than one household; a household can, however, consist of more than one family, of one family together with one or more non-related persons, or entirely of non-related persons. In practice, most households are composed of a single family consisting of a married couple without children or of one or both parents and their unmarried children. It should not be assumed, however, that this identity exists.¹¹

The term "family" may also refer to the "extended family" or "joint family" which would include a couple with not only their minor children but also their married

children and their families and other relatives as well; the extended family is often found in predominantly rural economies. Such a family may be scattered or may live together and share a housing unit. For statistical purposes, it would not be practical to deal with the "family" in this wider sense, that includes persons tied to each other by kinship but residing in different households.¹² Therefore, in conformity with the United Nations definition, the family can be interpreted in a limited sense as a group of two or more persons who live together and share the same housing unit. This group may be referred to as the "family household".¹³

Table 1 gives an inventory of data on households and families from the 1960 round of population and housing censuses in countries and territories of the world. It includes a classification of concepts and definitions of the household used in those countries according to (a) the housekeeping unit approach; (b) the household-housing unit approach.¹⁴ It further provides information on the availability of data on heads of households or families by sex and age.

From this table, it will be immediately noticed that except for several Eastern European countries and for Portugal the household concept has been used in practically all the recent censuses of Western European, African, American and Asian countries. Among Latin American countries, some use the term *familia*, but study of their census schedules and definitions shows that in practice

¹² The joint family or composite family generally is defined as consisting of more than two generations of a biological family and is found in countries where it is not the custom for children to leave the parental home on marriage; United Nations *Multilingual Demographic Dictionary*, p. 6.

¹³ *Handbook of Population Census Methods, Volume III: Demographic and Social Characteristics of the Population* (United Nations publication, Sales No. 58.XVII.6), p. 76. Generally, sociologists, anthropologists and social psychologists have emphasized interactional, institutional, functional and social psychological aspects of the family within a society, so that its scope is much broader than and somewhat different from this statistical approach. To family sociologists the family is a form of social organization and institution, through which a child grows up, develops his personality and acquires socialization. For the sociological literature, see, for example, the following: Marion J. Levy Jr., "Aspects of the analysis of family structure", in Ansley J. Coale, *et al.*, *Aspects of the Analysis of Family Structure* (Princeton, N.J., Princeton University Press, 1965), pp. 1-63; Clifford Kirkpatrick, *The Family as a Process and Institution*, second edition (New York, Ronald Press, 1963); Marvin B. Sussman, ed., *Sourcebook in Marriage and the Family*, second edition (Boston, Houghton Mifflin, 1963).

¹⁴ The household may be described as a socio-economic unit which may have one or more functions, the basic one being to provide the members of the unit with a common shelter. Therefore, most definitions of the household require—and in some instances this is the only requirement—that, in order to be considered a household, a group of persons must share the same housing unit, that is, live under the same roof. Usually, but not universally, the concept is expressed in terms of two basic functions, namely living in the same housing unit and having common provisions for essential living needs, particularly food. This is the housekeeping unit concept of the household, on which the definition recommended by the United Nations is based. In some cases, however, the concept is expressed in terms of one basic function only, namely sharing a housing unit. This is the housing unit concept, which is used in some countries, particularly in Northern American and Latin American countries, mainly because it is easy to apply during data collection. However its application obviously does not provide information for the direct analysis of two or more separate housekeeping groups sharing the same dwelling.

structure" in Ansley J. Coale, *et al.*, *Aspects of the Analysis of Family Structure* (Princeton, N.J., Princeton University Press, 1965), pp. 1-63.

⁷ *Principles and Recommendations for the 1970 Population Censuses*, paras. 146-147; *Principles and Recommendations for the 1970 Housing Censuses*, paras. 201-202 and 289-290.

⁸ *Report of the Seminar on Housing Statistics and Programmes for Asia and the Far East* (United Nations publication, Sales No. 65.II.F.12).

⁹ *Report of the Latin American Seminar on Housing Statistics and Programmes* (United Nations publication, Sales No. 63.II.G.14).

¹⁰ *Report of the United Nations Seminar on Housing Statistics and Programmes for Africa* (United Nations publication, Sales No. 68.II.K.7).

¹¹ *Principles and Recommendations for the 1970 Population Censuses*, paras. 213-214.

TABLE 1. AVAILABILITY OF STATISTICS ON HOUSEHOLDS AND FAMILIES AND SEX-AGE SPECIFIC HEADSHIP DATA IN THE 1960 ROUND OF POPULATION AND HOUSING CENSUSES IN COUNTRIES AND TERRITORIES OF THE WORLD

Continent and country or territory	Census year	Household statistics			Family statistics	Family nucleus data	Headship data by sex and age
		Housekeeping unit concept	Household-housing unit concept	Distribution of households and families by size			
<i>Africa</i>							
Algeria . . .	1960	x	—	—	x	—	—
Angola . . .	1960	—	x	—	x	—	—
Basutoland (now Lesotho) . .	1956	—	x	x	x	—	—
Cameroon . .	1957	...	...	x	—	—	—
Congo (Brazzaville) (now Congo)	1958	...	...	—	—	—	—
Dahomey . .	1961	—	—	x	—	—	—
Ethiopia . . .	1961	—	x	—	—	—	—
Gabon . . .	1960/61	x	—	x	—	—	—
Ghana . . .	1960	—	x	—	—	—	—
Ifni	1960	x	—	—	—	—	—
Ivory Coast . .	1956/58	...	...	x	x	—	—
Kenya	1962	x	—	x	—	—	—
Libya	1964	—	x	x	—	—	—
Mali	1960/61	...	...	x	—	—	—
Mauritius . .	1962	x	—	—	—	—	—
Morocco . . .	1960	...	...	x	—	—	—
Mozambique . .	1960	—	x	x (1950)	—	—	—
Réunion . . .	1961	...	...	x	—	—	—
Seychelles . .	1960	x	—	x	—	—	—
Sierra Leone .	1960	x	—	x	—	—	—
South Africa .	1960	—	x	x	—	—	—
Southern Rhodesia . .	1962	—	x	x	—	—	—
Sudan	1960	x	—	—	—	—	—
Togo	1958/59	—	x	—	—	—	—
United Arab Republic (now Egypt)	1960	—	x	x	—	—	—
Zambia	1961	x	—	—	—	—	—
<i>Northern and Middle America and the Caribbean</i>							
Bahamas . . .	1963	x	—	—	...	—	—
Barbados . . .	1960	x	—	x	x	—	x
Bermuda . . .	1960	x	—	x	—	—	—
British Honduras . .	1960	x	—	x	—	—	—
Canada	1961	—	x	x	x	x	x
Cayman Islands . . .	1960	x	—	x	—	—	—
Costa Rica . . .	1963	x	—	x	x	—	x
Dominica . . .	1960	x	—	x	x	—	—
Dominican Republic . .	1960	—	x	x	x	—	x
El Salvador . . .	1961	—	x	x	—	—	—
Greenland . . .	1960	x	—	x	x	x	x
Grenada	1960	x	—	x	x	x	x
Guadeloupe . . .	1961	x	—	x	—	—	x
Guatemala . . .	1964	—	x	x	x	—	x (1950)
Haiti	1950	x	—	x	x	—	x
Honduras . . .	1961	—	x	x	x	—	—
Jamaica	1960	x	—	x	—	—	—
Martinique . . .	1961	x	—	x	—	—	x
Mexico	1960	x	—	x	x	—	—
Nicaragua . . .	1963	—	x	x	x	—	x (1950)
Panama	1960	—	x	x	x	x	x
Puerto Rico . .	1960	—	x	x	x	x	x
St. Lucia . . .	1960	x	—	x	x	—	—

TABLE 1 (continued)

Continent and country or territory	Census year	Household statistics			Family statistics	Family nucleus data	Headship data by sex and age
		Housekeep- ing unit concept	Household- housing unit concept	Distribution of households and families by size			
<i>Northern and Middle America and the Caribbean (continued)</i>							
St. Pierre and Miquelon . . .	1957	x	—	x	x	x	x (1967)
St. Vincent . .	1960	x	—	x	x	—	—
Trinidad and Tobago . . .	1960	x	—	x	x	—	x
Turks and Caicos Islands . . .	1960	x	—	x	—	—	—
United States of America . .	1960	—	x	x	x	x	x
United States Virgin Islands . . .	1960	—	x	x	x	x	—
<i>South America</i>							
Argentina . . .	1960	—	x	x	x	—	x
Brazil	1960	—	x	x	x	—	x (1950)
British Guiana (now Guya- na)	1960	x	—	x	x	—	—
Chile	1960	—	x	x	x	—	—
Colombia . . .	1964	x	—	x	x	—	—
Ecuador	1962	x	—	x	x	—	—
French Guiana	1961	—	x	—	—	—	—
Paraguay . . .	1962	—	x	x (1950)	x	—	—
Peru	1961	—	x	x	x	—	—
Surinam	1964	...	...	x	—	—	—
Uruguay	1963	—	x	—	—	—	—
Venezuela . . .	1961	x	—	x	—	—	—
<i>Asia</i>							
Brunei	1960	x	—	x	—	—	—
Cambodia (now Khmer Republic) . . .	1962	...	...	x (1958)	—	—	—
Ceylon	1963	x	—	x (1953)	—	—	—
Cyprus	1960	x	—	x	—	—	—
Hong Kong . .	1961	x	—	x	—	—	—
India	1961	x	—	x	—	—	—
Iran	1956	—	x	x	—	—	—
Iraq	1957	...	...	x	—	—	—
Israel	1961	—	x	x	—	—	x
Japan	1960	x	—	x	x	x	x
Jordan	1961	x	—	x	—	—	—
Korea, Republic of	1960	x	—	x	x	—	—
Macau	1960	—	x	x	x	x	—
Malaysia . . . Federation of Malaya (now West Malaysia)	1957	x	—	x	—	—	—
North Borneo (now Sabah)	1960	x	—	x	—	—	—
Sarawak	1960	x	—	x	—	—	—
Pakistan	1961	x	—	x	—	—	—
Philippines . .	1960	x	—	x (1957)	—	—	—
Ryukyu Islands	1960	x	—	x	—	—	—

TABLE 1 (continued)

Continent and country or territory	Census year	Household statistics			Family statistics	Family nucleus data	Headship data by sex and age
		Housekeep- ing unit concept	Household- housing unit concept	Distribution of households and families by size			
<i>Asia (continued)</i>							
Singapore (sample survey) . . .	1966	x	—	x	x	x	x
Syria	1960	—	x	x	x	—	—
Thailand	1960	—	x	x	—	—	—
Turkey	1960	x	—	x	—	—	—
<i>Europe</i>							
Albania	1955	—	—	x	x	—	—
Austria	1961	x	—	x	x	x	x
Belgium	1961	x	—	x	x	x	x
Bulgaria	1956	—	—	x	x	—	—
Czechoslovakia	1961	—	x	x	x	x	x
Denmark	1960	x	—	x	x	x	x
Finland	1960	x	—	x	x	x	x
France	1962	—	x	x	x	x	x
Germany, Federal Republic of	1961	x	—	x	x	x	x
Germany, West Berlin	1961	x	—	x	x	x	...
Gibraltar	1951	x	—	x	—	—	—
Greece	1961	x	—	x	—	—	—
Hungary	1960	x	—	x	x	x	x
Iceland	1960	x	—	x (1950)	—	—	—
Ireland	1961	x	—	x	—	—	—
Italy	1961	x	—	x	x	x	x
Jersey and Guernsey	1961	x	—	x	—	—	—
Luxembourg . . .	1960	x	—	x	x	x	x
Malta and Gozo	1957	x	—	x	—	—	—
Monaco	1962	...	...	x	—	—	—
Netherlands . . .	1960	x	—	x	x	x	x
Norway	1960	x	—	x	x	x	x
Poland	1960	x	—	x	x	x	—
Portugal	1960	x	—	x	x	—	—
Romania	1965	—	—	—	x	—	—
Spain	1960	x	—	—	x	x	—
Sweden	1960	—	x	x	x	x	x
Switzerland . . .	1960	—	x	x	x	x	x
United Kingdom							
England and Wales	1961	x	—	x	x	x	x
Northern Ireland	1961	x	—	x	x	x	x
Scotland	1961	x	—	x	x	x	x
Yugoslavia	1961	x	—	x	x	x	—
<i>Oceania</i>							
American Samoa	1960	—	x	—	x	x	—
Australia	1961	—	x	x	—	—	x
Christmas Islands (Australia)	1957	...	...	x	—	—	—
Fiji	1956	x	—	—	—	—	—
Guam	1960	—	x	—	x	x	—
New Zealand . . .	1961	—	—	x (1956)	—	—	—
Niue	1961	...	...	x	—	—	—
Pacific Islands	1958	...	...	x	—	—	—
Western Samoa	1961	—	x	—	—	—	—

TABLE 1 (concluded)

Continent and country or territory	Census year	Household statistics			Family statistics	Family nucleus data	Headship data by sex and age
		Housekeep- ing unit concept	Household- housing unit concept	Distribution of households and families by size			
<i>USSR</i>							
USSR	1959	—	—	x	x	—	—
Byelorussian SSR	1959	—	—	x	x	—	—
Ukrainian SSR	1959	—	—	x	x	—	—

x Given type of data was available or category concerned was relevant.

— Data were not available or category was not relevant.

... Some statistics on households were available, but the definition was vague or unobtainable.

their definition of this term is equivalent to the concept of "household" or "family household".¹⁵

As shown in table 1, in most Western European and Asian countries, the housekeeping unit concept has been predominantly used, whereas in the American nations, in both Northern and Latin America (except small islands in the Caribbean Sea) the household-housing unit approach has been more widely practised in their respective censuses. The Pan-American practice of the household-housing unit approach has its own history and it has been derived from the recommendations made in the past at meetings of the Inter-American Statistical Institute.¹⁶

Persons not living in households include persons in military installations and correctional and penal institutions, in the dormitories of schools and universities, in hospitals and in religious institutions. As a rule, a relatively small proportion of the population belongs in this category. The relative numbers of private and institutional households may be affected by the criteria established for the census treatment of certain border-line cases. In some censuses, for example, the directors and personnel of certain institutions are counted as households if they occupy a separate housing unit. Guests in hotels who have no other residence are also, when they fulfil certain requirements, counted as households in some censuses. A boarding house may be classified as a household if the number of roomers does not exceed the number of family members, including servants, or if the number does not exceed a given number, usually 5 or 10, depending on the definition adopted.¹⁷ In some countries, such as Japan,

persons residing in rooming houses are tabulated with institutional households to form a group of so-called "quasi-households".

FAMILY NUCLEUS

The "family nucleus" is the family in the narrow sense and may be called the conjugal family nucleus. More popularly it has been widely termed the "nuclear family". It consists of one of the following combinations: (a) a married couple without children; (b) a married couple with one or more unmarried children; (c) one parent (either father or mother) with one or more unmarried children.¹⁸ An unmarried woman with one or more unmarried children should be treated as a separate family nucleus, even if she and her children are living in the same household as her parents. "Children" in the above usage includes foster children as well as adopted children.

The United Nations publication *Principles and Recommendations for the 1970 Population Censuses* has recommended as first priority the classification of family nuclei by the number of members.¹⁹ Regionally, however, as seen in table 1, the availability of family nucleus data is confined mainly to European and Northern American countries. In African and Asian regions only a few countries tabulated family nucleus data in the 1960 round of censuses.

HEAD OF THE HOUSEHOLD AND FAMILY

According to the United Nations definition, the head of the household is the person who is acknowledged as such by the other household members.²⁰ Although a more desirable definition for purposes of dependency statistics would be the person who bears the chief responsibility for the economic maintenance of the household, it is not recommended that this definition be applied because of the

¹⁵ The following countries in Latin America use different terms meaning much the same as "household": Chile: *hogar censal*; Colombia: *familia censal*; Costa Rica: *familia censal*; Ecuador: *hogar censal particular*; El Salvador: *hogar particular o familia censal privada*; Honduras: *familia censal*; Guatemala: *hogar particular*; Nicaragua: *hogar particular*; Paraguay: *hogar particular*; Panama: *hogar o familia*; Republic of Dominica: *hogar particular*; Uruguay: *hogar particular*; Peru: *familia censal*; Argentina: *hogar censal*; Brazil: *Familias recenseadas*. Before the 1970 censuses, the concept of "private household" had been used. For the 1970 censuses, however, the concept of "household" was recommended to replace it.

¹⁶ Inter-American Statistical Institute, *Report on the VI Session of the Committee on Improvement of National Statistics, Buenos Aires, 17-18 November 1958* (Washington, D.C., 1958), chap. I, "Program of the 1960 census of America", pp. 703 and 732.

¹⁷ *Handbook of Population Census Methods, Volume III*, pp. 68-69.

¹⁸ *Principles and Recommendations for the 1970 Population Censuses*, para. 215; *Principles and Recommendations for the 1970 Housing Censuses*, para. 249.

¹⁹ *Principles and Recommendations for the 1970 Population Censuses*, para. 313, tabulation (4).

²⁰ *Ibid.*, paras. 269-270.

difficulty of collecting the information needed to determine economic responsibility.²⁰

Likewise, according to the United Nations *Principles and Recommendations*, the head of the family can be either (a) the person who is acknowledged as such by the other members of the census family or of the family nucleus; (b) the member of the family or of the family nucleus who meets specified requirements.²⁰ If the first definition is used, the head of the family must be identified by means of a direct question during the enumeration. If the second definition is employed, the head of the family can be identified at the processing stage by such characteristics as sex, age and marital status, or simply by virtue of being the head of a one-person household.²⁰

Sociologically, the head of a family may be the person who sits at the apex of the system of dominant and subordinate relationships among the members. But, where there are gaps between the largest income earner and the titular head in the family, the problem of how to determine which person should be the head remains unsolved.

In the 1960 round of censuses, according to table 1, 36 countries and territories provided the headship data cross-tabulated at least by sex and age. Definitions of the head of the household among these countries are shown in table 2 by three major categories. Out of 36 countries, 23 have defined the head of the household (or family) as the one who reports himself as such or is so reported by another member of the household (or family). Seven countries have defined the head as "a person who controls the maintenance of the household (exercises the authority to run the household)" or used a similar definition. Another three countries have defined the "head" as the "main supporter" (chief earner) of the household.

As is apparent from table 2, a majority of the countries that have tabulated heads of households (or families) by sex and age have defined the head as the person reported as such and have not applied any particular economic and sociological criteria to distinguish the head of the household (or family) from the other members. By the same token, categories 2 and 3, defining the head as "the person who controls the maintenance of the household (exercises the authority to run the household)" and "the main supporter (chief earner of household)", may overlap considerably and there is no real difference between them.

TABLE 2. DEFINITION OF HEAD OF HOUSEHOLD (OR FAMILY) IN THE 1960 ROUND OF CENSUSES IN 36 COUNTRIES AND TERRITORIES WHERE HOUSEHOLD (OR FAMILY) DATA HAVE BEEN TABULATED AT LEAST BY SEX AND AGE

Country or territory	Head of household reported by respondents as such (either by himself or by the other members) ^a	Person who controls the maintenance of household (exercises the authority to run the household)	Main supporter and others
<i>Northern and Middle America and the Caribbean</i>			
Barbados	—	—	x
Canada	x	—	—
Costa Rica	x	—	—
Dominican Republic	x	—	—
Grenada	—	—	x
Guadeloupe	x	—	—
Guatemala	x	—	—
Haiti	—	x	—
Martinique	x	—	—
Nicaragua	x	—	—
Panama	x	—	—
Puerto Rico	x	—	—
St. Pierre and Miquelon	—	x	—
Trinidad and Tobago	—	x	—
United States of America	x	—	—
<i>South America</i>			
Argentina	x	—	—
Brazil	x	—	—
<i>Asia</i>			
Israel	x ^b	—	—
Japan	x	—	—
Singapore	x	—	—
<i>Europe</i>			
Austria	x	—	—
Belgium	—	x	—
Czechoslovakia	—	x	—
Denmark	—	—	x
Finland	—	—	x
France	x	—	—
Germany, Federal Republic of	x	—	—
Hungary	—	—	x
Italy	x	—	—
Luxembourg	—	x	—
Netherlands	x	—	—
Norway	—	—	x
Sweden	—	x	—
Switzerland	x	—	—
United Kingdom	x	—	—
<i>Oceania</i>			
Australia	x	—	—
TOTAL	23	7	6

SOURCE: for European countries, *European Population Censuses: The 1960 Series, International Recommendations and National Practices*, Conference of European Statisticians, Statistical Standards and Studies, No. 3 (United Nations publication, Sales No. 64.II.E/Mim.36), tables 5 and 6, pp. 110-111 and pp. 112-113; other countries, national census volumes.

^a In some cases even where there are no definitions given in the census reports, the census questionnaires included a question on the relationship of the household or family members to the head, and hence it was concluded that the head of the household or family was reported or designated as such either by himself or by the other members.

^b When identification is difficult, the oldest member of household is designated.

Chapter II

EVALUATION OF DATA

PROBLEMS OF DEFINITION

The data on households and families obtained from the population and housing censuses are subject to important errors and biases due to failure on the part of the enumerators to follow instructions, to preconceptions on the part of both the enumerators and the respondents, and to ignorance and lapse of memory, if not unwillingness to give accurate information, on the part of the latter. Errors and biases in the data are generally most important for the marginal categories of households and families, including single-person households, quasi-households, institutional households, lodgers and boarders.

In international studies, comparison, examination and evaluation of data with reference to census concepts, definitions and classifications are very important, par-

ticularly in the case of those statistics relating to the above marginal categories of households and families, which may be recognized as such in some countries and not in others. Differences between the two concepts of the "housekeeping unit" and the "household-housing unit" cause differences in the reported number and composition of households and families. Although the "housekeeping unit" concept is theoretically more desirable than that of the "household-housing unit", the former may be somewhat less practicable and subject to more errors in Latin American and Asian countries, since enumerators and respondents find the concept of "making common provision for food or other essentials for living" rather difficult to understand.

Table 3 shows the percentage distribution of private households and their population by size of household for countries where data are available. In this table, households

TABLE 3. PERCENTAGE DISTRIBUTION OF HOUSEHOLDS AND POPULATION BY SIZE OF HOUSEHOLD IN THE 1960 ROUND OF CENSUSES AND SAMPLE SURVEYS OF SELECTED COUNTRIES AND TERRITORIES

Continent and country	Year of census or sample survey	Percentage of households by size					Percentage of population in household by size				
		1	2-4 persons per household	5-6	2-6	7+	1	2-4	5-6	2-6	7+
<i>Africa</i>											
Basutoland (now Lesotho)	1956	11.1	51.2	21.7	72.9	16.0	2.7	37.0	28.4	65.4	31.9
Cameroon	1957	46.0	46.8	6.5	53.3	0.8	20.9	60.9	15.5	76.4	2.7
Dahomey	1961	14.3	45.4	20.1	65.5	20.3	3.2	30.6	24.7	55.3	41.5
Gabon	1960/61	9.6	61.1	15.9	77.0	13.4	2.5	43.6	22.2	65.8	31.7
Kenya	1962	8.5	33.2	24.8	58.0	33.5	1.6	18.5	24.8	43.3	55.2
Libya	1964	6.0	46.5	26.2	72.7	21.3	1.3	30.0	30.5	60.5	38.2
Mali	1960/61	0.2	51.1	24.3	75.4	24.5	0.0	28.2	24.9	53.1	46.9
Morocco	1960	7.9	44.2	24.7	68.9	23.2	1.6	27.8	28.2	56.0	42.4
Réunion	1961	11.8	41.7	21.4	63.1	25.1	2.5	26.3	24.9	51.2	46.3
Seychelles	1960	16.7	49.6	17.1	66.7	16.6	4.2	35.7	23.6	59.3	36.5
Sierra Leone	1963	22.7	47.7	12.4	60.1	17.2	5.7	32.6	16.9	49.5	44.8
South Africa	1960										
White population		6.7	59.2	24.4	83.6	9.7	1.7	45.1	33.1	78.2	20.1
Coloured population		3.7	30.7	24.5	55.2	41.1	0.6	14.7	20.7	35.4	64.0
Asiatic population		1.4	22.5	22.5	45.0	53.5	0.2	9.6	16.4	26.0	73.8
Southern Rhodesia	1962	17.7	34.2	20.8	55.0	27.4	3.5	20.7	22.8	43.5	53.0
United Arab Republic (now Egypt)	1960	7.8	39.8	26.9	66.7	25.6	1.6	24.4	29.3	53.7	44.8

TABLE 3 (continued)

Continent and country	Year of census or sample survey	Percentage of households by size					Percentage of population in household by size				
		1	2-4 persons per household	5-6	2-6	7+	1	2-4 persons per household	5-6	2-6	7+
<i>Northern and Middle America and the Caribbean</i>											
Barbados . . .	1960	17.6	46.5	19.0	65.5	16.9	4.4	33.4	26.0	59.4	36.2
Bermuda . . .	1960	10.1	58.7	19.1	77.8	12.1	2.6	44.2	26.2	70.4	27.1
British											
Honduras . . .	1960	13.5	40.2	21.0	61.2	25.3	2.9	25.3	24.4	49.7	47.5
Canada . . .	1961	9.3	58.4	21.5	79.9	10.9	2.4	44.3	29.9	74.2	23.5
Cayman											
Islands . . .	1960	10.8	43.9	22.7	66.6	22.5	2.4	28.4	27.1	55.5	42.1
Costa Rica . . .	1963	5.9	33.2	24.4	57.6	36.5	1.1	18.6	24.1	42.7	56.2
Dominica . . .	1960	16.9	44.5	19.4	63.9	19.2	4.1	31.3	25.4	56.7	39.2
Dominican											
Republic . . .	1960	8.7	39.5	23.3	62.8	28.5	1.7	23.7	25.2	48.9	49.3
El Salvador . . .	1961	5.1	38.3	27.9	66.2	28.7	1.0	22.4	28.5	50.9	48.1
Greenland . . .	1960	7.6	35.7	25.5	61.2	31.2	1.5	21.3	26.5	47.8	50.7
Grenada . . .	1960	16.2	40.5	20.9	61.4	22.4	3.6	27.0	25.7	52.7	43.7
Honduras . . .	1961	4.2	33.6	27.5	61.1	34.8	0.7	18.8	26.6	45.4	53.9
Jamaica . . .	1960	19.1	46.0	17.8	63.8	17.1	4.9	33.8	24.8	68.6	36.5
Martinique . . .	1961	20.3	40.6	17.6	58.2	21.5	4.8	27.7	22.8	50.5	44.7
Mexico . . .	1960	...	41.1	29.2	70.3	29.7	...	23.0	22.8	45.8	47.8
Netherlands											
Antilles . . .	1960	11.7	41.3	20.4	61.7	26.6	2.4	24.7	22.5	47.2	50.5
Nicaragua . . .	1950	3.9	33.6	26.7	60.3	35.8	0.7	17.5	24.3	41.8	57.5
Panama . . .	1960	13.4	39.2	22.8	62.0	24.6	2.9	25.2	26.7	51.9	45.2
St. Lucia . . .	1960	16.0	45.7	18.7	64.4	19.6	3.8	31.5	24.1	55.6	40.6
St. Pierre and											
Miquelon . . .	1957	9.9	53.4	25.4	78.8	11.4	2.5	39.6	34.2	73.8	23.7
St. Vincent . . .	1960	12.0	38.3	22.8	61.1	26.9	2.5	23.6	25.5	49.1	48.4
Trinidad and											
Tobago . . .	1960	16.5	40.7	18.7	59.4	24.0	3.7	26.1	22.7	48.8	47.5
Turks and											
Caicos Islands	1960	13.7	45.0	20.6	65.6	20.7	3.2	30.6	26.2	56.8	39.9
United States											
of America . . .	1960	14.0	63.7	11.0 ^a	...	11.3 ^b	4.3	54.8	16.7 ^a	...	24.2 ^b
United States											
Virgin											
Islands . . .	1950	30.8	43.3	13.5	56.8	12.4	9.3	36.0	22.1	58.1	32.6
<i>South America</i>											
Argentina . . .	1960	6.9	54.5	23.4	77.9	15.2	1.6	39.1	29.0	68.1	30.3
Brazil	1950	5.0	42.0	25.1	67.1	27.9	1.0	25.2	26.7	51.9	47.1
British Guiana											
(now											
Guyana) . . .	1960	11.0	37.8	21.8	59.6	29.4	2.2	22.4	23.7	46.1	51.8
Chile	1960	5.0	37.3	26.9	64.2	30.9	0.9	21.6	27.2	48.8	50.3
Ecuador . . .	1962	6.7	40.1	25.4	65.5	27.8	1.3	24.1	27.1	51.2	47.5
Paraguay . . .	1950	5.0	38.4	25.8	64.2	30.8	1.0	22.4	26.5	48.9	50.1
Peru	1961	7.5	37.7	26.7	64.4	28.1	1.6	24.1	30.0	54.1	44.3
Surinam . . .	1964	14.7	39.5	18.8	58.3	27.0	3.1	24.2	21.8	46.0	51.0
Venezuela . . .	1961	8.8	35.3	23.4	58.7	32.5	1.7	20.4	24.1	44.5	53.8
<i>Asia</i>											
Brunei	1960	14.2	34.2	24.3	58.5	27.3	2.9	21.4	26.9	48.3	48.9
Cambodia											
(now Khmer											
Republic) . . .	1958	1.5	43.1	32.8	75.9	22.7	0.3	27.7	35.8	63.5	36.2
Ceylon	1953	7.6	39.7	27.3	67.0	25.4	1.5	24.6	29.7	54.3	44.2
Cyprus	1960	10.8	53.0	24.0	77.0	12.2	2.7	39.6	32.8	72.4	24.9
Hong Kong . . .	1961	15.2	42.3	22.4	64.7	20.2	3.4	28.3	27.5	55.8	40.8
India	1961	7.1	...	...	66.4	26.5	1.4	...	...	52.7	45.9
Iran	1956	5.4	28.5	47.3	75.8	18.8	1.2	15.9	50.3	66.2	32.6
Iraq	1957	4.2	40.3	28.1	68.4	27.3	0.8	24.2	29.3	53.5	45.7
Israel	1961	11.6	60.8	16.9	77.7	10.7	3.1	48.9	24.0	72.9	24.0
Japan	1960	4.7	47.7	30.4	78.1	17.3	1.0	32.7	36.2	68.9	30.1
Jordan	1961	5.8	38.2	25.2	63.4	30.8	1.1	21.9	26.3	48.2	50.7
Korea,											
Republic of	1960	2.3	33.6	31.2	64.8	32.9	0.4	19.5	30.8	50.3	49.3

TABLE 3 (continued)

Continent and country	Year of census or sample survey	Percentage of households by size					Percentage of population in household by size				
		1	2-4	5-6	2-6	7+	1	2-4	5-6	2-6	7+
		Persons per household					persons per household				
Malaysia											
Federation of Malaya (now West Malaysia)	1957	10.0	41.3	24.4	75.7	24.3	2.1	26.1	27.4	53.5	44.5
North Borneo (now Sabah)											
	1960	8.1	40.8	25.7	66.5	25.5	1.6	25.1	28.2	53.3	45.1
Sarawak	1960	5.4	35.3	27.3	62.6	32.0	1.0	20.4	27.2	47.6	51.4
Pakistan	1961	4.6	37.3	29.5	66.8	28.7	1.0	25.8	35.2	61.0	37.9
Philippines	1957	1.6	33.3	30.3	63.6	34.8	0.3	18.9	29.1	48.0	51.7
Ryukyu Islands											
	1960	16.5	37.2	22.6	59.8	23.8	3.7	24.8	28.5	53.3	43.1
Singapore	1966	8.2	30.0	23.6	53.6	38.2	1.4	16.0	22.3	38.3	60.3
Syria	1960	6.7	35.6	26.3	61.9	31.3	1.3	20.6	27.2	47.8	51.0
Thailand	1960	2.5	34.4	30.2	64.6	32.9	0.4	19.7	29.4	49.1	50.5
Turkey	1960	3.9	42.0	29.6	71.6	24.5	0.8	26.6	32.1	58.7	40.5
Europe											
Albania	1955	7.4	32.4	27.7	60.1	32.5	1.3	18.3	27.1	45.4	53.2
Austria	1961	19.7	62.9	12.7	75.6	4.7	6.5	58.4	22.5	80.9	12.6
Belgium	1961	16.8	67.1	12.1	79.2	4.0	5.6	61.7	21.4	83.1	11.3
Bulgaria	1956	2.3	65.6	22.8	88.4	5.3	1.7	54.5	32.9	87.4	11.0
Czechoslovakia	1961	14.2	69.1	13.8	82.9	2.8	4.6	64.8	23.6	88.4	7.1
Denmark	1960	19.8	65.4	12.5	77.9	2.3	6.8	64.4	22.8	87.2	6.0
Finland	1960	21.5	53.4	17.2	70.6	7.8	6.4	47.0	27.7	74.7	18.9
France	1962	19.6	60.2	14.7	74.9	5.5	6.3	54.2	25.3	79.4	14.3
Germany, Federal Republic of	1961	20.4	65.8	11.5	77.3	2.4	7.1	65.0	21.4	86.4	6.5
Germany, West Berlin	1961	37.7	58.6	3.3	61.9	0.4	18.0	72.3	8.4	80.7	1.3
Guernsey	1961	12.3	70.7	13.6	84.3	3.4	4.0	63.9	23.4	87.3	8.7
Gibraltar	1961	4.9	57.6	26.1	83.7	11.4	1.2	42.8	33.8	76.6	22.2
Greece	1961	10.0	58.4	23.7	82.1	7.9	2.6	47.5	33.8	81.3	16.1
Hungary	1960	14.5	68.5	14.0	82.5	3.0	4.7	63.8	24.0	87.8	7.4
Iceland	1950	17.7	48.5	22.9	71.4	10.9	4.7	39.9	32.7	72.6	22.7
Ireland	1961	12.6	52.1	20.4	72.5	14.9	3.2	37.9	27.8	65.7	31.1
Italy	1961	10.7	62.4	19.5	81.9	7.4	2.9	51.8	28.8	80.6	16.5
Luxembourg	1960	11.5	69.8	14.8	84.6	3.9	3.6	62.4	24.6	87.0	9.4
Malta and Gozo	1957	11.3	52.2	19.6	71.8	16.9	2.7	36.9	25.8	62.7	34.6
Monaco	1956	21.7	67.6	9.1	76.7	1.6	8.1	69.2	18.0	87.2	4.6
Netherlands	1960	11.9	61.3	18.1	79.4	8.6	3.3	49.6	27.2	76.8	19.9
Norway	1960	18.0	63.7	15.2	78.9	3.2	5.8	60.4	26.0	86.4	7.8
Poland	1960	16.2	57.3	20.6	77.9	5.9	4.7	50.2	32.0	82.2	13.2
Portugal	1960	8.3	59.4	20.8	80.2	11.5	2.1	45.3	28.5	73.8	24.0
Romania	1956	27.9	54.0	14.1	68.1	4.0	9.6	53.8	26.0	79.8	10.6
Sweden	1960	21.9	65.3	11.0	76.3	1.9	7.8	66.5	20.7	87.2	5.0
Switzerland	1960	14.2	64.6	15.6	80.2	5.6	4.3	56.3	25.5	81.8	13.8
United Kingdom											
England and Wales	1961	13.4	71.2	12.6	83.8	2.8	4.4	66.3	22.0	88.4	7.2
Northern Ireland	1961	11.5	59.7	18.7	78.4	10.1	3.1	47.0	27.2	74.2	22.7
Scotland	1961	11.8	69.0	15.4	84.4	3.8	3.6	61.8	25.4	87.2	9.2
Yugoslavia	1961	13.8	52.0	23.2	75.2	11.0	3.6	41.4	32.6	74.0	22.4
Oceania											
Australia	1961	10.3	62.7	20.8	83.5	6.2	2.9	51.9	31.4	83.3	13.8
Christmas Island (Australia)	1957	67.2	17.0	8.4	25.4	7.4	29.5	23.2	20.0	43.2	27.4
New Zealand	1956	10.0	62.5	20.6	83.1	6.9	2.8	50.9	30.8	81.7	15.5
Niue	1961	9.6	30.9	28.5	59.4	31.1	1.8	18.4	28.8	47.2	51.0
Pacific Islands	1958	4.4	32.1	22.3	54.4	41.2	0.7	15.6	19.2	34.8	64.5

TABLE 3 (concluded)

Continent and country	Year of census or sample survey	Percentage of households by size					Percentage of population in household by size				
		1	2-4 persons per household	5-6	2-6	7+	1	2-4 persons per household	5-6	2-6	7+
USSR											
USSR	1959	15.7	62.1	17.4	79.5	4.8	4.8	55.6	28.3	83.9	11.3
Byelorussian											
SSR	1959	14.4	63.3	18.5	81.8	3.8	4.3	56.9	30.0	86.9	8.8
Ukrainian											
SSR	1959	15.1	47.1	35.1	82.2	2.8	4.5	35.2	48.3	83.5	12.0

SOURCE: United Nations, *Demographic Yearbook, 1962* (United Nations publication, Sales No. 63.XIII.1), table 12, pp. 398-413; United Nations, *Demographic Yearbook, 1963* (United Nations publication, Sales No. 64.XIII.1), table 33, pp. 704-713. The data for some countries were taken directly from the cards on households and population by size of household kept in the Statistical Office of the United Nations Secretariat.

Singapore: Ministry of National Development, Republic of Singapore and Economic Research Centre University of Singapore, *Singapore Sample Household Survey, 1966*, Report No. 1, tables relating to population and housing (Singapore, September 1967), table H.73, pp. 267-268.

El Salvador: Dirección General de Estadística y Censos, Ministerio de Economía, República de El Salvador, *Tercer Censo Nacional de Población 1961* (1965), table 44, p. 828.

Panama: Dirección de Estadística y Censo, Contraloría General de la República de Panamá, *Censos Nacionales de 1960: Sexto Censo de Población y Segundo de Vivienda, Volume VII, Características de la Familia* (1964), table 2, p. 2 and table 7, p. 20.

^a 5 persons per household.
^b 6+ persons per household.

are broken down into four categories: (a) one-person households; (b) households with 2-4 persons; (c) households with 5-6 persons; (d) households with 7 or more persons. Some explanation will be given below regarding the methods of classification.

(a) Separate treatment of one-person households is particularly needful since a majority of them are young, unmarried individuals living in urban areas as independent dwellers in small apartments, or as lodgers and boarders in the same housing units with host households. Both the lodgers and boarders, and even the single persons living separately in apartments, are marginal groups whose definitions are generally not clear-cut. The distinction between them is sometimes quite arbitrary. Thus it is understood that percentage differences as recorded among countries may largely reflect differences in definitions and concepts, whereas serious differences arising from varying degrees of urbanization and industrialization, which are generally regarded, directly or indirectly, as important determinants of the size of households and families, may be concealed.

(b) The majority of households in this group are considered to be nuclear families with one or two children. A relatively large percentage of households of this group in a country would indicate a relatively large number of small nuclear families, the result of comparatively low fertility, and only a small number of large, extended families.

(c) Households with 5-6 persons are regarded as intermediate sized households.

(d) Households with 7 persons or more signify relatively large families, whether of the nuclear type with a large number of children living together, or of the extended type. This situation generally reflects high fertility and underdevelopment.

From table 3, it is immediately clear that there are substantial differences not only among regions of the world but also among countries within the same region

with relatively similar cultures and economic levels. Those disparities are particularly great with respect to the percentage of one-person households and of households with 7 or more persons.

Evaluation and comparison are made for each region from one country to another, on the basis of the data in table 3. Within the African region, Cameroon in 1957 shows 46.0 per cent for one-person households, containing 20.9 per cent of the total population, and 0.8 per cent for households with 7 persons and more, containing 2.7 per cent of the population in the same category. Sierra Leone in 1963 had 22.7 per cent for one-person households, containing 5.7 per cent of the population, and 17.2 per cent for households with 7 persons and more, containing 44.8 per cent of the population. At the other extreme, Mali, in 1960/61 had only 0.15 per cent for one-person households, containing 0.03 per cent of the population, and 24.5 and 46.9 per cent respectively for households of 7 and over. Can these differences really reflect corresponding differences in the actual structure of households? This possibility cannot be ruled out, but they may also be largely related to differences in definition and enumeration procedures in the censuses.

For the Latin American countries, examples are taken from Dominica, the Dominican Republic and Honduras. In Dominica in 1960, one-person households constituted 16.9 per cent of all private households and 4.1 per cent of total population, while households of 7 persons and over constituted 19.2 per cent of households and 39.2 per cent of the population. The Dominican Republic in 1960, however, shows only 8.7 per cent of households and 1.7 per cent of the population for one-person households, and 28.5 and 49.3 per cent for households of 7 and over. Single households in Honduras, 1961, constituted 4.2 per cent of households and 0.7 per cent of the population, and households of 7 and over were 34.8 and 53.9 per cent. At the other extreme, Martinique, in 1961, showed 20.3 per cent for one-person households, containing 4.8 per

cent of the population, and 21.5 and 44.7 per cent for households of 7 and over. Considering the relatively similar economic, social and cultural backgrounds of these countries, and their geographical proximity to each other, it might well be conjectured that the differences are largely due to census definitions of households and families and to related census enumeration practices.

Likewise, Asia shows disparities among its countries that are as wide as those in other continents. The Ryukyu Islands (1960) showed 16.5 per cent of households and 3.7 per cent of population in one-person households and Hong Kong (1961) showed 15.2 per cent of households and 3.4 per cent of the population in one-person households, whereas Japan (1960) showed 4.7 per cent of households and 1.0 per cent of the population in the same category. Furthermore, for one-person households, the Philippines (1957) showed 1.6 per cent of households and 0.3 per cent of the population for one-person households, and Cambodia (1958) 1.5 per cent and 0.3 per cent, respectively, which are extremely small percentages for this category. By the same token, the Republic of Korea (1960) had 2.3 per cent of households and 0.4 per cent of the population in one-person households. There may perhaps be substantive differences in actual situations, since the Ryukyu Islands and Hong Kong represent somewhat atypical cases in East Asia, yet cultural similarities existing between Japan, Korea, the Ryukyu Islands and Hong Kong suggest that there may also be some fundamental differences in actual census practices and definitions of households and families.

In Europe, there is generally more homogeneity than in Africa, America and Asia with regard to the percentage of one-person households and the population included in this category. In many Western European countries one-person households constitute from 10 to 20 per cent of all households, and their population amounts to between 3 and 7 per cent of total population. There are notable exceptions, however, among Eastern European countries such as Bulgaria and Albania, where in the mid-1950s one-person households made up only 2.3 per cent and 7.4 per cent respectively of all households. Moreover, the proportion of total population living in these households was only 1.7 and 1.3 per cent, respectively.

In Oceania, Christmas Island (Australia) in 1957 had an extremely high figure of 67.2 per cent as the percentage of one-person households and 29.5 per cent of the total population resided in such households, whereas the Pacific Islands in 1958 showed 4.4 per cent and 0.7 per cent, respectively.

AN EXAMPLE OF CHANGE IN DEFINITION

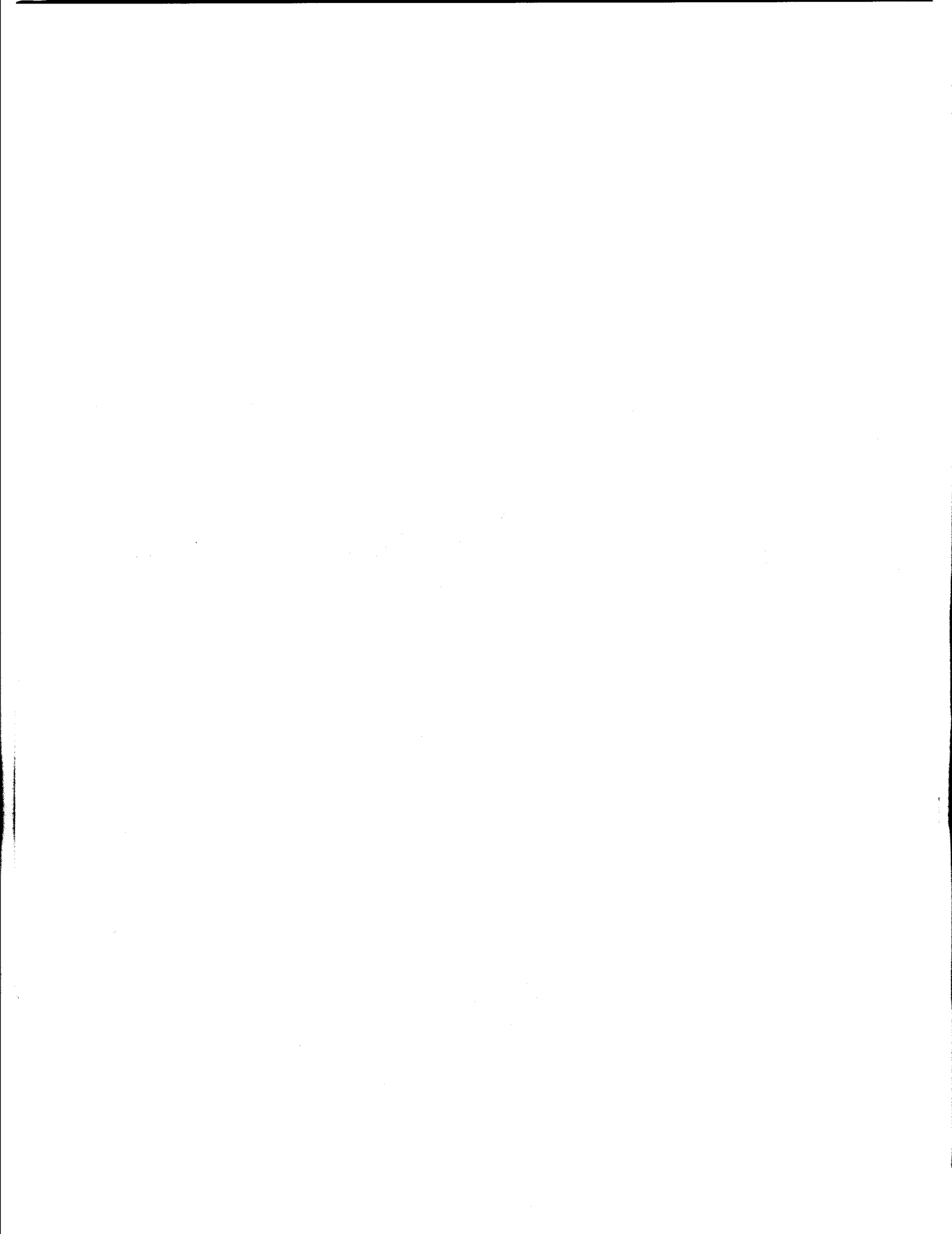
The case of the Ryukyu Islands is a clear example of the effects of differences in the definition of households and families, illustrating the importance of evaluating data before undertaking demographic analyses and projections.

In the 1960 census of the Ryukyu Islands, the percentage of private households of one person was 16.5. On the other hand, it was only 8.7 in the 1955 census, and similar percentages are shown in censuses taken prior to 1945. Before the Second World War, in the censuses of 1920 and 1930 the households were cross-classified by size. In the 1920 census, one-person households comprised 8.3 per cent of the total of private ("ordinary") households and in the 1930 census, they comprised 9.3 per cent of the total.

The sudden increase in the percentage of one-person households can be explained to a large extent by the change in the definition of this type of household. Before 1960, the censuses distinguished between ordinary households and quasi-households or institutional households. In this way a large number of *de facto* one-person households in institutions, group quarters or domestic employment were not included in one-person households in the ordinary households but were treated as members of large ordinary households or quasi-households. This way of enumerating only the one-person private ("ordinary") households as one-person households was changed dramatically in 1960 when each one-person household in the true sense, no matter whether private, quasi or institutional, came to be recognized as such. This is the reason why the number of one-person households grew in comparison not only with the numbers recorded in previous census years, but also with those of other countries in the Far East region, including of course, Japan and the Republic of Korea.

Part Two

**SUMMARIES OF VARIOUS METHODS USED FOR PROJECTING
HOUSEHOLDS AND FAMILIES**



INTRODUCTION

A good number of countries have recently made projections of households and families.¹ Several countries — such as France, Ireland, the United Kingdom and the United States of America — have been issuing periodic publications of household and family projections since the Second World War. Projections have seldom been attempted in the developing countries.

Numerous methods for projecting households and families have been devised and applied by different countries, institutions and individuals. The methods used vary widely from the crude to the highly refined, depending upon the type of data available and the needs served by the projections.

Part two of this manual attempts an inventory of the major demographic methods used in past projections of households and families, and of their frames of reference. Besides its own purpose of providing a convenient list of the main techniques of projection, it will also serve as an introduction to the subsequent chapters, which will focus more on the use of the "headship rate method".

The classification of the methods of projecting households and families may be made in various ways. H. V. Muhsam classified the so-called "sectional projections" into two main groups: (a) the cohort method; (b) the ratio method.² The "cohort method" is essentially the same method as is generally used in "component projections" of total population. In this type of method, persons or groups born or formed in a particular period of time are traced through life, to ascertain the proportion who have certain relevant characteristics, concerning the number of children born to them, their economic activity, household headship, school enrolment and so forth. The cohort method projections are projections that not only deal with the stock of population but also take account of its flows.

The ratio method relies on a projection of the total population by certain demographic characteristics. The

size of a certain section in the population is obtained by applying suitable participation ratios, such as economic activity rates, school enrolment ratios, percentages urban and rural, or "headship rates", to the total population already projected according to the corresponding demographic traits. For instance, the future economically active population may be obtained by applying sex-age specific economic activity rates (ratio of the economically active population by sex and age to the population by the corresponding categories), estimated for future years, to the population projections by the same categories. Likewise, the future number of households or families may be obtained by applying sex-age and/or marital-status specific headship rates (ratios of heads to the total population in the same sex-age and/or marital-status groups), estimated for future years, to the corresponding population projections.

The problems involved in household and family projections stem from the fact that the basic household and family statistics on which the projections must be based are not normally collected regarding the movement of persons in and out of households and families. Inflows and outflows concerning the individuals, that is, births, deaths, marriages and divorces, are well-defined events which are reported to the authorities and are cross-tabulated by their statistical office. By contrast, changes in household or family status, ins and outs, are rarely reported to any local agency, thus making it difficult to obtain the "vital statistics" of households and families. In most cases, the probabilities of such events can only be inferred from cross-sectional data.³

For these reasons, it is usually difficult to attempt a cohort approach to household and family projections, although this approach is known to be generally superior to the ratio method and has been recommended as the methodological alternative to that method. Some cohort approaches were attempted in the past, using fertility and nuptiality tables as tools.⁴ It should be noted here, how-

¹ At least 42 sets of country projections have so far been located by the Population Division. For 15 countries out of 23, 32 different sets of projections have been prepared by the headship rate method; and for the remaining 10 countries, projections have been made either by simple ratio methods, by the vital statistics method or the highly sophisticated life-table method.

² H. V. Muhsam, "Projections of urban and rural population, economically active population, households and families", *Proceedings of the World Population Conference, Belgrade, 30 August-10 September 1965, Volume I: Summary Report* (United Nations publication, Sales No. 66.XIII.5), p. 272. In comparison with projections of economically active population and urban-rural population distribution, projections of households and families may be called a "molecular type" of projection, in contrast to an "atomistic" type. See Minoru Tachi, *Keishiki Jinkogaku (Formal Demography)* (Tokyo, Kokon Shoin Co., 1960), pp. 247-251. According to Tachi, individuals of the population represent the "atomistic" units of the society, while households, families and business establishments constitute the "molecular" units.

³ Guy H. Orcutt and Alice M. Rivlin, "An economic and demographic model of the household sector: a progress report" in United States National Bureau of Economic Research, *Demographic and Economic Change in Developed Countries* (Princeton, Princeton University Press, 1960), p. 296. Countries such as the Scandinavian countries, the Netherlands, Israel and Japan which maintain population registers receive reports from individual households or families. Their cross-tabulation by demographic characteristics or individuals and households or families for each year or each month, while not impossible, is extremely costly, due to the enormous number of cells to be cross-tabulated and published at frequent intervals.

⁴ See, for example, S. P. Brown, "Analysis of a hypothetical stationary population by family units — a note of some experimental calculatons", *Population Studies* (London), vol. IV, No. 4 (March 1951), pp. 380-394; Ruth Glass and F. G. Davidson, "Household

ever, that not all the cohort-type projections of households and families are necessarily superior to those made by the ratio method. Without sex-age breakdowns of the household heads or the other members, a simple method dealing with aggregate ins and outs of households might risk introducing more errors than the cross-sectional headship rate method, classified by sex, age and/or marital status. Actually, hardly any cohort projections have been found which are sophisticated enough to supersede the headship rate method, whose sex, age and marital status specific rates are assumed to change. Even the United States Bureau of the Census, which has so far

structure and housing needs", *Population Studies* (London), vol. IV, No. 4 (March 1951), pp. 395-420.

accumulated the greatest wealth of household and family statistics and projections in the world, has not yet made cohort-type projections of households and families.

In view of the relatively rare application of the cohort method, an attempt is being made to reclassify all the practicable methods of projecting households and families into the following four categories: (a) Simple households-to-population ratio method; (b) Life-table method; (c) Vital statistics method; (d) Headship rate method.

The above four categories are by no means mutually exclusive. For example, the "headship rate method" can be combined with the life-table method if detailed headship data are available by duration of marriage, number of children and the like, in addition to the tabulations by sex and age.

Chapter III

METHODS NOT USING HEADSHIP RATE

SIMPLE HOUSEHOLD-TO-POPULATION RATIO METHOD

Mainly because of the paucity of cross-tabulated census or sample survey data on household and family heads, it is not possible with developing countries to make an elaborate projection of households and families which takes into account the various factors affecting their future growth and structural changes. In those countries, it is frequently necessary to resort to population census data for estimating the future rate of growth of households. A crude estimate is obtained by taking the rate of growth of total households to be equal to the rate of growth of the population, or, similarly, by taking the same ratio of the number of households to the total population and applying it to the future population projections already prepared. This method clearly assumes that the average size of household remains constant during the projection period. It should be noted, however, that in many countries, the number of households may grow at a considerably different rate from that of the total population,¹ thus invalidating the general use of such a constant ratio method. A growth rate different from that for the population may therefore be used for households.

A better estimate of the future number of households may be obtained either (a) by calculating the rate of growth of the adult population of, for instance, 18 years and over, or between 20 and 65 or 25 and 70 years old, from the base year to the year of the projections, then applying this rate of growth to the number of households at the base year; (b) by applying the ratio between the number of households at the base year and the adult population for the same year, to the future adult population for the year of the projections, since household formation is usually confined to this section of the population.² As was seen, the number of persons in this kind of broad age group is little affected by the assumed trend of either fertility or

mortality during the periods for which most projections are made, and hence it introduces relatively few errors to the projected population figures.³ In the absence of data required for more refined methods, a frequently used method for estimating the future number of households is the application to the projected population total of a constant or changing ratio of the number of households to the adult population.

In geographical subdivisions such as provinces, states or cities, the demand for household and family projections has recently increased, but available basic demographic statistics on households and families are much more limited than for the nation as a whole and, for this reason, projections by more refined methods may not be directly possible. In such circumstances, the above-mentioned type of simple ratio method may be employed, and the ratio may be extrapolated by modified exponential, logistic or other mathematical curves.⁴

An example of how to project households, using the ratio of the number of households to the population aged 20-64, will be shown below. Venezuela is the sample country here. Venezuela took two post-war censuses, in 1950 and 1961, from which data on both the age composition of the population and the number of households are available. The basic figures are as follows:

Year	Number of households	Population aged 20-64	Ratio of the number of households to population aged 20-64
1950	903 175	2 286 975	0.39492
1961	1 372 275	3 234 775	0.42423

The official population projections by five-year age group are readily available for the years 1965, 1970 and 1975.⁵ Multiplication of the future projections of population for ages 20-64 by the future estimated ratio of the number of households to the population aged 20-64 will yield the projections of the number of households.

One important question is whether the ratio of the number of households to the population aged 20-64 will change in the future and, if so, in what way. From 1950 to

¹ This has clearly been seen in recent years in countries like Japan, where urban-rural migration has been swift and substantial in volume, and the nuclearization of the family has become a common phenomenon. From 1955 to 1960, the population growth rate in Japan was 0.91 per cent per annum, whereas the rate of growth of households was 2.84 per cent. From 1960 to 1965, the population growth rate was 1.02 per annum, whereas the rate of growth of households was 3.12 per cent. Eleven developed countries for which long-term data are available show continuous secular declines in average size of household, indicating that the growth of households has been faster than that of the population.

² Jacob S. Siegel, "Demographic information required for housing programmes with special reference to Latin America", revised version of a paper prepared for the Latin American Seminar on Housing Statistics and Programmes, held at Copenhagen in 1962, p. 42.

³ H. V. Muhsam, "Population data and analyses needed in assessing present and future housing requirements", paper prepared for the United Nations Seminar on Evaluation and Utilization of Population Census Data in Asia and the Far East, held at Bombay, 20 June to 8 July 1960.

⁴ Linear extrapolation can also be done, but it normally gives unrealistically high figures as the number of years increases.

⁵ Gobierno de Venezuela, Dirección General de Estadística y Censos Nacionales, Oficina de Análisis Demográfico, *Proyección de la Población de Venezuela* (Caracas, 1963).

1961 the ratio increased from 0.39492 to 0.42423. The question arises as to whether the increase in the ratio will or can continue further. In this connexion, some of the countries whose historical experience may throw light on the future course of this index for Venezuela may be examined here.

For this purpose, five developed countries are selected, Canada, Denmark, Japan, Sweden and the United States of America, for which trends in the number of households and the age composition of the population are available for sufficiently long periods of time. An examination of long-range trends in this ratio would make it possible to

assess an interrelationship between the change in the ratio and the tempo of demographic transition and modernization and to estimate future levels of the ratio. Sweden provides numbers of households since 1860, Canada since 1871, the United States of America since 1890, Denmark since 1901 and Japan since 1920. Numbers of households and population aged 20-64 for these countries are shown in table 4.

From table 4, which shows the trends of the five countries, the following points may be drawn:

(a) Although there were some fluctuations, secular increasing trends are clear in each of the five countries.

TABLE 4. HISTORICAL TRENDS IN THE RATIO OF THE NUMBER OF HOUSEHOLDS TO THE POPULATION AGED 20-64: SWEDEN, CANADA, UNITED STATES OF AMERICA, DENMARK AND JAPAN

Sweden				Canada			
Year	Number of households (in thousands)	Population aged 20-64 (in thousands)	Ratio of number of households to population aged 20-64	Year	Number of households (in thousands)	Population aged 20-64 (in thousands)	Ratio of number of households to population aged 20-64
1860	892.5	2 011.3	0.44374	1871	622.7	1 562.6	0.39850
1870	1 017.3	2 144.7	0.47433	1881	800.4	1 961.2	0.40812
1880	1 152.3	2 356.4	0.48901	1891	900.1	2 299.8	0.39138
1900	1 368.3	2 555.1	0.53552	1901	1 058.4	2 696.0	0.39258
1910	1 471.6	2 792.7	0.52695	1911	1 483.0	3 809.2	0.38932
1920	1 607.3	3 121.7	0.51488	1921	1 897.1	4 539.8	0.41788
1930	1 743.3	3 492.5	0.49916	1931	2 275.2	5 478.9	0.41527
1945	2 361.8	4 125.2	0.57253	1941	2 706.1	6 420.3	0.42149
1950	2 385.1	4 253.7	0.56071	1951	3 409.3	7 614.5	0.44774
1960	2 581.2	4 354.8	0.59273	1956	3 923.6	9 222.6	0.42543
1965	2 777.7	4 537.4	0.61218	1961	4 554.7	8 449.3	0.53906
				1966	5 180.5	10 045.9	0.51568

United States of America				Denmark			
Year	Number of households (in thousands)	Population aged 20-64 (in thousands)	Ratio of number of households to population aged 20-64	Year	Number of households (in thousands)	Population aged 20-64 (in thousands)	Ratio of number of households to population aged 20-64
1890	12 690.2	31 324.2	0.40512	1901	556.7	1 216.5	0.45762
1900	15 964.0	39 135.7	0.40791	1911	649.4	1 390.0	0.46719
1910	20 255.6	49 381.7	0.41018	1921	794.8	1 710.7	0.46461
1920	24 351.7	57 666.8	0.42228	1930	940.5	1 994.0	0.47166
1930	29 904.7	68 490.7	0.43662	1940	1 158.1	2 295.2	0.50457
1940	34 948.7	77 344.4	0.45186	1950	1 330.8	2 472.7	0.53820
1950	42 857.3	86 663.9	0.49452	1960	1 544.4	2 560.8	0.60309
1960	53 021.1	94 034.0	0.56385	1965	1 663.3	2 676.4	0.62147

Japan		
Year	Number of households (in thousands)	Population aged 20-64 (in thousands)
1920	11 101.1	26 910.0
1925	11 879.2	28 641.5
1930	12 582.0	31 000.8
1935	13 378.1	33 574.9
1940	14 218.9	35 202.3
1950	16 580.1	41 090.1
1955	17 959.9	46 103.7
1960	20 656.2	50 693.5
1965	24 081.8	56 076.1

(Source notes next page)

Ratios have been increasing and are highly likely to continue to do so in the near future.

(b) In Sweden and the United States of America and especially in Denmark, the ratio exceeded the level of 50 per cent and even of 60 per cent. It is considered that a host of social and economic factors influenced such tendencies. Particularly in the case of Sweden, where the ratio had already reached the level of about 50 per cent at the beginning of the century, the increase may have been caused to a considerable extent by the process of aging due to the current fertility decline and to the emigration of the young working population from Sweden at the end of the nineteenth century and the beginning of the twentieth century.⁶ A quick analysis of the ratios of the number of households to the population aged 20-64 for the five countries suggests that it would be realistic to assume that Venezuela may in the future reach the level of 50 per cent.

(c) A J-shaped or U-shaped curve seen in the figures for both Canada and Japan indicates interesting demographic and economic features of a very rapidly changing society.

⁶ The Swedish statistics show that the number of emigrants as well as the excess of emigration over immigration became noticeably large after around 1880. The trend of this large outflow of presumably working-age population continued until about 1915, and then gradually tapered off; see Sweden, Statistiska Centralbyrån, *Historisk Statistik för Sverige*, table B.17, pp. 64-65. Denmark experienced somewhat similar tendencies in emigration, though on a much smaller scale and in a less distinct way, in the early twentieth century; see Denmark, Det Statistiske Department, *Befolkningsudvikling og Sundhedsforhold, 1901-1960*, table 30, p. 117. This was because the headship rate, in other words, the ratio of the number of heads of households to the population in the corresponding sex-age group, is normally lower in the younger than in the older working-age population, so that the emigration of a relatively smaller proportion of the younger age group would produce a larger ratio of the number of heads over the population aged from 20 to 64. At the same time, it is generally considered that, even in those early periods, younger people tended to have their own households separate from their parents, and older people tended to retain their headship by separating from their sons and daughters.

The population in the society is first subject to a mortality decline, causing a relative increase in non-head population in the age group 20-64, thus leading to an initial appreciable decline in the ratio of the number of households to the population aged 20-64. The population is later subject to a process of undoubling of households promoted by urban-rural migration, improvement in the housing shortage and so on, and thus the ratio is raised. Canada changed its definition of the term household in the 1951 census from that of the housekeeping unit to that of the housing (dwelling) unit, but as is evident in table 4, the effect of this appears to be insignificant in the J-shaped swing of the trend. Among developing countries, for example, the Republic of Korea has shown a similar J-shaped curve in the household-to-population ratio from 1950 to 1966, as shown below.

Year	Number of households (in thousands)	Population aged 20-64 (in thousands)	Ratio of the number of households to population aged 20-64
1955	3 801.9	9 508.5	0.39984
1960	4 378.0	11 029.0	0.39695
1966	5 191.5	12 810.1	0.40527

SOURCE

Heads for 1955: United Nations, *Demographic Yearbook*, 1963, pp. 708-709;
 Heads for 1960: The card file in the Statistical Office of the United Nations;
 Heads for 1966: The Bank of Korea, *Economic Statistics Yearbook*, 1970 (Seoul, 1970), p. 9;
 Population: United Nations, *Demographic Yearbook* for various years.

In view of the above observations concerning other countries, it is assumed that the ratio of the number of households to the population aged 20-64 for Venezuela will further continue to increase. On the basis of this hypothesis, an application is made of a modified exponential curve to the situation in Venezuela for which the ratio of the number of heads over the population aged 20-

SOURCES:

Sweden

Households for 1860-1950: Statistiska Centralbyrån, *Historisk Statistik för Sverige, I: Befolkning, 1720-1950* (Stockholm, 1955), p. 34, table A.24.

Households for 1960: United Nations, *Demographic Yearbook*, 1962, pp. 410-411, table 12.

Population for 1860-1950: Statistiska Centralbyrån, op. cit., p. 22, table A.16.

Population for 1960: United Nations, *Demographic Yearbook*, 1962, pp. 178-179, table 5.

Canada

Households for 1871-1931: Dominion Bureau of Statistics, *Seventh Census of Canada, 1931, Volume I: Population Summary* (Ottawa, 1936), p. 1396, table 106.

Households for 1941: Dominion Bureau of Statistics, *Eighth Census of Canada, 1931, Volume V: Dwellings, Households and Families* (Ottawa, 1947), table 1, p. 2.

Households for 1951-1961: Dominion Bureau of Statistics, *1961 Census of Canada, Series 2.1, Households and Families*, Bulletin 2.1 (Ottawa, 1963), p. 1-1.

Population for 1871-1931: Dominion Bureau of Statistics, *Seventh Census of Canada, Vol. I*, table 8, p. 387 and table 9, pp. 388-389.

Population for 1941, 1951, 1956 and 1961: Dominion Bureau of Statistics, *1961 Census of Canada, Series 1.2, Bulletin 1.2-2* (Ottawa, 1962), table 20, pp. 20-1-2.

United States of America

Households for 1890-1950: Conrad Taeubner and Irene B. Taeuber, *The Changing Population of the United States*, Census Monograph Series (New York, John Wiley and Sons, Inc., 1958), table 54, p. 173.

Households for 1960: United States Bureau of the Census, *United States of America Census of Population: 1960, Vol. I: Characteristics of*

Population, Part 1, "United States summary" (Washington, D.C. United States Government Printing Office, 1964), table 62, pp. 1-175.

Population for 1890-1950: United States Bureau of the Census, *United States Census of Population: 1950, Vol. II: Characteristics of Population*, Part 1, "United States summary" (Washington, D.C., United States of America Government Printing Office, 1953), table 39, pp. 1-93.

Population for 1960: United States Bureau of the Census, *United States Census of Population: 1960, Vol. I*, part 1, table 65, pp. 1-99.

Denmark

Households for 1901-1960: Denmark Det Statistiske Department, *Befolkningsudvikling og Sundhedsforhold, 1901-1960* (Copenhagen, 1966), Statistiske Undersøgelser Nr. 19, table 6.

Population for 1901-1960: *ibid.*, table 8, pp. 58-61.

Japan

Households for 1920-1950: Japan Bureau of Statistics, Office of the Minister, *Showa 25-nen Kokusei Chosa Hokokusho (Population census of 1950)*, Volume 8: *Final Report*, table 16.1, p. 218.

Households for 1955: United Nations, *Demographic Yearbook*, 1962, pp. 404-405.

Households for 1960: Japan Bureau of Statistics, Office of the Prime Minister, *Showa 35-nen Kokusei Chosa Hokokusho (1960 Population Census of Japan)*, Volume 3: *All Japan*, part 1, table 16, p. 452.

Households for 1965: Japan Bureau of Statistics, Office of the Prime Minister, *Showa 40-nen Kokusei Chosa Hokokusho (1965 Population Census of Japan)*, Volume 3: *Whole Japan*, part 1, "Age, sex, etc.", table 9, pp. 382-383.

Population for 1920-1960: Japan Bureau of Statistics, Office of the Prime Minister, *Showa 35-nen Kokusei Chosa Hokokusho (Population census of Japan, 1960)*, *Nihon no Jinko (Population of Japan)* (Tokyo, 1963), table 20, pp. 340-345.

Population for 1965: Japan Bureau of Statistics, *Showa 40-nen Kokusei Chosa Hokokusho*, Volume 3, table 2, p. 78.

TABLE 5. AN EXAMPLE OF PROJECTING HOUSEHOLDS FOR VENEZUELA BY USING THE RATIO OF THE NUMBER OF HOUSEHOLDS TO THE POPULATION AGED 20-64

(1) Year (t)	(2) $\frac{t-1950}{11}$	(3) (2) × 1.9784362	(4) Antilog (3)	(5) (4) × 0.60508	(6) $\frac{1-(5)}{11}$ Estimated ratio for future years	(7) Population projection for ages 20-64 (in thousands)	(8) (6) × (7) Projections of households (in thousands)
1965	1.36364	1.9705947	0.93453	0.56547	0.43453	3 638	1 581
1970	1.81818	1.9607931	0.91368	0.55285	0.44715	4 241	1 896
1975	2.27273	1.9509913	0.89329	0.54051	0.45949	5 036	2 314

64 is available only for the two time-points of 1950 and 1961. Estimates of the ratio for the future years are made in the following formula:⁷

$$(E:1) h_t = 1 - (1 - h_{1950}) \times \left(\frac{1 - h_{1961}}{1 - h_{1950}} \right)^{\frac{(t-1950)}{11}}$$

Where h_t denotes the ratio of total households to the population aged 20-64 in year t ; h_{1950} denotes the said ratio in 1950 as obtained from the 1950 census; and h_{1961} denotes the ratio in 1961 as obtained from the 1961 census.

The value of "11" (eleven) in $\frac{(t-1950)}{11}$ as the power in the equation means the number of years from 1950 to 1961.

The steps for computing h_t for the years 1965, 1970 and 1975 are shown below:

First, find the value of $\frac{(1 - h_{1961})}{(1 - h_{1950})}$

$$\frac{1 - h_{1961}}{1 - h_{1950}} = \frac{1 - 0.42423}{1 - 0.39493} = \frac{0.57577}{0.60508} = 0.95156$$

Then, obtain the logarithm of 0.95156
 $\log 0.95156 = 1.9784362$

After having obtained the above value, find the values of $\frac{(t-1950)}{11}$ for 1965, 1970 and 1975 and multiply them by 1.9784362. The rest of the process of computation is made clear in the steps shown in table 5. Column (7) gives the United Nations population projections for age groups 20-64. The projected numbers of households for Venezuela by this ratio method are shown in column (8).

The limitation of the simple households-to-population ratio is obvious. In the first place, no matter how elaborate the technique of curve-fitting for projections, a simple ratio method lacks the dimension of structural change in the population, thus limiting the possibility of predicting the future number, size and composition of households. Secondly, this simple ratio method does not provide any of the several desirable types of by-products relating to the characteristics of households and families. For example, a future distribution of heads of household by sex and age may be wanted for many purposes, in addition to

projections of the total number of households. It can be obtained as the by-product of calculation by the headship rate method, but the simple ratio method naturally cannot produce such a derivative. Furthermore, more refined procedures allow for alternative possibilities resulting from possible variations in the crucial factors affecting changes in the number of households and families, and hence permit some evaluation of the results in terms of the components which made up the final totals.⁸

LIFE-TABLE METHOD: THE BROWN-GLASS-DAVIDSON MODELS

S. P. Brown made for the United Kingdom a model distribution of the families in a hypothetical stationary population by sex, age and marital status, on the basis of the 1947 British Social Survey data.⁹ Ruth Glass and F. G. Davidson used Brown's family distribution model for projecting future distributions of households and housing needs.¹⁰

Brown's calculation of a model distribution of stationary population by family units was actually based on two types of hypothetical population distribution, a stationary population distribution by sex, age and marital status, and a distribution of the number of married couples, widows and widowers, by number of children. Table 6 shows the stationary population distribution by sex, age and marital status that would ultimately be reached if the 1947 experiences of the United Kingdom in mortality and nuptiality were to continue, and births were to occur in the numbers required to maintain the over-all population at a constant level.

From table 6, it is possible to determine the number of families by size in the hypothetical stationary population of 100,000 persons, making the following assumptions: (a) that any child marrying before age 25 would move from his or her parents to form a new family unit; (b) that, on reaching age 25 without marrying, children would normally leave home and that the number of unmarried

⁷ The formula in its general form was taken from the United States Bureau of the Census, "Illustrative projections of the number of households and families: 1960 to 1980", *Current Population Reports—Population Characteristics*, Series P-20, No. 90 (September 29, 1958), p. 9.

⁸ Jacob S. Siegel, *op. cit.*, p. 42.

⁹ S. P. Brown, "Analysis of a hypothetical stationary population by family units—a note on some experimental calculations", *Population Studies* (London), vol. IV, No. 4 (March 1951), pp. 380-394.

¹⁰ Ruth Glass and F. G. Davidson, "Household structure and housing needs", *Population Studies* (London), vol. IV, No. 4 (March 1951), pp. 395-420.

TABLE 6. THE BROWN MODEL OF STATIONARY POPULATION BY SEX, AGE AND MARITAL STATUS FOR THE UNITED KINGDOM

Age group	Men				Women			
	Single	Married	Widowers	Total	Single	Married	Widows	Total
0-4	3 718	—	—	3 718	3 547	—	—	3 547
5-9	3 668	—	—	3 668	3 508	—	—	3 508
10-14	3 646	—	—	3 646	3 491	—	—	3 491
15-19	3 608	12	—	3 620	3 354	116	—	3 470
20-24	3 007	570	2	3 579	2 195	1 236	5	3 436
25-29	1 580	1 941	10	3 531	847	2 534	15	3 396
30-34	832	2 632	19	3 483	408	2 914	33	3 355
35-39	585	2 815	28	3 428	293	2 947	72	3 312
40-44	490	2 826	42	3 358	247	2 874	139	3 260
45-49	437	2 763	56	3 256	222	2 743	225	3 190
50-54	397	2 626	81	3 104	203	2 536	352	3 091
55-59	358	2 406	118	2 882	189	2 225	540	2 954
60-64	315	2 087	172	2 574	173	1 833	751	2 757
65-69	262	1 673	232	2 167	152	1 362	954	2 468
70-74	201	1 196	272	1 669	125	857	1 074	2 056
75-79	133	721	252	1 106	93	406	1 020	1 519
80-84	69	327	180	576	56	125	745	926
85-89	27	109	87	223	26	22	385	433
90 and over	8	28	33	69	11	2	161	174
All ages	23 341	24 732	1 584	49 657	19 140	24 732	6 471	50 343

SOURCE: S. P. Brown, "Analysis of a hypothetical stationary population by family units — a note on some experimental calculations", *Population Studies* (London), vol. IV, No. 4 (March 1951), p. 392.

Note: the distribution of unmarried children under 25 is assumed to be as follows:

Children of married couples	29 587
Children of widows	1 980
Children of widowers	505
Orphans	100
Illegitimate children	1 570
TOTAL	33 742

children above that age continuing to reside with their parents would be roughly counterbalanced by the number below that age who ceased to live in the parental home for reasons other than marriage.¹¹

Sizes of families, according to the above two assumptions, were determined by three sets of hypothetical population distributions, showing the numbers of unmarried children under age 25 separately for married couples, widows and widowers, using data from the 1946 British Family Census.¹² On the basis of these data, adjustments were made to convert the population distribution by number of children born into that by number of children living in the family and unmarried under age 25. The resultant table (table 7) of family distribution in a stationary population of 100,000 is clearly a hypothetical distribution of families, indicating a state which would ultimately be reached by the interactions of the various demographic factors of mortality, fertility, marriage and divorce.

Glass and Davidson maintained that it is unlikely that families and households would ever be identical, as not all unmarried adults or widowed people would be able or willing to live on their own. They might join other families, as relatives, boarders or domestic servants, and thus "households", as distinct from "families", would be formed. The previously shown distribution of biological families and the survivors of such families, and of single

persons over the age of 25, represents, therefore, the upper limit of household formation.¹³ Because of these assumptions, and because of the age structure of the stationary population of 100,000 persons, there is an extraordinarily high proportion of one-person and two-person families (62.0 per cent of all families),¹⁴ a large total of separate families and a very small average size of family (2.4 persons per family).¹⁵ Such figures do not provide a realistic picture of households as distinct from family structure. For the purpose of estimating housing needs, additional considerations would have to be introduced.

In order to obtain a more realistic picture of the household structure as distinct from the family structure, it is necessary to consider how many and which of the one-person families should be redistributed among other families, and to which families they would most likely be attached. One-person families were reallocated according to their 1947 distribution by their relationship to the households with which they lived;¹⁶ the result is shown in table 8, example A. This is a more realistic estimate in the long run. In addition, Glass and Davidson prepared an alternative conversion, allowing for a considerable amount

¹³ Ruth Glass and F. G. Davidson, op. cit., pp. 395-396.

¹⁴ It should be noted here that Brown's concept of "family" is different from that of the United Nations; for example, he regards one-person households as one-person families.

¹⁵ Ruth Glass and F. G. Davidson, op. cit., p. 396.

¹⁶ According to Glass and Davidson, those data were obtained from the report of the Government Social Survey (now part of the new Office of Population Censuses and Surveys) on *The British Household*, by P. G. Gray, based on a national sample inquiry carried out in 1947.

¹¹ S. P. Brown, op. cit., p. 386.

¹² Many other kinds of special data for the marriage cohort were also taken from the British Family Census. S. P. Brown, op. cit., p. 385.

TABLE 7. THE BROWN MODEL OF STATIONARY POPULATION BY FAMILY UNIT FOR THE UNITED KINGDOM

Persons in family unit	Age group (wife, widow, widower or single person over 25)						All ages
	Under 25	25-34	35-44	45-54	55-64	65 and over	
1 b	3	3 696	1 683	1 473	2 053	6 435	15 343
2 a	741	1 405	891	1 384	2 668	2 626	9 715
b	4	26	93	227	388	111	849
3 a	460	2 043	1 926	1 878	1 047	118	7 472
b	—	15	63	151	127	12	368
4 a	120	1 174	1 466	1 162	269	20	4 211
b	—	5	25	58	30	—	118
5 a	28	457	515	374	44	5	1 423
b	—	2	19	39	18	—	78
6 a	3	218	508	273	21	2	1 025
b	—	—	6	10	—	—	16
7 or more a	—	151	515	209	9	2	886
b	—	—	7	15	—	—	22
All sizes: a	1 352	5 448	5 821	5 280	4 058	2 773	34 732
b	7	3 744	1 896	1 973	2 616	6 558	16 794
a + b	1 359	9 192	7 717	7 253	6 674	9 331	41 526
Total persons in above family units	3 511	22 261	25 516	21 219	13 391	12 432	98 330

SOURCE: S. P. Brown, op. cit., p. 394.
 Note: the balance of the total population of 100,000 persons consists of 100 orphans and 1,570 unmarried illegitimate children under age 25.

^a With married couples.
^b Without married couples.

TABLE 8. THE BROWN-GLASS-DAVIDSON MODEL OF HYPOTHETICAL POPULATION; COMPARISON OF FAMILY AND HOUSEHOLD DISTRIBUTION FOR THE UNITED KINGDOM

(1) Number of persons per household	(3) Original family distribution, families		(4) Number of persons in each group	(6) Household distribution					
	Number	Percentage		(7) Example A, households ^a			(8) Example B, households ^b		
				Number	Percentage	Persons	Number	Percentage	Persons
1	15 343	37.0	15 343	8 269	23.6	8 269	3 459	11.2	3 459
2	10 564	25.4	21 128	9 223	26.4	18 446	8 349	27.0	16 698
3	7 840	18.9	23 520	7 416	21.2	22 248	8 635	27.9	25 905
4	4 329	10.4	17 316	5 237	15.0	20 948	5 221	16.9	20 884
5	1 501	3.6	7 505	2 241	6.4	11 205	2 345	7.6	11 725
6 or more	1 949	4.7	13 518	2 616	7.4	18 884	2 944	9.4	21 329
TOTAL	41 526	100.0	98 330 ^c	35 002	100.0	100 000	30 953	100.0	100 000
Average household size (persons)			2.37			2.86			3.23
Percentage of households containing members other than immediate family		0.0			10.0-16.0			18.0-25.0	

SOURCE: Ruth Glass and F. G. Davidson, "Household structure and housing needs", *Population Studies* (London), vol. IV, No. 4 (March 1951), p. 398.

^a A potential and perhaps, in the long run, more realistic future distribution of population within households by size.

^b A probable and realistic future distribution in the short run.
^c The balance of the total population of 100,000 persons — 100 orphans and 1,570 unmarried illegitimate children under age 25 — had not been allocated to families in the original distribution.

of doubling-up in households, as shown in table 8, example B. This estimate is probable in the short run, but realistic only for the present. In the first type of estimation, the members of nuclear-family households comprise 84.0 per cent of the population in households, and one-person households comprise 8.3 per cent. The alternative, on the other hand, shows 85.0 per cent as nuclear-family households and only 3.4 per cent as one-person households. At the same time, the first type of estimation derived

directly from the Brown model without any doubling-up, consists of 83.0 per cent as nuclear-family households and 15.3 per cent as one-person households, the remaining 1.7 per cent being orphans and illegitimate children.¹⁷

Although Glass and Davidson did not give projections using actual figures, it is possible to obtain household projections by a simple method of prorating the projected

¹⁷ Ruth Glass and F. G. Davidson, op. cit., p. 398.

TABLE 9. COMPUTATIONS OF HOUSEHOLD PROJECTIONS FOR THE UNITED KINGDOM ON THE BASIS OF THE BROWN-GLASS-DAVIDSON MODEL OF STATIONARY POPULATION AND HOUSEHOLD DISTRIBUTION, 1970 AND 1980

(1) Number of persons per household	(2) Number of stationary population, example B	(3) Number of stationary households, example B	1970 projections		(6) Number of stationary population, example A	(7) Number of stationary households, example A	1980 projections	
			Population	Households			Population	Households
			(2) × 56 614 000 ^a 100 000 (in thousands)	(3) × 56 614 000 ^a 100 000 (in thousands)			(6) × 60 686 000 ^b 100 000 (in thousands)	(7) × 60 686 000 ^b 100 000 (in thousands)
1	3 459	3 459	1 958	1 958	8 269	8 269	5 018	5 018
2	16 698	8 349	9 453	4 727	18 446	9 223	11 194	5 597
3	25 905	8 635	14 666	4 889	22 248	7 416	13 501	4 500
4	20 884	5 221	11 823	2 956	20 948	5 237	12 713	3 178
5	11 725	2 345	6 638	1 328	11 205	2 241	6 800	1 360
6 or more	21 329	2 944	12 075	1 667	18 884	2 616	11 460	1 588
TOTAL	100 000	30 953	56 614	17 525	100 000	35 002	60 686	21 241
Average household size			3.23				2.86	

SOURCE: figures in columns (2), (3), (6) and (7) are based on table 8.
^a Population projection for the United Kingdom, 1970, according to projection II published by the Organisation for Economic Co-operation

and Development.
^b Population projection for 1980, according to projection II.

total population by the stationary distribution of both population and households, as shown in table 9, columns (4), (5), (8) and (9). According to the report of the Organisation for Economic Co-operation and Development (OECD) on projections of European populations,¹⁸ assuming net immigration, declining mortality and increasing fertility, projections for the United Kingdom give 56,614,000 households for 1970 and 60,686,000 for 1980. The application of the stationary distribution of both population and households as given in table 8, using the values of example B for 1970 and those of example A for 1980, results in the computation of projections of numbers of households and their members as shown in table 9. It should be noticed that average household sizes are naturally the same as those for the model household distributions.

Disadvantages in the life-table approach will be evident without much elaboration. First, this type of estimation of household and family distribution has no direct correspondence with the population projections by sex and age readily available for the United Kingdom. In general, population projections by sex and age can be made more easily and perhaps more reliably than those of numbers of households and families and other sectional population projections. Hence, the use of readily available population projections as the basis for household projections would be a labour-saving and more reliable way to meet the complex problems of the sectional projections.

Secondly, in Glass and Davidson's assumptions, when families were converted into households, allowance was made only for doubling-up involving one-person households and not for doubling-up among multiple-person households. Further, if this model were applied to other countries, doubling-up among multi-person households would still be recognized as important and widely prevalent in developing countries. It would be too simplistic to

assume that there is no doubling-up among multi-person households in those countries.

Thirdly, in this life-table approach, it is necessary to go through so many stages of complicated computations, drawing upon so many different sources of detailed data regarding mortality, fertility, nuptiality, divorce, household formation, and so on, that the computational processes may be subject to much greater cumulated error. Even aside from the complexities in the methodological steps and procedures and the enormous amount of computational labour required, this method could hardly be used for developing countries where such elaborate types of statistical information are generally not available in a reliable form.

Fourthly, when projections are made on the basis of the stationary distribution of population and households as shown in table 9, the question inevitably arises whether the same stationary distribution of population and households by number of persons per household can appropriately be applied for future years. Even though — as stated by Glass and Davidson — the distribution and composition of the biological families in a hypothetical stationary population computed by Brown were very similar in age and sex structure to what is likely to exist in England and Wales in 1971,¹⁹ there will be, of course, no guarantee of a similar population structure in later years and the chances are even more remote that there will be any close similarity in the household structure by number of persons per household.

In spite of the disadvantages referred to above, however, this type of life-table approach is theoretically a very interesting example of a demographic method of household projection, mobilizing advanced demographic techniques and substantive knowledge to shed light on a relatively unexplored field of family and household formation and dissolution. By this method, an estimation is made to obtain both an upper and lower limit of the projections, providing a theoretical range of projections between the

¹⁸ Organisation for Economic Co-operation and Development, *Demographic Trends, 1965-1980, in Western Europe and North America* (Paris, 1966), Supplement: "Country reports".

¹⁹ Ruth Glass and F. G. Davidson, op. cit., p. 395.

potential and short-term probable number of households. Perhaps some of the factors involved in computation are much less likely to be influenced by social and cultural, than by demographic factors, so that it might be easy to apply a series of demographic models for these factors. As will be indicated later, since the schedules of headship rates to be applied to developing countries might in effect over-emphasize the experience of the developed countries, further development of this type of demographic approach might supplement the method using the model headship rate. As seen in table 9 another merit of this life-table approach is that it can make projections of households by size of membership. As stated in part one, there has been a growing concern among government agencies and private enterprises over household and family projections by size.

VITAL STATISTICS METHOD

Theoretically, the cohort approach takes the "stock-flow" framework for projections of the number of households and families, highlighting the dynamic aspects of formation, growth and dissolution of households and families. This approach, however, has never actually been practised for household and family projections, for the reasons explained at the beginning of this chapter. In the demography of manpower, a multiple decrement table of working life can serve as a useful tool in the cohort approach for labour force projections.²⁰ On the other hand, in the demography of households and families, the similar idea of

²⁰ Harold Wool, *Tables of Working Life: Length of Working Life for Men* (United States Bureau of Labor Statistics, Washington, D.C., 1950), bulletin No. 1001; Stuart Garfinkle, *Tables of Working Life of Women* (United States Bureau of Labor Statistics, Washington, D.C., 1957), bulletin No. 1204.

a "family life table" to show important phases of family formation, growth and dissolution, by age or by marriage duration of family head, has never really been validated. Such a table would show, at the same time, the average number of members of a family in each stage of family life. Without such a family life table, it would certainly be difficult to make any elaborate cohort approach to projections of households and families.

Wolfgang Illing made a "vital statistics" approach to household and family projections.²¹ In this method, he dealt with the projection of families of married couples and then transformed these into households. This method has certain merits. First and foremost, family formation and dissolution can be related to changes affecting individual members such as marriages, divorces, and deaths in time-series trends, and the patterns of each can be studied separately. Accordingly, unlike other methods, by which projections are made only for the total stock of families and the net balance between the number of family formations and dissolutions, this method can provide information on the future trends of the various components.

The stock of families (F_t) at the end of a given year t may be summarized by the following balancing equation:

$$(E:2) \quad F_t = F_0 + \sum_{j=1}^t (M_j - D_j^m - S_j + N_j^m)$$

where F_0 is designated as the stock of families at a given base year 0, M the sum of marriages, D^m deaths of married

²¹ Wolfgang Illing, *Population, Family, Household and Labor Force Growth to 1980* (Ottawa, Economic Council of Canada, September 1967), Staff Study No. 19, pp. 49-69. A similar study was made by the Netherlands Central Bureau of Statistics. See, Centraal Bureau voor de Statistiek, *Statistische en Econometrische Onderzoekingen* (The Hague, 1959), p. 130.

TABLE 10. ESTIMATED NET FAMILY FORMATION FOR CANADA, 1950-1966
(In thousands)

(1) Year	(2) Marriages	(3) Net immigration of married females	(4) Deaths of married persons	(5) Divorces	(6) Net family formation	(7) Adjustment	(8) Number of families as of end of year
1950							3 264.0
1951							3 357.6
1952	128.4	27.1	54.9	5.3	93.6	-1.7	3 447.6
1953	128.5	24.3	55.2	5.6	90.0	-2.0	3 538.4
1954	131.0	24.2	56.3	6.2	90.8	-1.9	3 624.6
1955	128.6	21.2	55.8	5.9	86.2	-1.9	3 699.2
1956	128.0	11.6	57.3	6.1	74.6	-1.6	3 787.6
1957	132.7	21.7	58.7	6.0	88.4	-1.3	3 908.2
1958	133.2	59.5	61.2	6.7	120.6	-4.2	3 989.5
1959	131.5	18.4	61.1	6.3	81.3	-1.2	4 064.4
1960	132.5	13.1	63.4	6.5	74.9	-0.8	4 143.0
1961	130.3	21.1	64.5	7.0	78.6	-1.3	4 201.5
1962	128.5	2.2	65.5	6.6	58.5	-0.1	4 257.6
1963	129.4	0.3	66.9	6.7	56.1	—	4 316.9
1964	131.1	4.3	68.4	7.7	59.3	—	4 388.9
1965	138.1	11.8	69.3	8.6	72.0	—	4 474.1
1966	145.5	18.7	70.0	9.0	85.2	—	4 574.6
1966*	155.3	26.6	71.4	10.0	100.5	—	

SOURCE: Wolfgang M. Illing, *Population, Family, Household and Labor Force Growth to 1980* (Ottawa, Economic Council of Canada, September 1967), Staff Study No. 19, p. 67.

* 1966 census results not available when these estimates were prepared.

TABLE 11. PROJECTED NET FAMILY FORMATION FOR CANADA, 1967-1980
(In thousands)

(1) Year	(2) Marriages	(3) Net immigration of married females ^a	(4) Deaths of married persons	(5) Divorces	(6) Net family formation ^a	(7) Number of families as of end of year
1967	159.2	16.5	73.5	10.0	92.2	4 666.8
1968	167.0	16.5	74.9	10.0	98.7	4 765.5
1969	174.9	16.5	76.0	10.2	105.2	4 870.7
1970	182.8	16.5	77.4	10.6	111.3	4 982.0
1971	190.2	16.5	78.9	10.9	116.9	5 098.9
1972	197.4	16.5	80.3	11.2	122.4	5 221.3
1973	204.1	16.5	81.6	11.5	127.5	5 348.8
1974	210.6	16.5	83.5	11.8	131.8	5 480.6
1975	216.6	16.5	85.0	12.2	135.9	5 616.5
1976	222.2	16.5	86.6	12.5	139.6	5 756.1
1977	227.1	16.5	88.2	12.8	142.6	5 898.7
1978	232.2	16.5	89.9	13.2	145.6	6 044.3
1979	236.7	16.5	91.7	13.6	147.9	6 192.2
1980	240.7	16.5	93.7	14.0	149.5	6 341.7

SOURCE: Illing, op. cit., p. 68.

^a Figures based on the average annual net immigration assumption of 70,000 persons to 1980, subject to considerable year-to-year fluctuations. For example, 1967 figure likely to be somewhat higher than indicated here.

TABLE 12. ESTIMATED AND PROJECTED HOUSEHOLDS FOR CANADA, 1950-1980
(As of end of year; in thousands)

(1) Year	(2) Families	(3) Households		(5) Total
		Family ^a	Non-family	
<i>Estimated</i>				
1950	3 264	2 951	457	3 407
1951	3 358	3 029	469	3 497
1952	3 448	3 127	474	3 601
1953	3 538	3 224	482	3 705
1954	3 625	3 320	495	3 815
1955	3 699	3 403	512	3 915
1956	3 788	3 496	532	4 028
1957	3 908	3 623	555	4 178
1958	3 990	3 710	581	4 291
1959	4 064	3 796	609	4 405
1960	4 143	3 886	640	4 526
1961	4 202	3 962	672	4 634
1962	4 258	4 023	707	4 731
1963	4 317	4 092	743	4 835
1964	4 389	4 170	779	4 948
1965	4 474	4 259	814	5 074
1966	4 575	4 364	850	5 214
<i>Projected</i>				
1967	4 667	4 462	882	5 344
1968	4 766	4 565	914	5 480
1969	4 871	4 676	946	5 622
1970	4 982	4 793	976	5 769
1971	5 099	4 915	1 007	5 922
1972	5 221	5 044	1 037	6 081
1973	5 349	5 178	1 067	6 245
1974	5 481	5 316	1 097	6 414
1975	5 617	5 459	1 128	6 587
1976	5 756	5 612	1 158	6 770
1977	5 899	5 763	1 188	6 951
1978	6 044	5 911	1 218	7 129
1979	6 192	6 062	1 248	7 310
1980	6 342	6 215	1 278	7 493

SOURCE: Illing, op. cit., p. 69.

^a Total families, excluding those not maintaining a household.

persons, S divorces, and N^m net immigration of families respectively in year t .²²

Table 10 shows illustrative estimates of net family formation for the years 1950–1966 according to the above equation, and table 11 gives projections in the same way for the years 1967–1980. As the components of change, marriages, deaths, divorces and net immigration are separately projected. Marriages, being regarded as the most important of all, are projected by applying the constant rate of marriage by sex and age to the corresponding population projections. The future magnitude of net immigration of married females was kept constant after 1967 inclusive.

The total of these four components is converted into the number of households by the following formula:

$$(E:3) \quad H_t = \frac{h_t}{1 - n_t} F_t$$

where h_t is the ratio of the number of family households to the number of families, and n_t the ratio of non-family to total households.²³ Table 12 shows projections of households for the years 1967–1980 by the above conversion formula, together with the estimates for the years 1950–1966. Column (2) shows the stock of families, F_t , and column (5) shows the total number of households converted, H_t .

The 1941–1961 censuses provide data on the relationship between family households and families. The ratio between the two series (a rising one, as progressively more families are willing or able to set up their own households) was estimated annually by intercensal interpolation up to

1961, and was projected to 1980. The ratio was estimated to increase from 0.943 in 1961 to 0.980 in 1980. This is based on the assumption that further increases in living standards and the construction of suitable housing will enable all but a small residual proportion of total families to establish their own households.²⁴

This approach is, of course, not free from methodological and practical limitations. First, methodologically, the above conversion from the number of families to that of households was not made specifically by sex and age, and hence, it does not take into consideration sex-age differentials in the relationship between family and household. Secondly, for practical reasons, it is again difficult to apply this method to other countries, particularly to developing ones, since complete and accurate marriage and divorce statistics are unavailable in most of those countries. Illing's method is an interesting and assiduous approach, but, like the Brown–Glass–Davidson models in the previous section, it has no correspondence to and no utilization of the already available population projections by sex and age, which can be prepared with more accuracy and facility under normal circumstances.

Finally, Illing's approach is not really a stock-flow model of formation and dissolution of family or household. It is concerned with inflows and outflows of individual vital events relating to family formation, namely with individual marriages, divorces, deaths and migrations. Although some marriages automatically create additional households and some deaths among family members immediately result in the dissolution of families, such factors do not necessarily constitute actual inflows and outflows of families and households as such.

²² Illing, *op cit.*, p. 52.

²³ *Ibid.*, p. 57.

²⁴ *Ibid.*, p. 57.

Chapter IV

HEADSHIP RATE METHOD

DEVELOPMENT OF THE METHOD

Since the 1950 round of censuses, partly in answer to their own needs and perhaps partly under the stimulus of the United Nations recommendations for expanded census enumeration and tabulation, a great number of countries have been collecting more detailed information on the demographic and socio-economic characteristics of families, households and housing. The recent development of more detailed statistical data of improved quality has therefore enabled many countries for the first time to undertake projections of numbers of households and families. A host of European and Northern American countries started preparing household and family projections, based on improved data, around 1950. This was chiefly in response to the great demand arising from the postwar reconstruction and national economic development planning, particularly in the fields of housing construction and the production and distribution of consumer durables.

The United States Bureau of the Census made its first attempt to project future household formation during the Second World War when certain government agencies urgently needed such information to enable them to allocate material resources for industrial production. The task of these agencies was to see that at least the minimum of civilian needs for housing, household appliances and the like would be filled while direct war needs were being met. To facilitate this task the Bureau of the Census in 1943 developed and published its first set of household projections. From the beginning, the United States Bureau of the Census employed the headship rate method specific by sex and age of heads.¹

Development of the prototype of the headship method was already initiated as early as in 1938, when the United States National Resources Planning Committee published projections of the number of households up to 1980, using the headship rate method on the basis of the 1930 population census.² In this series of projections, future sex-age specific headship rates were kept constant all the way through.

In view of the present status of the methodological development of demographic projections of households

and families and of the availability of such data, the headship rate method seems to be perhaps the most plausible and widely applicable method for many countries and for some years to come. Although this method does not directly take into account the dynamic aspects of the family life cycle, namely formation, growth, contraction and dissolution of households and families, it certainly has methodological advantages over many other methods of projection, including the extrapolatory method and the life-table method. Because it employs available population projections by sex and age (and sometimes marital status) as its base, it can reflect underlying changes in population composition which largely affect the size and proportion of households and families. Moreover, this method can assess the extent to which future changes in the number of households and families will be attributable to the effects of changes in population composition and the extent to which they will be attributable to other factors. The headship rate method also provides the projections in useful detail. For example, a distribution of future heads of households by sex and age is needed for economic and social planning purposes and only the headship rate method can afford to provide such information.

Projections of the total population by sex and age are generally considered easier as regards the formulation of underlying assumptions than are those of households and families, the economically active population, the urban-rural population and so on. This is because a sectoral population is more subject to the direct effects of social and economic factors, which are more difficult to estimate precisely and to predict. In other words, the participation rate in a group of a sectoral population is more susceptible to short-term changes in economic and social factors.

Up to the present, household and family projections by the headship rate method have been prepared either officially by government agencies or privately by individual research institutions in 15 countries. Thirty-two sets of projections by the headship rate method have so far been located by the Population Division of the United Nations. A synopsis of these projections is presented in the annex table, with brief summaries of the assumptions underlying them, methods of projecting prospective changes in headship rates, years of projection, number of variants used and so on. In this connexion, it should be mentioned that the Committee on Housing, Building and Planning of the United Nations Economic Commission for Europe (ECE) has made a very substantial contribution to the development of the methodology of household and family projections by organizing and systematizing a number of

¹ Paul C. Glick, *American Families*, Census Monograph Series (New York, John Wiley and Sons, Inc., 1957), p. 164. This set of projections was published by the United States Bureau of the Census, *Population — Special Reports*, series P-46, No. 4.

² United States National Resources Planning Committee, *The Problems of a Changing Population* (Washington, D.C., Government Printing Office, 1938), p. 25.

projections available in the ECE region and by encouraging the preparation of household and family projections in some countries where projections had never been attempted before.³ The Commission has also specifically recommended the headship rate method as the most appropriate one applicable to the member countries of the Commission and has adopted the report of the Government of the Netherlands on their household projections⁴ as the model for the other ECE member countries.⁵

Among the country projections prepared by government agencies and private research workers, the largest number of series of projections have been contributed by the United States of America. There are eight of these, apparently reflecting the early awareness in that country of the importance of household and family projections and the great demand to have them frequently brought up to date. Eight out of the nine series of projections in the the United States of America have been prepared by the United States Bureau of the Census, which has taken the lead in this field in many respects, for example in the sophistication of its projection methods and the very detailed classification of household and family census statistics and projections, not only by sex, age and marital status but also by family type and size of membership.

The United Kingdom has produced six separate series of projections, in which the National Institute of Economic and Social Research has played an important part, by

developing methodology and by formulating assumptions for the future number of households and families in the United Kingdom.

SEX-AGE SPECIFIC HEADSHIP RATES

The headship rate method requires the classification of the population by sex and age and, if possible, by marital status. For each class, projections are made for (a) the number of persons; (b) the ratio of the number of household or family heads to the number of persons, which ratio is called the specific "headship rate". The projected number of households and families in the entire population is obtained by adding up over all classes the product of the figures (a) and (b), estimated separately for each class.⁶

To clarify the headship rate method, it may be useful to express the methodological steps involved by algebraic equation. Let $P(i, j, t)$ be the population of sex i , age j and at time t , and let $H(i, j, t)$ be the number of heads of households or families by sex i , age j and time t . Then the headship rate specific for sex and age at time t , $h(i, j, t)$, is expressed by the following formula:

$$(E:4) \quad h(i, j, t) = \frac{H(i, j, t)}{P(i, j, t)}$$

In order to explain how to obtain sex-age specific headship rates an example is given for Finland (1960) in table 13. The calculation of sex-age specific headship rates is very simple. As shown in the above formula and in table 13, it involves the division of the number of heads of households or families by the population in the same sex

³ Economic Commission for Europe, "Techniques of surveying a country's housing situation, including estimating current and future housing requirements" (ST/ECE/HOU/6, Geneva, 1962).

⁴ The Netherlands Central Directorate of Housing and Building, "Monograph on the housing situation in the Netherlands", specimen statement 1964, chaps. I-IV. This specimen statement was made pursuant to the recommendation of the Committee on Housing, Building and Planning of the Economic Commission for Europe (ECE) at its twenty-first session in June 1961 to facilitate the preparation of national monographs by the members of ECE.

⁵ See *The Housing Situation and Perspectives for Long-term Housing Requirements in European Countries* (United Nations publication, Sales No. 68.II.E.6).

⁶ Robert Parke, Jr., "The choice of assumptions in household and family projections" in United Nations, *World Population Conference, 1965, Volume III: Projections, Measurement of Population Trends* (United Nations publication, Sales No. 66.XIII.7), pp. 78-82, especially p. 78.

TABLE 13. CALCULATION OF SEX-AGE SPECIFIC HEADSHIP RATES FOR FINLAND, 1960

Age group	Male heads	Male population	Headship rates	Female heads	Female population	Headship rates
			for males: Male heads Male population × 100			for females: Female heads Female population × 100
15-19	6 626	189 309	3.500	8 380	182 797	4.584
20-24	48 133	158 911	30.289	21 231	153 461	13.835
25-29	96 199	147 806	65.085	17 702	141 284	12.529
30-34	122 244	155 194	78.769	16 981	153 062	11.094
35-39	120 602	139 918	86.195	19 156	154 254	12.418
40-44	106 645	117 231	90.970	22 174	138 622	15.996
45-49	117 313	126 421	92.796	30 543	146 555	20.841
50-54	116 580	124 763	93.441	37 512	145 523	25.777
55-59	93 210	100 288	92.942	37 457	122 330	30.620
60-64	68 286	75 448	90.507	36 268	102 580	35.356
65-69	45 180	52 996	85.252	31 017	78 310	39.608
70-74	27 353	35 540	76.964	24 486	60 323	40.591
75-79	13 499	20 480	65.913	14 746	38 681	38.122
80+	6 502	13 124	49.543	8 490	28 057	30.260

SOURCE: Heads, Finland, Central Statistical Office, *General Census of Population, 1960, VIII: Households and their Housing Conditions* (Helsinki, 1963), table 2, p. 29; Population, Finland, Central Statistical Office, *General Census of Population, 1960, II: Population by Age, Marital Status, Main Language etc.* (Helsinki, 1963), table 4, p. 102.

and age group. However, there are two points that need attention:

(a) The beginning age group 15-24, 10-19 or 15-19 should not be open-ended, as "under 25" or "under 20". In many countries for which the headship data are readily available, the first age group is usually found open-ended. Inasmuch as the number of heads for the age group under 25 or 20 is very small and the base population for the age group is very large, the headship rate calculated by dividing the number of heads by the population under 25 or 20 becomes excessively small as compared with the values for the other age groups;

(b) Usually the statistics offer the tabulations by sex and age only for private or family households. If there are tabulations available for the institutional households, it is obviously more accurate to compute the headship rates separately for these two sectors.

The formula showing how to calculate projections of the number of households and families may be presented as follows. Suppose that for year $t + x$ (x years from the base year) the population projections by sex and age have already been prepared and the sex-age headship rates have been estimated, then the number of households or families for the year $t + x$ can be obtained by the following equation:

Total number of future households or families in year $t + x$

$$(E:5) \sum_i \sum_j H(i, j, t + x) = \sum_i \sum_j P(i, j, t + x) \cdot h(i, j, t + x)$$

The above equations simplify the situation where the sex-age specific headship rate represents only the quotient of the number of all households in a sex-age class (i, j), inclusive of both private ("family" or "ordinary") and institutional (collective, or "quasi") households, divided

by the population in the same class. In reality, however, sex-age specific headship rates very frequently refer only to private households, simply because of the limitation of data. Although private households represent an overwhelming majority of all households, the use of only private household headship rates certainly leads to an underestimation of the total number of households, unless allowance is made for institutional or collective households. If sex-age specific headship rates are also available for the institutional households, in addition to those for private households, then the algebraic expression may be modified by letting the symbol $h(Prv., i, j, t)$ be the sex-age specific rate for private households, and the symbol $h(Ins., i, j, t)$ be the sex-age specific headship rate for institutional households.

$$(E:6) \sum_i \sum_j H(i, j, t + x) = \sum_i \sum_j P(i, j, t + x) \cdot [h(Prv., i, j, t + x) + h(Ins., i, j, t + x)]$$

However, in most of the countries where headship data are collected, sex-age specific headship rates are not available for institutional households; therefore, an adjustment ratio between the total number of private households and that of institutional households may be assumed for future years, and this ratio may be applied to the projections of private households to obtain projections of institutional households. Illustration of these steps will be given in the following chapter.

The headship rate is, of course, not distributed at random within either the male or female population of potential headship age. As seen in table 13, the proportion of heads of households differs largely in different age categories of the population, ranging from nearly 100 per cent in some categories down to zero in others. In order to elucidate the age-selective variation of headship rates over a wider range, table 14 presents sex-age specific headship

TABLE 14. SEX-AGE SPECIFIC HEADSHIP RATES FOR SELECTED COUNTRIES AROUND 1960 (Percentage)

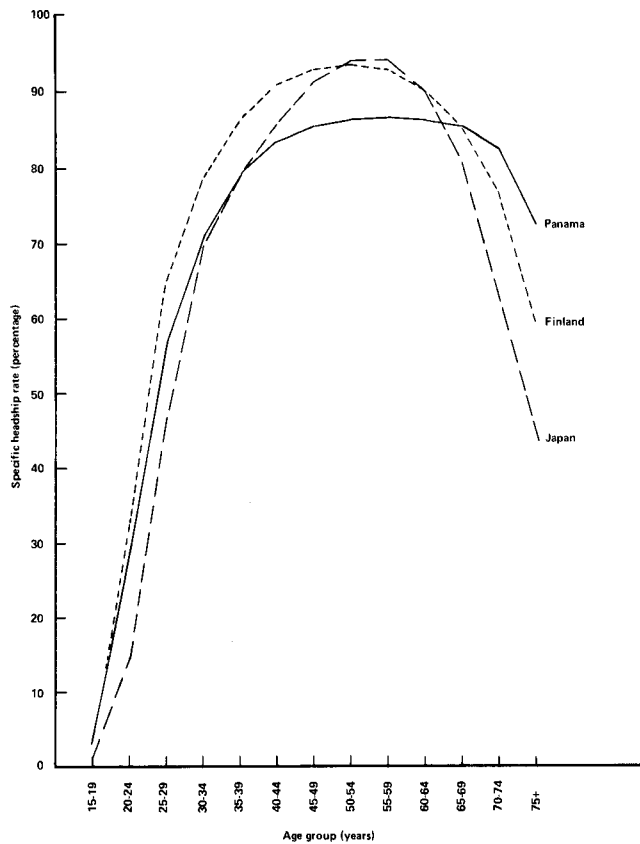
Age group	Costa Rica 1963	Panama 1960	United States of America 1960	Argentina 1960	India 1961 ^a	Japan 1960	Federal Republic of Germany 1961	Hungary 1960	Italy 1961	Sweden 1960
<i>Male</i>										
15-24	11.5	15.0	19.8	7.2	22.3	4.3	12.8	13.1	5.6	10.8
25-34	59.1	63.0	80.3	60.7	55.0	51.5	72.6	76.7	54.3	73.1
35-44	80.3	81.1	89.3	89.4	78.3	81.7	95.7	85.8	82.2	88.1
45-54	86.1	85.8	90.7	91.7	86.9	92.7	93.9	88.9	91.2	91.9
55-64	86.2	86.4	89.9	73.8	85.2	91.1	98.9	86.9	92.1	93.3
65+	78.0	80.4	83.0	52.0	61.0	63.1	88.7	75.8	80.5	86.3
<i>Female</i>										
15-24	1.0	3.6	2.7	0.6	1.9	1.0	4.2	3.1	0.6	5.0
25-34	5.1	12.3	6.9	2.2	6.0	3.3	6.1	8.4	2.6	8.5
35-44	12.9	20.5	10.0	4.5	11.3	10.5	12.1	11.0	6.9	10.1
45-54	23.7	29.1	15.3	7.2	13.5	17.5	24.0	10.3	13.4	15.6
55-64	33.6	37.2	24.0	9.0	13.9	14.4	31.0	8.0	21.7	27.2
65+	38.7	38.3	36.3	8.5	10.0	10.4	44.1	11.5	30.6	46.8
Average household size (persons) . . .	5.8	5.0	3.3	3.7	5.2	4.6	2.9	2.9	3.6	2.7

SOURCE: National population censuses.

^a Estimated on the basis of the 1951 data for West Bengal.

FIGURE I

Age-specific male headship rates for Finland (1960), Japan (1965) and Panama (1960)



Source: National population censuses.

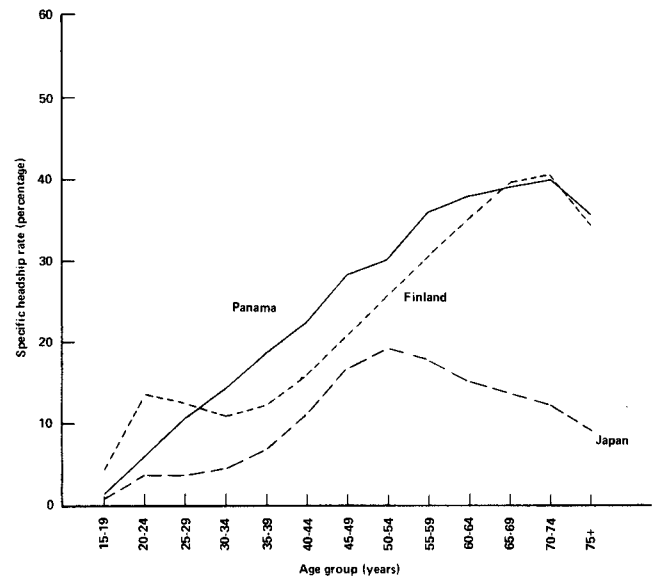
rates for some selected countries in different geographical regions. Figures I and II show the age curves of headship rates for Finland (1960), Japan (1965) and Panama (1960) for males and females.

The age curves of headship rates for Finnish, Japanese and Panamanian males take the form which is found almost universally throughout the world. The pattern of the age curve for male headship rates roughly resembles that of male economic activity rates (labour force participation rates).⁷ Males become the heads of households or families at various ages, mostly before 35 and some between 35 and 65 years; nearly all are heads by age 50 and the rate decreases thereafter, first gradually, then rapidly. Variations of this pattern in the statistics of different populations relate primarily to the age distribution of those newly becoming heads below 35 and of those retiring above 55 years. Generally, however, the pattern of the male headship rate shows a unimodal curve similar to a normal curve, whereas that of the age-specific economic activity rates takes the form of a flat-headed unimodal curve even resembling a trapezium.

⁷ For reference to the age patterns of male and female economic activity rates, see the United Nations, *Demographic Aspects of Manpower, Report I, Sex and Age Patterns of Participation in Economic Activities* (United Nations publication, Sales No. 61.XIII.4).

FIGURE II

Age-specific female headship rates for Finland (1960), Japan (1965) and Panama (1960)



Source: National population censuses.

For females, the level of headship rates is far lower and more variable between different countries than for males. At younger ages, the rate is extremely low. It substantially increases after age 35, reaching to the level of 30–40 per cent in the last age group, 65 and over.

Similarly, the headship rate by sex, age and marital status is expressed by the following formula:

$$(E:7) \quad h(i, j, k, t) = \frac{H(i, j, k, t)}{P(i, j, k, t)}$$

where $h(i, j, k, t)$ indicates headship rate specific for sex i , age j , marital status k and time t . $H(i, j, k, t)$ denotes the number of heads of households or families specific for sex i , age j , marital status k and time t and $P(i, j, k, t)$ symbolizes the population in the same category at the same time t .

The computational steps of headship rates specific for sex, age and marital status are shown in table 15, for Sweden, 1960. Heads and population sometimes can only be broken down into two categories of “married” and “not married” or into three groups of “single”, “married” and “others” (including both widowed and divorced). Often, there is an additional category of “separated” within the “married” category and sometimes the last column for “divorced” in the marital status divisions includes “marital status unknown”, so that care should be taken to have the denominator cover a comparable population group by sex, age and marital status.

Since marital status is also an important demographic trait, next to sex and age in influencing headship, headship rates specific for sex, age and marital status are likely to be more stable (less variable) in different social and

TABLE 15. CALCULATION OF HEADSHIP RATES SPECIFIC FOR SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1960

Age group	Single			Married			Widowed			Divorced		
	Heads	Population	Headship rate ^a	Heads	Population	Headship rate ^a	Heads	Population	Headship rate ^a	Heads	Population	Headship rate ^a
<i>Male</i>												
15-24 . . .	16 388	497 090	3.3	35 941	41 658	86.3	13	19	68.4	103	360	28.6
25-34 . . .	24 809	147 184	16.9	286 669	300 812	95.3	335	450	74.4	3 261	7 712	42.3
35-44 . . .	35 656	89 544	39.8	420 719	430 853	97.6	2 005	2 368	84.7	8 616	16 586	51.9
45-54 . . .	40 419	76 170	53.1	420 773	427 194	98.5	6 842	7 726	88.6	11 502	19 006	60.5
55-64 . . .	36 061	59 406	60.7	322 084	326 291	98.7	16 632	18 730	88.8	8 329	12 709	65.5
65+ . . .	31 376	52 917	59.3	244 405	255 144	95.8	66 185	93 141	71.1	5 910	9 103	64.9
<i>Female</i>												
15-24 . . .	20 350	415 511	4.9	1 380	104 552	1.3	93	150	62.0	538	1 187	45.3
25-34 . . .	22 599	72 375	31.2	4 584	363 986	1.3	1 564	1 978	79.1	7 258	11 061	65.6
35-44 . . .	21 823	51 660	42.2	5 742	448 350	1.3	7 404	8 567	86.4	16 328	21 593	75.6
45-54 . . .	31 461	64 822	48.5	5 319	410 493	1.3	23 761	26 797	88.7	18 562	23 480	79.1
55-64 . . .	44 670	78 749	56.7	3 003	281 634	1.1	55 375	63 608	87.1	13 442	16 771	80.2
65+ . . .	62 044	100 810	61.5	1 968	173 991	1.1	145 329	197 042	73.8	11 584	15 070	76.9

SOURCE: Heads, Sweden, Central Bureau of Statistics, *Census of the Population in 1960, IX; Industry, Occupation, Commuting, Households and Education in the Whole Country, by County etc.* (Stockholm, 1964), table 39, pp. 186-187; Population, Sweden, Central Bureau of Statistics, *Census of the Popu-*

lation in 1960, I: *Population by Sex, Age and Marital Status etc.* (Stockholm, 1961).

$$^a \text{ Headship rate} = \frac{\text{Heads}}{\text{Population}} \times 100.$$

economic conditions than headship rates specific only for sex and age. Thus, other things being equal, the method using headship rates specific for sex, age and marital status will generally yield methodologically more accurate projections of households and families than the one using only sex-age specific rates. On the other hand, however, the method using rates specific for sex, age and marital status necessarily presupposes the availability of population projections by sex, age and marital status which are far more complicated and difficult to prepare than those classified by sex and age. In fact, only a small number of countries and institutions have ever undertaken such a detailed kind of population projection. The methods of projecting future population by marital status in addition to sex and age are clearly beyond the scope of the present manual.

The methodological procedures of projecting households by headship rates specific for sex, age and marital status may be expressed by an equation similar to that used for projecting households by headship rates specific for sex and age as shown in equation 5. If headship rates can be obtained simultaneously by sex, age and marital status, then, for example, equation 3 will be expanded to the following:

$$(E:8) \sum_i \sum_j \sum_k H(i, j, k, t + x) \\ = \sum_i \sum_j \sum_k P(i, j, k, t + x) \cdot h(i, j, k, t + x)$$

where $P(i, j, k, t + x)$ denotes the population of sex i , age j and marital status k in x years from year t , and $H(i, j, k, t + x)$ and $h(i, j, k, t + x)$ signify respectively the number of heads of households or families and the specific headship rate in the same class and at the same time.

Similarly, specific headship rates may be calculated for population categories defined in terms of other various

characteristics or a combination of characteristics, including urban-rural residence, type and size of household and family, type of family nucleus and number of children, number of members whose main source of livelihood is economic activity, and number of dependent members, and others, if the relevant classifications of population and the heads are provided in the census tabulations.

CHOICE OF ASSUMPTIONS REGARDING PROSPECTIVE CHANGES IN HEADSHIP RATES

The annex table shows a variety of methodological assumptions in 32 sets of country projections of numbers of households and families, which have been developed with respect to the future course of headship rates specific for sex and age or for sex, age and marital status and the future distribution of population by sex, age and marital status.

The main methodological problem in the headship rate method of projections is how to estimate accurately future levels of headship rates specific for sex and age or for sex, age and marital status. The basic assumptions about the future trends of the rate may be classified within the following four categories:⁸

(a) Constant rate method;

(b) Extrapolative method by using annual average change of rates in the past or by applying a simple mathematical formula on the basis of past trends;

⁸ Some of the projections classified here use a somewhat different concept from the headship rate in household and family. The Australian projections by Hall and Hill used the concept of "dwelling occupancy ratio", which may be expressed as the headship rate per dwelling unit. A. R. Hall and M. R. Hill, "Housing demand in Australia, 1959-1974", *Economic Record* (Melbourne), vol. XXXVI, No. 76, December 1960, pp. 550-567.

(c) Regression method by using either cross-sectional or subnational data on headship rates on the one hand, and economic and social indicators on the other;

(d) Normative approach drawn up in the Government's housing policy in accordance with its social and economic development programmes.⁹

It should be pointed out here that these categories are not necessarily mutually exclusive. The classification is a matter of convenience. Examples of the various methods will be given below.

Constant rate method

This method is actually a special case of the "extrapolative method". The assumption of holding the future headship rate constant is the most frequently used method among nationally available household and family projections. It has been widely used by various government agencies and institutions, particularly during the decade of the 1950s, when, with the advent of national economic and social planning, the need for household and family projections grew greater among the developed countries, but when there was only one census available for obtaining sex-age specific headship rates. The fact that among many nations the availability of headship data is limited to the 1950 round of censuses alone made impossible for those countries the extrapolation of headship rates for future years on the basis of at least two time points.

Analytically, projections prepared by holding headship rates constant are offered as measures of future changes in the number of households solely attributable to population growth and changes in the distribution by sex, age and marital status.¹⁰ When such projections are accompanied by projections of "potential" households in which there is no doubling-up among the married couples, or among the other marital status groups, the two series together provide some indication of the range within which the future number of households may actually fall.¹¹

Twenty-two country projections have employed, wholly or partly, the constant headship rate method.¹² In the case of the Chilean projections, married males, and widowed and divorced females, respectively, under 60 years of age, were assumed to have a headship rate of 100 per cent, and this value is held constant in each set of projections.

⁹ The Economic Commission for Europe made a study about the recent household projections among European countries and classified them according to the assumptions of future course and levels of headship rate. According to ECE, the headship rate assumptions are classified as follows: (a) statistical extrapolation of existing headship rates; (b) allowing for expected economic and social development; (c) expressing the normative goals of housing policy.

¹⁰ Robert Parke, Jr., "The choice of assumptions in household and family projections", *Proceedings of the World Population Conference, Belgrade, 1965, Vol. III: Projections, Measurement of Population Trends* (United Nations publication, Sales No. 66.XIII.7), pp. 78-82.

¹¹ *Ibid.*, p. 80.

¹² Australia, Belgium, Chile, Denmark, France (1959, 1961 and 1964, Federal Republic of Germany, Hungary, Italy, Japan (1961), United Kingdom (1955, 1960, two in 1961, 1964) and United States of America (1938, 1943, 1946, 1952, 1956 and 1958). The year of the projection is given where there is more than one series of national projections.

This, as was mentioned, is actually a potential rather than a probable type of projection.¹³

Extrapolative method

Where there are two or more population censuses available in a country having tabulations of household and family heads by sex, age and marital status, headship rates can be extrapolated on the basis of these data, either by using their average annual changes or by applying mathematical formulae to them.

Several countries in Western Europe and the United States of America have made household and family projections by extrapolating headship rates using algebraic formulae. These country projections generally assume that cases of doubling-up within households will tend to decrease and one-person households will increase; accordingly, headship rates in most of the sex-age-marital status groups will gradually but continually increase up to certain critical maximum points.

For example, in the projections prepared by the Central Directorate of Housing and Building of the Netherlands, it was found from an observation of the two successive census dates of 1956 and 1960 that the headship rate appeared to show a certain increase with the course of time. Accordingly, the headship rates by sex, age and marital status were extrapolated rectilinearly.

In the Netherlands projections, since the changes between 1956 and 1960 were not always regular, and even resulted in a decrease in a few age groups, much detailed adjustment was made before applying a linear extrapolation. Since an extrapolation of the increase for married females on the basis of the 1956-1960 experience would require such a level that the percentages of married males and of married females, taken together, would by 1962 exceed 100 per cent in some age groups, it was assumed that the housing requirements of married females, expressed in percentages, would remain equal to those at 31 May 1960. Similarly, for divorced males and females, the increase in the headship rate in the basic period was so large that a linear extrapolation would lead to a rate exceeding 100. For this increase, much smaller rates were, therefore, used for the future. It was assumed that the headship rates for divorced females in 1982 would almost equal those for widowed females, which meant that the rates would increase by about 5 per cent per five-year period in all age groups. For divorced males, the increase in the rate was also limited to 5 per cent per five-year period.¹⁴

As already mentioned, the United States projections of households and families have been made regularly by the United States Bureau of the Census since 1943. Since the termination of the Second World War, six series of projec-

¹³ Julio V. Morales, "Estimación de las necesidades de viviendas en Chile entre 1952 y 1982" (E/CN.9/CONF.1/L.18) paper submitted to the United Nations Seminar on Utilization and Evaluation of Population Census Data in Latin America, Santiago, Chile, 30 November-18 December 1959.

¹⁴ Netherlands, Central Directorate of Housing and Building, "Monograph on the housing situation in the Netherlands", specimen statement, 1964, chaps. II-IV, pp. 42-44.

tions have been made by sex, age, marital status and type of family unit. The methods used for projecting future headship rates have been essentially the extrapolation of past trends on the basis of the average annual percentage changes for the past several years. Different assumptions have been applied to future changes in the headship rate on the basis of its past annual changes. For example, in the 1958 projections, the following assumptions were made for each of the four series of projections by assuming different fractions of the average annual change from 1950 to 1956-1958 in the headship rate specific for sex, age and marital status for the periods 1957-1965, 1965-1975 and 1975-1980:

Fractions of the average annual change in headship rates for the base period 1950 to 1956-1958 as assumed for future household projections, 1957-1980: United States of America

Series	1957-1965	1965-1975	1975-1980
A	1	$\frac{1}{2}$	$\frac{1}{3}$
B	$\frac{1}{2}$	$\frac{1}{3}$	No change
C	$\frac{1}{3}$	No change	No change
D	1956-1958 level held constant	1956-1958 level held constant	1956-1958 level held constant

SOURCE: United States Bureau of the Census, "Illustrative projections of the number of households and families", *Current Population Reports — Population Characteristics*, series P-20, No. 90 (Washington D.C., 29 December 1958), p. 7.

In fact, only 2 per cent of the married couples in the United States of America were then doubled-up in the households of others, so that little further undoubling could be expected. There is, therefore, little need for the use of another approach, like the regression method, for example, in the United States of America. However, significant changes can be expected in other groups, for example among the widowed.

In the 1958 projections by the United States Bureau of the Census, an interesting alternative series of computations was developed by using a modified exponential curve. The trends in headship rates specific for sex, age and marital status from 1950 to 1957 were used to calculate the corresponding headship rates for 1980 for different types of family unit. The following exponential formula was used:¹⁵

(E:9) Percentage of household heads in year n

$$= \left[1 - \left(\frac{1 - 1950 \text{ percentage of household heads}}{1 - 1957 \text{ percentage of household heads}} \right) \right]^{n-1950} \times \left(\frac{1 - 1957 \text{ percentage of household heads}}{1 - 1950 \text{ percentage of household heads}} \right)$$

This procedure does not allow projected proportions in excess of 1. However, where the proportion declined in the base period, the formula operated with the proportion rather than with its complement. This method was repeatedly used for parts of the United States projections

¹⁵ The United States Bureau of the Census, "Illustrative projections of the number of households and families: 1960 to 1980", *Current Population Reports*, series P-20, No. 90, p. 9.

made in 1967. In the latest 1967 household projections, proportions for the intermediate years between 1964 and 1985 were obtained by parabolic interpolation (three-point polynomial through the proportion for the years 1957, 1964 and 1985; $Y = a + bx + cx^2$).¹⁶

The projections for Finland prepared by the Finnish National Housing Board were basically of the type used for estimating future headship rates by mathematical extrapolation.¹⁷ Finland is one of a few countries for which census tabulations of household heads have been made by urban and rural residence as well as by sex and age. The basic assumption underlying the projections is that, as a result of the rise in income levels, headship rates are expected to increase up to the normatively maximum values. In this sense, the Finnish projections are a kind of mixture of the use of an extrapolatory method, a normative approach and a regression method obtaining income elasticity.¹⁸

Three different methods of extrapolation were used in the Finnish projections.¹⁷ For married people, in the urban area, the future growth of the headship rate in each decade of the period 1960-1980 was assumed to be half the same percentage increase as in the decade 1950-1960. However, the maximum values for urban married males were set at 95.0 per cent for the age group 20-24, 98.0 per cent for the age group 25-29 and 99.0 per cent for the age group 30-34. Likewise, for married males, the maximum headship rates were assumed to be 99.5 per cent in age groups 35-64, and 96.0 per cent in older age groups. In the rural areas, the maximum rates were assumed to be slightly lower. Table 16 shows the urban-rural distribution of headship rates by sex, age and marital status for 1960, 1970 and 1980. Differing projections for the elderly were made, in view of the assumption that the changes in the distribution of income would favour elderly people still more, according to the new working pension system.¹⁹

Regression method

This method has been fairly extensively used in Sweden,²⁰ Denmark²¹ and Norway,²² and also in Japan.²³

¹⁶ United States Bureau of the Census, "Projections of the number of households and families 1967 to 1985", *Current Population Reports*, Population Estimates, series P-25, No. 394, 6 June 1968, p. 7.

¹⁷ Finland, Housing Committee, "Housing situation in Finland" (Helsinki, September 1965), unpublished paper contributed to the preparation of the ECE study, *The Housing Situation and Perspectives for Long-term Housing Requirements in European Countries* (United Nations publication, Sales No. 68.II.E.6).

¹⁸ It was not quite clear, however, from the documents available how these normative goals were derived from the income-elasticity analysis of headship rates made in the Swedish projections.

¹⁹ Finland, Housing Committee, "Housing situation in Finland", p. 50.

²⁰ Sweden, National Housing Board, "Comparison between the housing census in 1945 and that in 1960 — some information about the economic development between these years and the measures of housing policy" (October 1966).

²¹ Denmark, Ministry of Housing, "Danish housing requirements, 1960-1980" (Copenhagen, December 1965), unpublished paper contributed to the preparation of the ECE study mentioned in footnote 17, above. Denmark used three different approaches to the projections of headship rates, namely: (a) constant headship

In the case of the Swedish projections, the income elasticity was computed on the basis of data available for different social groups. The headship rates for future years were estimated by regression of headship rates on income observed in 1960 — slightly modified in view of the existing housing shortage — and differential income elasticities for different groups by sex, age and marital status. These elasticities have been assumed to be highest with the lowest age groups. Elasticities run from 0.1 to 1.5. For the married and formerly married the headship rates have been assumed not to exceed 85 per cent.²⁴

In Norway, the recent projections assumed that as a result of the future economic and social development, housing demands from some of the population groups would by 1980 be at a much higher level than what is

rate method; (b) income-elasticity method; (c) normative approach. Its income-elasticity method is, however, largely based on the Swedish experience of analysis of the relationship between the headship rate and income levels; even parameters obtained from the Swedish computations were used in the case of Denmark. The Swedish example was therefore a prototype of this approach in application to household projections.

²² Norway, Ministry of Municipal and Labour Affairs, "Housing situation and housing prospects in Norway" (Oslo, November 1965).

²³ Japan, Ministry of Health and Welfare, Institute of Population Problems, *Zenkoku Todofuken-betsu Setaisu no Shorai Suikei, Showa 40-65-nen, Showa 41-nen 8-gatsu Suikei* (Future projections of number of households for Japan and 46 prefectures: October 1965 to 1990, as projected in August 1966), Institute of Population Problems Research Series, No. 170 (August 1966).

²⁴ Sweden, National Housing Board, "Comparison between the housing census in 1945 and that in 1960...", p. 5.

indicated by the calculations using the constant headship rate. It was primarily the group of persons who had never married which showed the greatest increase in potential housing demand. Accordingly, it was assumed that headship rates of persons who had never married in urban areas would increase more than those in rural areas in all sex-age groups.

In the case of Japan, future levels of headship rates were estimated according to the regression lines between the headship rates and the degree of urbanization for 46 prefectures. Two series of sequential changes in headship rates were assumed. One series of assumptions was that the headship rates specific for sex, age and marital status for all Japan would change linearly to take (a) the average between the 1960 rates for all urban areas and all densely inhabited districts (the Japanese version of "urbanized area") by 1970; (b) the 1960 rates for all densely inhabited districts by 1975; (c) the 1960 rates for all densely inhabited districts within all urban areas by 1980. After 1980, the schedule of headship rates was assumed to be held constant. The other set of assumptions was that the headship rates specific for sex, age and marital status for all Japan would change linearly to take (a) the 1960 rates for all densely inhabited districts by 1970; (b) the 1960 rates for all densely inhabited districts within all urban areas by 1975; (c) rates to be held constant thereafter.²⁵

²⁵ Japan, Institute of Population Problems, *Zenkoku Todofuken-betsu Setaisu no Shorai Suikei...*

TABLE 16. ENUMERATED AND PROJECTED HEADSHIP RATES SPECIFIC FOR SEX, AGE AND MARITAL STATUS FOR FINLAND IN 1960, 1970 AND 1980 (Percentage)

Age group	Married males			Formerly married						Non-married					
				Male			Female			Male			Female		
	1960	1970	1980	1960	1970	1980	1960	1970	1980	1960	1970	1980	1960	1970	1980
<i>Urban communes</i>															
20-24	84.1	93.0	95.0	10.8	13.0	15.0	37.7	38.3	38.9	6.6	9.1	11.6	9.9	13.7	17.5
25-29	92.8	98.0	98.0	28.0	33.3	38.6	55.8	66.4	77.0	17.2	24.0	30.0	22.2	31.0	39.8
30-34	96.9	99.0	99.0	34.5	36.8	39.1	67.5	72.3	77.1	24.9	33.2	41.5	32.1	42.8	53.5
35-39	98.5	99.5	99.5	39.3	40.4	41.5	75.8	78.0	80.2	30.8	40.2	49.5	40.9	53.4	65.9
40-44	99.4	99.5	99.5	46.6	47.5	48.4	81.9	83.9	85.9	35.7	45.7	55.7	48.9	62.6	76.3
45-49	99.5	99.5	99.5	53.0	53.8	54.6	81.9	83.2	84.5	37.4	47.3	55.2	52.0	62.4	72.8
50-64	99.5	99.5	99.5	68.2	70.5	72.8	76.3	78.9	81.5	46.0	52.3	58.6	56.8	64.4	72.0
65+	95.9	96.0	96.0	68.3	72.5	77.0	56.9	60.4	64.1	50.8	56.6	63.1	52.7	58.4	64.8
TOTAL	97.2	98.5	98.6	59.1	62.4	65.0	68.7	70.2	72.6	19.0	22.0	30.3	36.3	40.1	50.9
<i>Rural communes</i>															
20-24	68.0	71.0	76.0	24.5	36.9	49.3	26.7	40.5	54.3	5.3	6.6	7.9	7.6	9.4	11.2
25-29	80.8	85.0	90.0	32.3	39.4	46.5	43.8	53.7	63.6	14.3	17.1	19.9	15.2	18.3	21.4
30-34	89.2	93.0	96.0	34.5	37.3	40.1	59.8	64.7	69.6	22.1	26.6	31.1	20.2	24.3	28.4
35-39	94.3	96.0	98.0	53.2	56.6	59.9	69.1	73.5	77.8	29.6	33.4	37.2	23.7	26.9	30.1
40-44	97.3	99.0	99.0	57.0	59.6	62.1	77.5	81.0	84.4	35.6	40.4	45.2	28.9	32.7	36.5
45-49	98.9	99.0	99.0	71.6	73.5	75.4	79.8	82.1	84.4	40.0	44.7	49.4	34.0	38.0	42.0
50-64	98.3	99.0	99.0	77.6	80.8	84.0	67.1	69.7	72.3	45.8	50.9	56.0	40.9	45.5	50.1
65+	83.9	86.0	89.0	51.2	54.2	57.3	38.7	41.0	43.5	39.0	47.5	57.9	41.8	50.8	61.7
TOTAL	92.5	94.0	95.0	59.7	61.3	63.1	53.8	53.0	51.9	19.7	20.4	24.9	24.4	26.7	32.5

SOURCE: Finland, Housing Committee, "Housing situation in Finland" (Helsinki, September 1965), unpublished paper contributed to the preparation of the ECE study *The Housing Situation and Perspectives for Long-term Housing Requirements in European Countries* (United Nations publication, Sales No. 68.II.E.6).

In general, it was observed that the larger the degree of urbanization the higher the headship rate according to the sequential order of (a) all Japan; (b) all urban areas; (c) all densely inhabited districts; (d) all densely inhabited districts within all urban areas. In order to determine the tempo of change in the schedule of headship rates, various regression analyses were made between headship rates and degrees of urbanization, while controlling the population composition.

Normative approach

Finally, an approach to setting up normative targets for projections of headship rates in the future will be briefly discussed here. This approach has been extensively used in the projections for the United Kingdom²⁶ and for

²⁶ For example, J. B. Cullingworth, *Housing Needs and Planning Policy* (London, Routledge and Kegan Paul, 1960). L. Needleman,

Denmark²⁷ and Norway.²⁸ Unlike the mathematical extrapolative method and the regression method, future headship rates can be estimated by a theoretical approximation of the future potential formation of households and families by using the current headship rates and the probable future economic and social development and implementation of the Government's housing policy.

In Denmark, this approach was used as one of the variants of the projections. Specifically, the rates were called "welfare headship rates". It was assumed that a housing

"A long-term view of housing", *National Institute Economic Review* (London), No. 18 (November 1961), pp. 19-37; D. C. Paige, "Housing", in W. Beckerman *et al.*, eds., *The British Economy in 1975* (Cambridge University Press, 1965), pp. 366-403 and pp. 579-594. See also the reference list attached to the annex table.

²⁷ Denmark, Ministry of Housing, "Danish housing requirements, 1960-1980".

²⁸ Norway, Ministry of Municipal and Labour Affairs, "Housing situation and housing prospects in Norway".

TABLE 17. HEADSHIP RATES SPECIFIC FOR SEX, AGE AND MARITAL STATUS FOR ALL RURAL DISTRICTS AND ALL TOWNS IN NORWAY, 1960 CENSUS AND ESTIMATION FOR 1970

Age group	Unmarried		Married couples ^a	Widowers	Widows	Divorced males	Separated Females
	Males	Females					
<i>Headship rates in the 1960 census</i>							
<i>Rural district</i>							
20-29	5	8	81	36	54	17	24
30-39	21	15	94	70	77	33	48
40-49	38	20	98	83	80	49	58
50-59	51	29	99	86	76	61	61
60-69	56	36	98	75	66	63	60
70+	48	35	89	47	48	52	52
TOTAL	24	22	95	58	59	48	53
<i>Town</i>							
20-29	7	15	80	44	65	18	36
30-39	22	33	95	73	83	28	62
40-49	29	39	98	78	87	35	72
50-59	39	49	99	81	88	41	76
60-69	45	58	99	81	85	48	77
70+	43	58	98	68	75	45	72
TOTAL	20	38	96	73	81	37	70
<i>Estimated headship rates in 1970</i>							
<i>Rural district</i>							
20-29	8	10	90	45	60	20	35
30-39	25	20	97	75	80	40	60
40-49	45	25	99	85	85	55	65
50-59	55	35	99	90	80	65	70
60-69	60	40	99	80	70	70	70
70+	55	40	92	50	50	55	55
TOTAL	27	25	96	63	63	57	62
<i>Town</i>							
20-29	15	25	95	50	70	25	45
30-39	40	50	98	75	85	35	75
40-49	50	60	99	80	90	45	80
50-59	55	65	99	82	90	50	85
60-69	60	70	99	82	88	55	85
70+	60	70	98	70	80	50	80
TOTAL	31	47	98	75	85	46	78

SOURCE: Norway, Ministry of Municipal and Labour Affairs, "Housing situation and housing prospects in Norway" (Oslo, November 1965), p. 35.

^a According to the age of the husband.

policy was established particularly to create opportunities for students and old people to dispose of independent dwellings. In this series, headship rates for all age groups of married men were assumed to be 100. The same levels were also applied to the assumption of "economic headship rate" only for married males. Unlike the "economic headship rates" which were determined theoretically by the income-elasticity analyses, the welfare headship rates for other marital status groups were assumed to be considerably higher than those observed in the 1960 census and those assumed under the "economic headship rate". The "welfare rate" assumed that the extensive housing policy would raise headship rates further, particularly in younger and older age groups. In all marital status groups aged 25 to 70, headship rates were assumed to be higher than 80. The rates were at the level of 90 for the unmarried and previously married women aged 26-64.

The case of the Norway projections is similar to that of the "economic projections" for Denmark. The Norwegian projections, however, present separate computations for urban and rural areas. Table 17 above indicates estimates of the headship rates specific for sex, age and marital status by urban and rural area for 1970, together with the levels given by the 1960 population census. From this table, it is clear that the headship rates for married males in all age groups were already extremely high in 1960 and the rates for the

male and female widowed groups aged 30 and over were also very high in 1960, particularly in the urban areas. In the 1970 projections, the rates for married males are 90, 97, 99, 99, 99 and 92 for age groups 20-29, 30-39, 40-49, 50-59, 60-69, and 70 years and over, respectively, in the rural areas and 95, 98, 99, 99, 99, and 98 for the same age groups respectively, in the urban areas. The age groups 40 to 69 both in the urban and rural areas show extremely high rates, 99 per cent in each 10-year age group.

The series of projections made for the United Kingdom similarly uses normatively set goals with consideration of both past and current levels and future probable levels of headship rates in relation to the economic and social development. In three projections made by Needleman,²⁹ Roskill³⁰ and Paige³¹ the headship rates for married males were set at 98.0. In the maximum projections by Cullingworth, the corresponding rates were set at the level of 100.0. For the other marital status groups, the future headship rates were either the same as levels observed in the 1951 census or were estimated round figures such as 50 or 70 per cent.

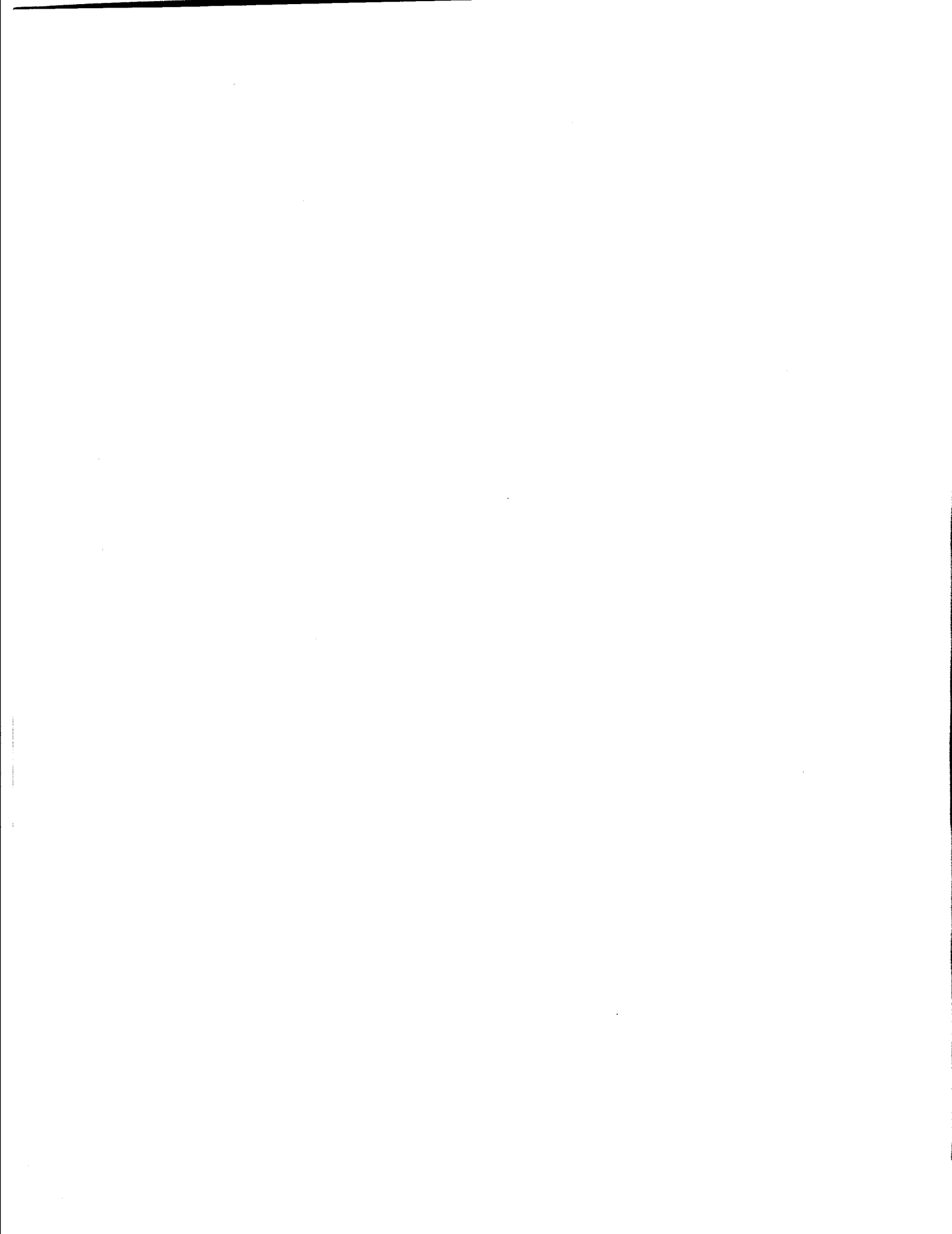
²⁹ Needleman, *op. cit.*

³⁰ O. Roskill, *Housing in Britain* (London, Town and Country Planning Association, 1964), particularly pp. 34-37.

³¹ Paige, *op. cit.*

Part Three

APPLICATION OF THE HEADSHIP RATE METHOD



Chapter V

EXAMPLES OF METHODS OF PROJECTING FUTURE HEADSHIP RATES

CONSTANT RATE METHOD

In part Two four major approaches to the projection of the number of households and families have been described. The last approach, namely the headship rate method, will be illustrated here in more detail by several examples, because this is considered the most adequate and useful method in the manual, and many applications of it have been developed by a good number of countries and institutions.

As was mentioned in chapter IV, projections of the number of households and families are usually made by the constant headship rate assumption, if data are available from only one census. Table 18 shows the projections of the number of households for Panama in 1965, 1970, 1975, and 1980, assuming that the 1960 sex-age specific headship rates will remain the same during subsequent periods. Table 19 illustrates the projections of the number

of ordinary households for Japan in 1970, 1975, 1980 and 1985 by the same constant method and, in addition, table 20 explains the projections of the numbers of quasi-households and total households in the corresponding years, holding constant the ratio of the number of quasi-households to that of ordinary households in 1960.

No additional explanation will be necessary for this method besides the remarks made in chapter IV. In tables 18, 19 and 20, it should again be noted that the population projections by sex and age available for Panama and Japan were originally rounded to the nearest thousand by the Population Division of the United Nations Secretariat. Accordingly, it will not be worthwhile to use headship rates with too many decimal places.

This method of projection also serves to estimate the effects of changes in population structure upon the future number of households. It may be considered to be one special aspect of "analytical projections" which are useful

TABLE 18. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF HOUSEHOLDS FOR PANAMA, 1965, 1970, 1975 AND 1980, ASSUMING CONSTANT SEX-AGE SPECIFIC HEADSHIP RATES
(In thousands, except for columns (1) and (2))

(1) Age group	(2) Headship rates, 1960 (percentage)	(3) - (6) Projected population				(7) - (10) Projected households				
		1965	1970	1975	1980	1965 (2) × (3)	1970 (2) × (4)	1975 (2) × (5)	1980 (2) × (6)	
<i>Males</i>										
15-24	15.0	117	137	161	197	17.6	20.6	24.2	29.6	
25-34	63.0	80	94	112	133	50.4	59.2	70.6	83.8	
35-44	81.1	61	67	76	90	49.5	54.3	61.6	73.0	
45-54	85.8	48	52	57	62	41.2	44.6	48.9	53.2	
55-64	86.4	27	35	42	47	23.3	30.2	36.3	40.6	
65+	80.4	23	27	32	40	18.5	21.7	25.7	32.2	
<i>Females</i>										
15-24	3.6	116	134	158	190	4.2	4.8	5.7	6.8	
25-34	12.3	79	95	111	131	9.7	11.7	13.7	16.1	
35-44	20.5	57	63	75	91	11.7	12.9	15.4	18.7	
45-54	29.1	43	48	53	59	12.5	14.0	15.4	17.2	
55-64	37.2	25	31	39	44	9.3	11.5	14.5	16.4	
65+	38.3	23	26	30	37	8.8	10.0	11.5	14.2	
TOTAL for both sexes		1 246	1 468	1 737	2 068	256.7	295.5	343.5	401.8	
Average household size						4.85	4.97	5.06	5.15	

SOURCE:

Headship rates:

- (a) Headship data: República de Panamá, Dirección de Estadística y Censo, *Censos Nacionales de 1960, Vol. VII: Características de la Familia* (Panamá, 1964), table 7, pp. 20-21;
- (b) Population by sex and age: República de Panamá, Dirección de Estadística y Censo, *Censos Nacionales de 1960, Vol. IV: Características Generales* (Panamá, 1963), table 24, pp. 41-42.

Population projections:

Prepared in 1969 by the Population Division, United Nations Secretariat.

TABLE 19. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF ORDINARY HOUSEHOLDS FOR JAPAN, 1970, 1975, 1980 and 1985, USING CONSTANT SEX-AGE SPECIFIC HEADSHIP RATES
(In thousands except for columns (1) and (2))

(1) Age group	(2) Headship rates, 1965 (percentage)	(4) Projected population				(9) Projected households			
		(3) 1970	(4) 1975	(5) 1980	(6) 1985	(7) 1970 (2) × (3)	(8) 1975 (2) × (4)	(9) 1980 (2) × (5)	(10) 1985 (2) × (6)
<i>Males</i>									
15-24	6.98	10 076	8 683	8 055	8 579	703.3	606.1	562.2	598.8
25-34	58.11	8 603	9 781	9 965	8 591	4 999.2	5 683.7	5 790.7	4 992.2
35-44	81.83	7 753	8 125	8 463	9 632	6 344.3	6 648.7	6 925.3	7 881.9
45-54	92.51	4 775	6 167	7 492	7 857	4 417.4	5 705.1	6 930.8	7 268.5
55-64	92.02	3 814	3 963	4 378	5 677	3 509.6	3 646.8	4 028.6	5 224.0
65+	66.29	3 210	3 852	4 484	4 889	2 127.9	2 553.5	2 972.4	3 240.9
<i>Females</i>									
15-24	2.10	9 847	8 415	7 784	8 231	206.8	176.7	163.5	172.9
25-34	4.08	8 751	9 821	9 796	8 374	357.0	400.7	399.7	341.7
35-44	8.88	7 764	8 194	8 671	9 739	689.4	727.6	770.0	864.8
45-54	17.84	5 779	6 763	7 584	8 009	1 031.0	1 206.5	1 353.0	1 428.8
55-64	16.55	4 340	4 823	5 452	6 387	718.3	798.2	902.3	1 057.0
65+	11.79	3 988	4 699	5 552	6 294	470.2	554.0	654.6	742.1
TOTAL for both sexes		103 499	109 948	116 347	121 346	25 574.4	28 707.6	31 453.1	33 813.6

SOURCE:

Headship rates:

(a) Heads: Japan, Office of the Prime Minister, Bureau of Statistics, 1965 Population Census of Japan, Volume 5, Part I: Age, Month of Birth, Marital Status, Legal Nationality, Households, Quasi-household Members and Housing Conditions (Tokyo, 1969), table 5, pp. 62-69;

(b) Population: *ibid.*, table 2, pp. 26-27.

Population projections:

see *World Population Prospects as Assessed in 1968* (Sales No. 73.XIII.4).

TABLE 20. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF TOTAL HOUSEHOLDS AND AVERAGE SIZE OF HOUSEHOLD FOR JAPAN, 1970, 1975, 1980 AND 1985, ASSUMING A CONSTANT RATIO OF THE TOTAL NUMBER OF QUASI-HOUSEHOLDS TO THAT OF ORDINARY (FAMILY) HOUSEHOLDS IN THE 1965 CENSUS

(In thousands except for columns (1) and (6))

(1) Year	(2) Ordinary households	(3) Quasi-households (2) × 0.04316	(4) Total households (2) + (3)	(5) Population projected	(6) Average household size (number of persons) (5)/(4)
1965	23 085.4	996.4 ^a	24 081.8	98 275	4.08
1970	25 574.4	1 103.8	26 678.2	103 499	3.88
1975	28 707.6	1 239.0	29 946.6	109 948	3.67
1980	31 453.1	1 357.5	32 810.6	116 347	3.55
1985	33 813.6	1 459.4	35 273.0	121 346	3.44

SOURCE: The numbers of the ordinary households and the population for 1970-1985 were projected by the Population Division, United Nations Secretariat.

^a The enumerated census figure for 1 October 1965.

for studying the effects of hypothetical variations in particular factors. When the economically active population is being analysed, such analytical projections have frequently been made in order to assess the effect of fertility, mortality, migration and other factors upon the over-all changes in economic activity of the population.¹

¹ *Methods of Analysing Census Data on Economic Activities of Population*, Population Studies, No. 43 (United Nations publication, Sales No. E.69.XIII.2), pp. 46-63.

EXTRAPOLATIVE METHODS

When more than two censuses have recorded data on heads of households and families classified at least by sex and age, it is possible more or less to establish the trend of headship rates (whether they are increasing or decreasing).²

² In general, the question of whether the trend of headship rate tends to be constant, or to increase faster or more slowly than the rate of population growth, cannot be answered with much assurance by comparing successive headship rates, unless the results

TABLE 21. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF HOUSEHOLDS FOR PANAMA IN 1970 AND 1980, ASSUMING ONE HALF OF THE TEN-YEAR CHANGE IN THE SEX-AGE HEADSHIP RATES FROM 1950 TO 1960 FOR 1960-1970 AND ONE QUARTER OF THE CHANGE FOR 1970-1980

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age group	Headship rates		Difference between 1950 and 1960 rates (3) - (2)	(4) 2	(4) 4	(3) + (5)	(7) + (6)	Projected population		Projected households 1970-1980	
	1950 (as percentage)	1960						1970 (in thousands)	1980	(7) × (9)	(8) × (10)
Males											
15-24	13.5	15.0	1.5	0.75	0.38	15.75	16.13	137	197	21.6	31.8
25-34	57.0	63.0	6.0	3.00	1.50	66.00	67.50	94	133	62.0	89.8
35-44	73.0	81.1	8.1	4.05	2.03	85.15	87.18	67	90	57.1	78.5
45-54	74.5	85.8	11.3	5.65	2.83	91.45	94.28	52	62	47.6	58.5
55-64	70.0	86.4	16.4	8.20	4.10	94.60	98.70	35	47	33.1	46.4
65+	61.3	80.4	19.1	9.55	4.78	89.95	94.73	27	40	24.3	37.9
Females											
15-24	2.8	3.6	0.8	0.40	0.20	4.00	4.20	134	190	5.4	8.0
25-34	9.8	12.3	2.5	1.25	0.63	13.55	14.18	95	131	12.9	18.6
35-44	17.5	20.5	3.0	1.50	0.75	22.00	22.75	63	91	13.9	20.7
45-54	25.4	29.1	3.7	1.85	0.93	30.95	31.88	48	59	14.9	18.8
55-64	29.6	37.2	7.6	3.80	1.90	41.00	42.90	31	44	12.7	18.9
65+	28.0	38.3	10.3	5.15	2.58	43.45	46.03	26	37	11.3	17.0
TOTAL for both sexes								1 468	2 068	316.8	444.9
Average household size										4.63	4.65

SOURCE:

Headship rates for 1950:

(a) Heads: República de Panamá, Dirección de Estadística y Censo, *Censos Nacionales de 1950 (Panamá, 1957)*, vol. VI, table 8, pp. 22-24;

(b) Population: *ibid.*, vol. I, table 17, p. 26.

Headship rates for 1960: see table 18, above.

Population projections: prepared in 1969 by the Population Division of the United Nations Secretariat.

With this information, future headship rates can be extrapolated. To extrapolate is to extend the trend in order to obtain estimates or forecasts for years beyond the data used in fitting the trend. Thus, the availability of sex-age headship data from more than two censuses will clearly increase the validity and accuracy of projected headship rates and population.

Extrapolation by geometrical progression

In the present series of United States household and family projections, the United States Bureau of the Census has frequently used relatively straightforward assumptions which imply that the future amount of change in headship rates will decrease geometrically. For example, the changes for the first projections period 1960-1970 will be one half of those observed during the basic period 1950-1960, and for 1970-1980 they will be one quarter of the observed increases. Using these assumptions for Panama for the periods 1960-1970 and 1970-1980 and for Japan for the periods 1965-1970 and 1970-1975, the examples in tables 21 and 22 respectively illustrate the computations of the prospective changes in sex-age head-

ship rates as well as the resulting projections. Table 23 indicates the computational process of projecting the total number of households for Japan, *via* the projections of the number of quasi-households, which assumes that the ratio of the number of quasi-households to that of ordinary households will also decrease by geometrical progression. In addition, tables 24 and 25 show the computational steps for the same countries and for the same years when the percentage changes are assumed to decline geometrically. In this case, it is assumed that the percentage change in headship rates for the period 1960-1970 will be half that for the period 1950-1960 and that for the period 1970-1980 it will further be reduced to one quarter of that for the period 1950-1960. Accordingly, table 26 illustrates the derivation of the numbers of quasi-households and total households, assuming a percentage change (a decline in this case) in the ratio of the number of quasi-households to that of ordinary households for 1970 and 1975 that takes place in the same fashion as the headship rate changes for ordinary households shown in table 25.

Some remarks should be made on the extrapolation of sex-age specific headship rates by geometrical progression on the basis of the two recent censuses:

(a) First of all, in the case of Panama, the assumption described above for the period 1970-1980 would result in headship rates beyond 100 per cent in some of the male groups, namely those of 55-64, and 65 and over, because the difference between the headship rates in 1950 and 1960 is very large in those age groups. Thus, it is assumed here that the change in headship rates between 1960 and 1970

of at least three censuses are available. But even the results of three censuses are insufficient to determine whether an observed acceleration or deceleration of increase appears to be a temporary or a long-term trend, whether it is fairly recent and may still gather momentum, or whether it has apparently run its course. To answer such questions with any assurance a minimum of four censuses containing headship data is required. Cf. *Manuals on Methods of Estimating Population, Manual 1: Methods of Estimating Total Population for Current Dates, Population Studies, No. 10* (United Nations publication, Sales No. 52.XIII.5), p. 31.

TABLE 22. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF ORDINARY HOUSEHOLDS FOR JAPAN IN 1970 AND 1975, ASSUMING ONE HALF OF THE FIVE-YEAR CHANGE IN THE SEX-AGE HEADSHIP RATES FROM 1960 TO 1965 FOR 1965-1970 AND ONE QUARTER OF THE CHANGE FOR 1970-1975

(1) Age group	(2) (3) Ordinary household headship rates		(4) Difference between 1960 and 1965 rates (3) - (2)	(5) $\frac{(4)}{2}$	(6) $\frac{(4)}{4}$	(7) (3) + (5)	(8) (7) + (6)	(9) (10) Projected population		(11) (12) Projected ordinary households	
	1960 (as percentage)	1965						1970	1975	1970 (7) × (9)	1975 (8) × (10)
Males											
15-24	4.33	6.98	2.65	1.33	0.66	8.31	8.97	10 076	8 683	837.3	778.9
25-34	51.50	58.11	6.61	3.31	1.65	61.42	63.07	8 603	9 781	5 284.0	6 168.9
35-44	81.74	81.83	0.09	0.05	0.02	81.88	81.90	7 753	8 125	6 348.2	6 654.4
45-54	92.73	92.51	-0.22	-0.11	-0.06	92.40	92.34	4 775	6 167	4 412.1	5 694.6
55-64	91.09	92.02	0.93	0.47	0.23	92.49	92.72	3 814	3 963	3 527.6	3 674.5
65+	63.10	66.29	3.19	1.60	0.80	67.89	68.69	3 210	3 852	2 179.3	2 645.9
Females											
15-24	0.99	2.10	1.11	0.56	0.28	2.66	2.94	9 847	8 415	261.9	247.4
25-34	3.26	4.08	0.82	0.41	0.21	4.49	4.70	8 751	9 821	392.9	461.6
35-44	10.53	8.88	-1.65	-0.83	-0.41	8.05	7.64	7 764	8 194	625.0	626.0
45-54	17.50	17.84	0.34	0.17	0.09	18.01	18.10	5 779	6 763	1 040.8	1 224.1
55-64	14.41	16.55	2.14	1.07	0.54	17.62	18.16	4 340	4 823	764.7	875.9
65+	10.44	11.79	1.35	0.68	0.34	12.47	12.81	3 988	4 699	497.3	601.9
TOTAL for both sexes								103 499	109 948	26 171.1	29 654.1
Average household size										3.95	3.71

SOURCE:

Headship rates for 1960:

(a) Heads: Japan, Office of the Prime Minister, Bureau of Statistics, 1960 Population Census of Japan, unpublished 1 per cent tabulations of the number of ordinary households by sex, age and marital status for the 46 prefectures of Japan, made available to the Population Division of the United Nations Secretariat in 1968;

(b) Population: *ibid.*, vol. 2: *One per cent Tabulation*, part 1, table 3.

Headship rates for 1965: see foot-note to table 19.

Population projections: prepared by the Population Division of the United Nations Secretariat.

will be only one quarter of that observed in the period 1950-1960, and that for the period 1970-1980 it will further diminish to one eighth;

(b) Secondly, although in most of the sex-age groups headship rates have increased and it is assumed that they will increase further although at a diminishing pace, in some countries certain age groups of females, namely those between 35 and 55 years, show rather decreasing trends. Whether or not these rates for females (in the ages where the population of women who are married and living with their husbands is high) will universally decrease, remain constant or increase still seems to be largely a matter of speculation and depends on the present and future demographic, economic and social conditions of the country concerned. The sex-age specific headship rates of females in those ages can be considered a function of the two factors, *viz.* the degree of ability to maintain separate and independent headship among the never married, widowed or divorced women and the changing structure of marital status in the female population of each age group. In the present illustrative projections for Panama and Japan, an assumption was made that headship rates will further decrease but at a slower pace in these age groups if they decreased from 1950 to 1960 in Panama or from 1960 to 1965 in Japan. Actually, there were no decreases at any age group in the case of Panama. On the other hand, decreases were observed in Japan in two age groups, 45-54 for males and 35-44 for females;

(c) In the above examples, attention should be paid to the specific statistical situation of Japan, where the household data are of two kinds: ordinary households and quasi-households.³ The sex-age specific headship data have been available only for the ordinary households.⁴ Thus, by the headship rate method, only projections of the number of ordinary households can be obtained and some kind of estimation may be made for the number of quasi-households.

For practical purposes and because not much is known about the demographic structure of quasi-households, the broad assumption was made that the ratio of the number of quasi-households to the number of ordinary households would also change in geometrical progression on the basis of the 1960-1965 period. Since the ratio of quasi-households to ordinary households declined slightly from

³ Ordinary households are similar to private or family households in the United Nations definitions, whereas quasi-households may be equivalent to institutional households including one-person dormitory type households.

⁴ The most recently published 1965 census tabulations have shown for the first time the breakdowns specific for sex, age and marital status of the members of quasi-households but not of their heads. See Japan, Office of the Prime Minister, Bureau of Statistics, 1965 Population Census of Japan, Vol. 5, 20 Per Cent Census Tabulations for All Japan, Part 1, "Age, month of birth, marital status, legal nationality, households, quasi-household members and housing conditions" (Tokyo, 1969), table 9, pp. 192-195. Also, both the 1960 and 1965 censuses cross-classified one-person quasi-households by their sex, age and marital status.

TABLE 23. ILLUSTRATIVE PROJECTIONS OF THE TOTAL NUMBER OF HOUSEHOLDS FOR JAPAN IN 1970 AND 1975, ASSUMING FOR 1965-1970 ONE HALF OF THE CHANGE IN THE RATIO OF THE QUASI-HOUSEHOLDS TO THE ORDINARY HOUSEHOLDS OBSERVED IN 1960-1965 AND ASSUMING FOR 1970-1975 ONE-QUARTER OF THAT CHANGE

(1) Ratio of quasi-households to ordinary households 1960 ^a	(2) Ratio of quasi-households to ordinary households 1965 ^b		(3) Half of the difference $\frac{(1) - (2)}{2}$		(4) One quarter of the difference $\frac{(1) - (2)}{4}$		(5) $(2) - (3)$		(6) $(5) - (4)$		(7) Projected ordinary households ^c (in thousands)		(8) Projected total households $[(5) + 1] \times (7)$ $[(6) + 1] \times (8)$		(9) Projected population ^d (in thousands)		(10) Projected population ^d (in thousands)		(11) Projected population ^d (in thousands)		(12) Projected population ^d (in thousands)		(13) Average household size (number of persons)		(14) Average household size (number of persons)	
	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965
0.04970	0.04316	0.00327	0.00164	0.03989	0.03825	26 171.1	29 654.1	27 215.1	30 788.4	103 499	109 948	3.80	3.57													

SOURCE:

^a Japan, Office of the Prime Minister, Bureau of Statistics, 1960 Population Census of Japan, vol. 3, part 1, table 16, pp. 452-453.
^b Table 20.
^c Table 22.
^d Table 20.

TABLE 24. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF HOUSEHOLDS FOR PANAMA IN 1970 AND 1980 WITH THE RATE OF INCREASE IN SEX-AGE SPECIFIC HEADSHIP RATES DECLINING IN GEOMETRICAL PROGRESSION

(1) Age group	(2) Headship rates 1950 (percentage)		(3) Headship rates 1960 (percentage)		(4) $\frac{(2) - (3)}{4} + 1$ $= \frac{(4) + 3}{4}$		(5) $\frac{(4) - 1}{8} + 1$ $= \frac{(4) + 7}{8}$		(6) $\frac{(4) - 1}{8} + 1$ $= \frac{(4) + 7}{8}$		(7) $(3) \times (5)$		(8) Headship rates $\frac{1970}{(3) \times (5)}$ $\frac{1980}{(6) \times (7)}$ (percentage)		(9) Projected population 1970 (in thousands)		(10) Projected population 1980 (in thousands)		(11) Projected population 1970 $(7) \times (9)$		(12) Projected households 1980 $(8) \times (10)$	
	1950	1960	1950	1960	1950	1960	1950	1960	1950	1960	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
15-24	13.5	15.0	1.1111	1.028	1.014	1.036	1.036	1.036	1.036	1.036	1.036	1.036	1.036	137	197	197	197	21.1	30.7	21.1	30.7	
25-34	57.0	63.0	1.1053	1.026	1.013	1.032	1.032	1.032	1.032	1.032	1.032	1.032	1.032	94	133	133	133	60.7	87.0	60.7	87.0	
35-44	73.0	81.1	1.1110	1.028	1.014	1.032	1.032	1.032	1.032	1.032	1.032	1.032	1.032	67	90	90	90	55.9	76.1	55.9	76.1	
45-54	74.5	85.8	1.1517	1.038	1.019	1.038	1.038	1.038	1.038	1.038	1.038	1.038	1.038	52	62	62	62	46.3	56.3	46.3	56.3	
55-64	70.0	86.4	1.2343	1.059	1.029	1.036	1.036	1.036	1.036	1.036	1.036	1.036	1.036	35	47	47	47	32.0	44.3	32.0	44.3	
65+	61.3	80.4	1.3116	1.078	1.039	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	27	40	40	40	23.4	36.0	23.4	36.0	
15-24	2.8	3.6	1.2857	1.071	1.036	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	134	190	190	190	5.2	7.6	5.2	7.6	
25-34	9.8	12.3	1.2551	1.064	1.032	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	95	131	131	131	12.4	17.7	12.4	17.7	
35-44	17.5	20.5	1.1714	1.043	1.021	1.043	1.043	1.043	1.043	1.043	1.043	1.043	1.043	63	91	91	91	13.5	19.8	13.5	19.8	
45-54	25.4	29.1	1.1457	1.036	1.018	1.036	1.036	1.036	1.036	1.036	1.036	1.036	1.036	48	59	59	59	14.4	18.1	14.4	18.1	
55-64	29.6	37.2	1.2568	1.064	1.032	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	31	44	44	44	12.3	18.0	12.3	18.0	
65+	28.0	38.3	1.3679	1.092	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	1.046	26	37	37	37	10.9	16.2	10.9	16.2	
TOTAL for all ages in both sexes														1 468	2 068	2 068	2 068	308.1	427.8	308.1	427.8	
Average house- hold size																			4.76	4.83	4.76	4.83

SOURCE: headship rates computed from the population census data. Population projections derived from Centro Latinoamericano de Demografía, Boletín Demográfico (Santiago), año 1, vol. II October 1968, table 2. The population projection figures later slightly modified by the Population Division, United Nations Secretariat. All population projections based on the medium assumption.

TABLE 25. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF ORDINARY HOUSEHOLDS FOR JAPAN IN 1970 AND 1975 WITH THE RATE OF INCREASE IN SEX-AGE SPECIFIC HEADSHIP RATES DECLINING IN GEOMETRICAL PROGRESSION

(1) Age group	(2) Ordinary household headship rates		(3) 1965 (percentage)	(4)	(5) $\frac{(4)-1}{2} + 1$ $= \frac{(4)+1}{2}$	(6) $\frac{(4)-1}{4} + 1$ $= \frac{(4)+3}{4}$	(7) Headship rates		(8) 1980 (6) x (7) (percentage)	(9) 1970 Projected population (in thousands)	(10) 1975 Projected population (in thousands)	(11) $\frac{1970}{(7) \times (9)}$ Projected ordinary households	(12) $\frac{1975}{(8) \times (10)}$ Projected ordinary households
	(1) 1960	(2) 1965					(7) $\frac{1970}{(5) \times (5)}$	(8) $\frac{1980}{(6) \times (7)}$					
15-24	4.33	6.98	1.6120	1.3060	1.1530	9.12	10.52	10.076	8.683	918.9	913.5		
25-34	51.50	58.11	1.1283	1.0642	1.0321	61.84	63.83	8.603	9.781	5 320.1	6 243.2		
35-44	81.74	81.83	1.0011	1.0006	1.0003	81.88	81.90	7 753	8 125	6 348.2	6 654.4		
45-54	92.73	92.51	0.9976	0.9988	0.9994	92.40	92.34	4 775	6 167	4 412.1	5 694.6		
55-64	91.09	92.02	1.0102	1.0051	1.0026	92.49	92.73	3 814	3 963	3 527.6	3 674.9		
65+	63.10	66.29	1.0506	1.0253	1.0127	67.97	68.83	3 210	3 852	2 181.8	2 651.3		
Males													
15-24	0.99	2.10	2.1212	1.5606	1.2803	3.28	4.20	9 847	8 415	323.0	353.4		
25-34	3.26	4.08	1.2515	1.1258	1.0629	4.59	4.88	8 751	9 821	401.7	479.3		
35-44	10.53	8.88	0.8433	0.9217	0.9608	8.18	7.86	7 764	8 194	635.1	644.0		
45-54	17.50	17.84	1.0194	1.0097	1.0049	18.01	18.10	5 779	6 763	1 040.8	1 224.1		
55-64	14.41	16.55	1.1485	1.0743	1.0371	17.78	18.44	4 340	4 823	771.7	889.4		
65+	10.44	11.79	1.1293	1.0647	1.0323	12.55	12.96	3 988	4 699	500.5	609.0		
TOTAL for both sexes								103 499	109 948	26 381.5	30 031.1		

SOURCE: see table 22.

TABLE 26. ILLUSTRATIVE PROJECTIONS OF THE TOTAL NUMBER OF HOUSEHOLDS FOR JAPAN IN 1970 AND 1975, ASSUMING FOR 1965-1970 ONE HALF OF THE RATE OF CHANGE IN THE RATIO OF THE QUASI-HOUSEHOLDS TO THE ORDINARY HOUSEHOLDS OBSERVED IN 1960-1965 AND ASSUMING FOR 1970-1975 ONE QUARTER OF THAT RATE OF CHANGE

(1) 1960	(2) 1965	(3) Ratio of quasi-households to ordinary households	(4) Half the rate of change of the rate of change		(6) (2) x (4)	(7) (5) x (6)	(8) Projected ordinary households (in thousands)	(9) 1975	(10) 1970	(11) 1975	(12) 1970	(13) 1975	(14) 1970	(15) 1975
			(3)	(4)											(5) $\frac{(3)+1}{2}$	(6) $\frac{(3)+3}{4}$	(7) $(7) + 1$	(8) $(7) + 1$	(9) $(7) + 1$	(10) $(7) + 1$	(11) $(7) + 1$	(12) $(7) + 1$	(13) $(7) + 1$	(14) $(7) + 1$	(15) $(7) + 1$
0.04970	0.04316	0.8684	0.9342	0.9671	0.04032	0.03899	26 381.5	30 031.1	27 445.2	31 202.0	103 499	109 948	3.77	3.52

1960 to 1965, the ratio for 1970 and onwards is assumed to decrease further. This assumption of decrease seems fairly plausible since the future increase in *per capita* income in Japan⁵ will further ease the present difficult housing situation and will facilitate the provision of separate and independent houses and apartments for those bachelors and spinsters who would otherwise have lived in a dormitory or an institutional type of household. As was noted, those dormitory and institutional types of households are regarded as "quasi-households" according to the current Japanese statistical definition. In the long run, the proportion of quasi-households should be small, in the neighbourhood of 1 per cent, even though it cannot reach the zero level.

As was mentioned, table 23 shows illustrative projections of the total number of households using the assumption that the change in the ratio of the number of quasi-households to that of ordinary households for the period 1965-1970 will diminish by one half of the change in the ratio observed in the period 1960-1965 and that for the period 1970-1975 will be one quarter of the change. On the other hand, table 26 indicates similar projections of the total number of households, assuming that the percentage change in the ratio of quasi-households to ordinary households for the period 1965-1970 will be half that for the period 1960-1965 and that for the period 1970-1975 will further be reduced to one quarter of that for the period 1960-1965.

Extrapolation by modified exponentials

Each of the illustrative projections referred to above implies that changes in the sex-age specific headship rates (the percentage of persons who are household heads) will diminish as time goes on, but that the rates of change will be discontinuous. For example, as shown in table 21 for Panama, one half of the ten-year change from 1950 to 1960 was assumed for the period 1960-1970, and one quarter of the change was assumed for the period 1970-1980. An alternative method is to assume that the ten-year or five-year change from year to year in the headship rate forms a continuous series. Illustrative projections of this type have been prepared again for Panama and Japan and the results are presented in tables 27 and 28.

In these projections, extrapolation was made by modified exponential functions and the following exponential formula was used to obtain headship rates specific for sex and age in future years.

$$(E:10) \quad h(i, j, t + x) = 1 - [1 - h(i, j, t - n)] \times \left[\frac{1 - h(i, j, t)}{1 - h(i, j, t - n)} \right]^{\frac{(t+x)-(t-n)}{n}}$$

where $h(i, j, t)$ indicates the headship rate specific for sex i , age j and time (year) t . The notation $h(i, j, t + x)$ denotes the headship rate specific for sex i and time (year)

$t + x$ (x years after t), and $h(i, j, t - n)$ symbolizes the headship rate specific for sex i , age j and time (year) $t - n$ (n years before t). The notation n in this equation specifically signifies the base period between the two census years for which the headship as well as the population data are available.

This type of modified exponential function possesses the advantage of requiring only two past observed points as the base data for the future trajectory of headship rates. It should be remembered that curve fitting by other types of modified exponentials such as the logistic or Gompertz function needs at least three past observed points as base data.

To elucidate the application of the above form of exponential function to estimate future headship rates, the example of Panama may again be used. The base period for the Panamanian projections is the ten-year interval between 1950 and 1960. Suppose a household projection is to be made for the year 1970, the modified exponential equation for extrapolating headship rate for 1970 by sex and age is expressed as follows:

$$(E:11) \quad h(i, j, 1970) = 1 - [1 - h(i, j, 1950)] \times \left[\frac{1 - h(i, j, 1960)}{1 - h(i, j, 1950)} \right]^{\frac{1970-1950}{10}} \\ = 1 - [1 - 1950 \text{ headship rate}] \times \left[\frac{1 - 1960 \text{ headship rate}}{1 - 1950 \text{ headship rate}} \right]^2$$

The actual process of computation for 1965, 1970, 1975 and 1980 for Panama is shown in table 27. Table 28 presents the same process for 1970, 1975, 1980 and 1985 for Japan. Notice that in the case of the Japanese projection, the value of n in the power at the right side of the equation is five. The equation for 1980, for example, for Japan is written as follows:

$$(E:12) \quad h(i, j, 1980) = 1 - [1 - h(i, j, 1960)] \times \left[\frac{1 - h(i, j, 1965)}{1 - h(i, j, 1960)} \right]^{\frac{1980-1960}{5}} \\ = 1 - [1 - 1960 \text{ headship rate}] \times \left[\frac{1 - 1965 \text{ headship rate}}{1 - 1960 \text{ headship rate}} \right]^4$$

As seen in these tables, only very elementary logarithmic knowledge is required for extrapolation of the future sex-age specific headship rates.

This method implies that the headship rates in all age groups will continue to rise indefinitely but at a gradually diminishing pace. In the Panamanian case, every age group shows an increase from 1950 to 1960. In Japan, however, age groups 45-54 for males and 35-44 for females show decreases from 1960 to 1965, thus presenting a problem.

It is of course possible to apply the same formula (E:10) for the extrapolation of headship rates in the age groups 45-54 for males and 35-44 for females for Japan. However, applications of the formula to these age groups yield decreases in headship rates at a rather accelerating pace, which is clearly in opposition to the present purpose.

⁵ Zenichi Itoh and Jiro Sakamoto, *Toshika Jidai no Nihon Keizai* (The Japanese economy in the age of urbanization) (Tokyo, Kodansha, 1967), pp. 258-259. This observation was based on the future projections and forecasts of all spheres of Japanese life in 1985, prepared by the Advisory Council on National Life to the Economic Planning Agency, Government of Japan.

TABLE 27. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF HOUSEHOLDS FOR PANAMA IN 1965, 1970, 1975 AND 1980, EXTRAPOLATING HEADSHIP RATES BY MODIFIED EXPONENTIALS

(1) Age group	(2) Headship rate, 1950	(3) Headship rate, 1960	(4) (1.000) - (2)	(5) (1.000) - (3)	(6) $\frac{(5)}{(4)}$	(7) Log (6)	(8) (7) × 1.5	(9) (7) × 2.0	(10) (7) × 2.5	(11) (7) × 3.0
<i>Males</i>										
15-24	0.135	0.150	0.865	0.850	0.983	I.9925535	I.9888302	I.9851070	I.9813837	I.9776605
25-34	0.570	0.630	0.430	0.370	0.860	I.9344985	I.9017477	I.8689970	I.8362462	I.8034955
35-44	0.730	0.811	0.270	0.189	0.700	I.8450980	I.7676470	I.6901960	I.6127450	I.5352940
45-54	0.745	0.858	0.255	0.142	0.557	I.7458552	I.6187828	I.4917104	I.3646380	I.2375656
55-64	0.700	0.864	0.300	0.136	0.453	I.6560982	I.4841473	I.3121964	I.1402455	2.9682946
65+	0.613	0.804	0.387	0.196	0.506	I.7041505	I.5562257	I.4083010	I.2603762	I.1124515
<i>Females</i>										
15-24	0.028	0.036	0.972	0.964	0.992	I.9965117	I.9947675	I.9930234	I.9912792	I.9895351
25-34	0.098	0.123	0.902	0.877	0.972	I.9876663	I.9814994	I.9753326	I.9691657	I.9629989
35-44	0.175	0.205	0.825	0.795	0.964	I.9840770	I.9761155	I.9681540	I.9601925	I.9522310
45-54	0.254	0.291	0.746	0.709	0.950	I.9777236	I.9665854	I.9554472	I.9443090	I.9331708
55-64	0.296	0.372	0.704	0.628	0.892	I.9503649	I.9255473	I.9007298	I.8759122	I.8510947
65+	0.280	0.383	0.720	0.617	0.857	I.9329808	I.8994712	I.8659616	I.8324520	I.7989424

(1) Age group	(12) Antilog (8)	(13) Antilog (9)	(14) Antilog (10)	(15) Antilog (11)	(16) (4) × (12)	(17) (4) × (13)	(18) (4) × (14)	(19) (4) × (15)	(20) Projected headship rates 1965	(21) Projected headship rates 1970
<i>Males</i>										
15-24	0.975	0.966	0.958	0.950	0.843	0.836	0.829	0.822	0.157	0.164
25-34	0.798	0.740	0.686	0.636	0.343	0.318	0.295	0.273	0.657	0.682
35-44	0.586	0.490	0.410	0.343	0.158	0.132	0.111	0.093	0.842	0.868
45-54	0.416	0.310	0.232	0.173	0.106	0.079	0.059	0.044	0.894	0.921
55-64	0.305	0.205	0.138	0.093	0.092	0.062	0.041	0.028	0.908	0.938
65+	0.360	0.256	0.182	0.130	0.139	0.099	0.070	0.050	0.861	0.901
<i>Females</i>										
15-24	0.988	0.984	0.980	0.976	0.960	0.956	0.953	0.949	0.040	0.044
25-34	0.958	0.945	0.931	0.918	0.864	0.852	0.840	0.828	0.136	0.148
35-44	0.946	0.929	0.912	0.896	0.780	0.766	0.752	0.739	0.220	0.234
45-54	0.926	0.903	0.880	0.857	0.691	0.674	0.656	0.639	0.309	0.326
55-64	0.842	0.796	0.751	0.710	0.593	0.560	0.529	0.500	0.407	0.440
65+	0.793	0.734	0.680	0.629	0.571	0.528	0.490	0.453	0.429	0.472

(1) Age group	(22) Projected headship rates		(24) Projected population (in thousands)	(25) 1970	(26) 1975	(27) 1980	(28) Projected households (in thousands)	(29) 1970	(30) 1975	(31) 1980
	1975	1980	1965				1965	1970	1975	1980
	1.000 - (18) 1.000 - (19)						(20) × (24)	(21) × (25)	(22) × (26)	(23) × (27)
<i>Males</i>										
15-24	0.171	0.178	117	137	161	197	18.4	22.5	27.5	35.1
25-34	0.705	0.727	80	94	112	133	52.6	64.1	79.0	96.7
35-44	0.889	0.907	61	67	76	90	51.4	58.2	67.6	81.6
45-54	0.941	0.956	48	52	57	62	42.9	47.9	53.6	59.3
55-64	0.959	0.972	27	35	42	47	24.5	32.8	40.3	45.7
65+	0.930	0.950	23	27	32	40	19.8	24.3	29.8	38.0
<i>Females</i>										
15-24	0.047	0.051	116	134	158	190	4.6	5.9	7.4	9.7
25-34	0.160	0.172	79	95	111	131	10.7	14.1	17.8	22.5
35-44	0.248	0.261	57	63	75	91	12.5	14.7	18.6	23.8
45-54	0.344	0.361	43	48	53	59	13.3	15.6	18.2	21.3
55-64	0.471	0.500	25	31	39	44	10.2	13.6	18.4	22.0
65+	0.510	0.547	23	26	30	37	9.9	12.3	15.3	20.2
TOTAL for both sexes			1 246	1 468	1 737	2 068	270.8	326.0	393.5	475.9
Average household size							4.60	4.50	4.41	4.35

SOURCE: as for table 18.

TABLE 28. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF ORDINARY HOUSEHOLDS FOR JAPAN IN 1970, 1975, 1980 AND 1985, EXTRAPOLATING HEADSHIP RATES BY MODIFIED EXPONENTIALS

(1) Age group	(3) Ordinary households headship rates		(4)	(5)	(6)	(7)	(8)	(9)	(10)
	1960	1965	1.0000 - (2)	1.0000 - (3)	(5) (4)	Log (6)	(7) × 2.0	(7) × 3.0	(7) × 4.0
	<i>Males</i>								
15-24 . . .	0.0433	0.0698	0.9567	0.9302	0.9723	I.9878003	I.9756006	I.9634009	I.9512012
25-34 . . .	0.5150	0.5811	0.4850	0.4189	0.8637	I.9363629	I.8727258	I.8090887	I.7454516
35-44 . . .	0.8174	0.8183	0.1826	0.1817	0.9951	I.9978667	I.9957334	I.9936001	I.9914668
45-54 . . .	0.9273	0.9251	0.0727	0.0749	1.0303	0.0129637	0.0259274	0.0388911	0.0518548
55-64 . . .	0.9109	0.9202	0.0891	0.0798	0.8956	I.9521141	I.9042282	I.8563423	I.8084564
65+ . . .	0.6310	0.6629	0.3690	0.3371	0.9136	I.9607561	I.9215122	I.8822683	I.8430244
<i>Females</i>									
15-24 . . .	0.0099	0.0210	0.9901	0.9790	0.9888	I.9951085	I.9902170	I.9853255	I.9804340
25-34 . . .	0.0326	0.0408	0.9674	0.9592	0.9915	I.9962927	I.9925854	I.9888781	I.9851708
35-44 . . .	0.1053	0.0888	0.8947	0.9112	1.0184	0.0079184	0.0158368	0.0237552	0.0316736
45-54 . . .	0.1750	0.1784	0.8250	0.8216	0.9959	I.9982157	I.9964314	I.9946471	I.9928628
55-64 . . .	0.1441	0.1655	0.8559	0.8345	0.9750	I.9890046	I.9780092	I.9670138	I.9560184
65+ . . .	0.1044	0.1179	0.8956	0.8821	0.9849	I.9933921	I.9867842	I.9801763	I.9735684

(1) Age group	(11) (7) × 5.0	(12) Antilog (8)	(13) Antilog (9)	(14) Antilog (10)	(15) Antilog (11)	(16) (4) × (12)	(17) (4) × (13)	(18) (4) × (14)	(19) (4) × (15)
<i>Males</i>									
15-24 . . .	I.9390015	0.9454	0.9192	0.8937	0.8690	0.9045	0.8794	0.8550	0.8314
25-34 . . .	I.6818145	0.7460	0.6443	0.5565	0.4806	0.3618	0.3125	0.2699	0.2331
35-44 . . .	I.9893335	0.9902	0.9854	0.9805	0.9757	0.1808	0.1799	0.1790	0.1782
45-54 . . .	0.0648185	1.0615	1.0937	1.1268	1.1610	0.0772	0.0795	0.0819	0.0844
55-64 . . .	I.7605705	0.8021	0.7184	0.6434	0.5762	0.0715	0.0640	0.0573	0.0513
65+ . . .	I.8037805	0.8347	0.7626	0.6967	0.6365	0.3080	0.2814	0.2571	0.2349
<i>Females</i>									
15-24 . . .	I.9755425	0.9777	0.9668	0.9560	0.9452	0.9680	0.9572	0.9465	0.9358
25-34 . . .	I.9814635	0.9831	0.9747	0.9664	0.9582	0.9511	0.9429	0.9349	0.9270
35-44 . . .	0.0395920	1.0371	1.0562	1.0757	1.0954	0.9279	0.9450	0.9624	0.9801
45-54 . . .	I.9910785	0.9918	0.9878	0.9837	0.9797	0.8182	0.8149	0.8116	0.8083
55-64 . . .	I.9450230	0.9506	0.9269	0.9037	0.8811	0.8136	0.7933	0.7735	0.7541
65+ . . .	I.9669605	0.9700	0.9554	0.9410	0.9268	0.8687	0.8557	0.8428	0.8300

(1) Age group	(21) Projected ordinary household headship rates I				(25) Projected ordinary household headship rates II (revised)			
	(20) 1970 1.0000 - (16)	(21) 1975 1.0000 - (17)	(22) 1980 1.0000 - (18)	(23) 1985 1.0000 - (19)	(24) 1970	(25) 1975	(26) 1980	(27) 1985
	<i>Males</i>							
15-24 . . .	0.0955	0.1206	0.1450	0.1686	0.0955	0.1206	0.1450	0.1686
25-34 . . .	0.6382	0.6875	0.7301	0.7669	0.6382	0.6875	0.7301	0.7669
35-44 . . .	0.8192	0.8201	0.8210	0.8218	0.8192	0.8201	0.8210	0.8218
45-54 . . .	0.9228	0.9205	0.9181	0.9156	0.9228	0.9206	0.9184	0.9163
55-64 . . .	0.9285	0.9360	0.9427	0.9487	0.9285	0.9360	0.9427	0.9487
65+ . . .	0.6920	0.7186	0.7429	0.7651	0.6920	0.7186	0.7429	0.7651
<i>Females</i>								
15-24 . . .	0.0320	0.0428	0.0535	0.0642	0.0320	0.0428	0.0535	0.0642
25-34 . . .	0.0489	0.0571	0.0651	0.0730	0.0489	0.0571	0.0651	0.0730
35-44 . . .	0.0721	0.0550	0.0376	0.0199	0.0749	0.0631	0.0533	0.0449
45-54 . . .	0.1818	0.1851	0.1884	0.1917	0.1818	0.1851	0.1884	0.1917
55-64 . . .	0.1864	0.2067	0.2265	0.2459	0.1864	0.2067	0.2265	0.2459
65+ . . .	0.1313	0.1443	0.1572	0.1700	0.1313	0.1443	0.1572	0.1700

(Table 28 continued overleaf)

TABLE 28 (continued)

(1) Age group	(28)	(29) Projected population	(30)	(31)	(32)	(33) Projected ordinary households	(34)	(35)
	1970	1975	1980	1985	1970 (24) × (28) (in thousands)	1975 (25) × (29)	1980 (26) × (30)	1985 (27) × (31)
<i>Males</i>								
15-24	10 076	8 683	8 055	8 579	962.3	1 047.2	1 168.0	1 446.4
25-34	8 603	9 781	9 965	8 591	5 490.4	6 724.4	7 275.4	6 588.4
35-44	7 753	8 125	8 463	9 632	6 351.3	6 663.3	6 948.1	7 915.6
45-54	4 775	6 167	7 492	7 857	4 406.4	5 677.3	6 880.7	7 199.4
55-64	3 814	3 963	4 378	5 677	3 541.3	3 709.4	4 127.1	5 385.8
65+	3 210	3 852	4 484	4 889	2 221.3	2 768.0	3 331.2	3 740.6
<i>Females</i>								
15-24	9 847	8 415	7 784	8 231	315.1	360.2	416.4	528.4
25-34	8 751	9 821	9 796	8 374	427.9	560.8	637.7	611.3
35-44	7 764	8 194	8 671	9 739	581.5	517.0	462.2	437.3
45-54	5 779	6 763	7 584	8 009	1 050.6	1 251.8	1 428.8	1 535.3
55-64	4 340	4 823	5 452	6 387	809.0	996.9	1 234.9	1 570.6
65+	3 988	4 699	5 552	6 294	523.6	678.1	872.8	1 070.0
TOTAL for both sexes	103 499	109 948	116 347	121 346	26 680.7	30 954.4	34 783.3	38 029.1
Average household size					3.88	3.55	3.34	3.19

SOURCE:
Headship rates: see table 22.
Population projections: prepared by the Population Division of the United Nations Secretariat.

Accordingly, for these age groups the following formula is used:

$$(E:13) \quad h(i, j, t + x)$$

$$= h(i, j, t - n) \left[\frac{h(i, j, t)}{h(i, j, t - n)} \right]^{[(t+x) - (t-n)]/n}$$

where $h(i, j, t)$ indicates headship rate specific for sex i , age j and time (year) t . The notation $h(i, j, t + x)$ denotes headship rates specific for sex i , age j and time (year) $t + x$ (x years after t) and $h(i, j, t - n)$ symbolizes headship rates specific for sex i , age j and time (year) $t - n$ (n years before t). The notation n in this equation specifically signifies the base period between the two census years for which the headship as well as the population data are available.

This formula is essentially similar to that used for calculating compound interest when the interest rate is given. To explain the application of this formula the estimation of headship rates for the year 1980 may be used as an example, assuming that the trend of the rates is decreasing. The expression can then be written as follows:

$$(E:14) \quad h(i, j, 1980)$$

$$= h(i, j, 1960) \left[\frac{h(i, j, 1965)}{h(i, j, 1960)} \right]^{\frac{1980-1960}{5}}$$

$$= \left(\frac{1960 \text{ headship rate}}{\text{headship rate}} \right) \left(\frac{1965 \text{ headship rate}}{1960 \text{ headship rate}} \right)^4$$

Table 29 shows application of the above formula to age groups 45-54 of males and 35-44 of females.

Another formula identical in nature to the above is used to estimate the future ratio of the number of quasi-households to that of ordinary households, which ratio is also on the downward trend. It is expressed in the following manner:

$$(E:15) \quad q_t = q_{1960} \left(\frac{q_{1965}}{q_{1960}} \right)^{\frac{t-1960}{5}}$$

where q_{1960} and q_{1965} indicate the ratio of the number of quasi-households to that of ordinary households in 1960 and 1965 respectively. It is here assumed that the ratio of the number of quasi-households to that of ordinary households will further decrease, but at a gradually slower pace. Table 30 presents the process of computation of the future number of total households as well as that of quasi-households using the above formula.

Evaluation

To return to equations E:11 and E:12 which deal with increases in headship rates at a diminishing pace: in those age groups which show tendencies to increase it would be useful to establish a schedule of maximum sex-age specific headship rates beyond which no further increases would be expected.

Such maximum values of headship rates naturally vary from age to age in both males and females. One way of setting up such a series of upper limits would be to take the highest sex-age specific rates ever achieved by developed countries equipped with accurate and complete data. Some developing countries, especially in the Caribbean, show extremely high rates in some age groups but they have not been used for the present purpose because of the small size of these populations and because of the inadequacy of their statistics.

TABLE 29. ILLUSTRATIVE EXTRAPOLATIONS OF THE HEADSHIP RATES FOR MALES AGED 45-54 AND FEMALES AGED 35-44 FOR JAPAN, 1960, BY EXPONENTIAL FUNCTION

(1) Sex-age group	(2) Headship rate for 1960	(3) 1965	(4)	(5)	(6)	(7)	(8)	(9)	(10) Antilog	(11) Antilog	(12) Antilog	(13) Antilog	(14) $\frac{1970}{(2) \times (10)}$	(15) Headship rate for $\frac{1975}{(2) \times (11)}$	(16) $\frac{1980}{(2) \times (12)}$	(17) Headship rate for $\frac{1985}{(2) \times (13)}$
			(3)	Log (4)	(5) x 2.0	(5) x 3.0	(5) x 4.0	(5) x 5.0	(6)	(7)	(8)	(9)	(2) x (10)	(2) x (11)	(2) x (12)	(2) x (13)
Male 45-54	0.9273	0.9251	0.9976	1.9989564	1.9979128	1.9968692	1.9958256	1.9947820	0.9952	0.9928	0.9904	0.9881	0.9228	0.9206	0.9184	0.9163
Female 35-44	0.1053	0.0888	0.8433	1.9259821	1.8519642	1.7779463	1.7039284	1.6299105	0.7112	0.5997	0.5057	0.4265	0.0749	0.0631	0.0533	0.0449

Source: see table 22.
 Note: This table shows the process of computation used to derive the projected future headship rates for males of age group 45-54 and females of age group 35-44 according to the following formula:

$$\text{Headship rate } (i, j, t) = \left(\frac{\text{1960 headship rate}}{\text{1960 headship rate}} \right)^{(t-1960)/5}$$

The values in columns (14), (15), (16) and (17) of the table were used in columns (24), (25), (26) and (27) of table 28 as "Projected headship rates II".

TABLE 30. ILLUSTRATIVE PROJECTIONS OF THE TOTAL NUMBER OF HOUSEHOLDS FOR JAPAN IN 1970, 1975, 1980 AND 1985, EXTRAPOLATING THE RATIO OF QUASI-HOUSEHOLDS TO ORDINARY HOUSEHOLDS BY AN EXPONENTIAL FUNCTION

(1) Year	(2) Ordinary households (in thousands)	(3) Quasi-households	(4) $\frac{(3)}{(2)}$
1960	19 678.3	978.0	0.04970
1965	23 085.4	996.4	0.04316

$$q_t = q_{1960} \left[\frac{q_{1965}}{q_{1960}} \right]^{\frac{t-1960}{5}}$$

Let q_{1960} and q_{1965} indicate the ratio of the number of quasi-households to that of ordinary households in 1960 and 1965 respectively.

Let q_t indicate the ratio in year t .

$$q_t = 0.04970 \times \left[\frac{0.04316}{0.04970} \right]^{\frac{t-1960}{5}}$$

$$\log \frac{0.04316}{0.04970} = \log 0.86841 = \bar{1}.9387248$$

(5) Year t	(6) $\frac{t-1960}{5}$	(7) (6) \times $\bar{1}.9387248$	(8) Antilog (7)	(9) (8) \times 0.04970	(10) Ordinary households (in thousands)
1970	2	$\bar{1}.8774496$	0.75414	0.03748	26 680.7
1975	3	$\bar{1}.8161744$	0.65490	0.03255	30 954.4
1980	4	$\bar{1}.7548992$	0.56872	0.02827	34 783.3
1985	5	$\bar{1}.6936240$	0.49388	0.02455	38 029.1

(5) Year t	(11) Quasi-households (in thousands)	(12) Total households (10) + (11)	(13) Population projected (in thousands)	(14) Average household size (13)/(12)
1970	1 000.0	27 680.7	103 499	3.74
1975	1 007.6	31 962.0	109 948	3.44
1980	983.4	35 766.7	116 347	3.25
1985	933.6	38 962.7	121 346	3.11

SOURCE: Japan, Office of the Prime Minister, Bureau of Statistics, 1960 Population Census of Japan, vol. 3, part 1, table 16, pp. 452-453 and 1965 Population Census of Japan, vol. 3, part 1, table, 9 pp. 384-385.

The maximum headship rates computed for a number of developed countries⁶ are shown in table 31, together with the unweighted average headship rates for the three Scandinavian countries of Denmark, Norway and Sweden. These Scandinavian countries could typically represent those developed countries with a high degree of urbanization and a high *per capita* income, whose sex-age specific headship rates generally were among the highest around 1960. Thus their rates could be regarded as possible target levels to be achieved in the near future by other countries in Europe with a lower *per capita* income and a lesser degree of urbanization.

If these maximum rates are to be considered a kind of asymptotic level not to be crossed over, then the estimated headship rates for Panama for age groups 15-24 and 65

and over for males and for all age groups except 15-24 for females would seem to be too high, especially for the years 1975 and 1980 (table 27, columns 20, 21, 22 and 23). On the other hand, an estimation by modified exponential functions yielded very low headship rates for females aged 35-44 in 1970 and after for Japan (table 28, columns 20, 21, 22 and 23). This is because the 1960-1965 trend for this age group displays a substantial decline in rate, whereas the other age groups for the same sex show uniform increases.

It is generally observed that Latin American countries are characterized by extraordinarily high levels of headship rates for males of age group 15-24 and for females of age groups 25-34, 35-44, 45-54 and 55-64 as compared with those for European and Northern American countries.⁷ Nevertheless, it is necessary to warn the reader here that indefinite extension of those headship rates for future years by exponential or modified exponential functions

⁶ Altogether 43 schedules of sex-age specific headship rates for individual countries have been collected and computed by the Population Division of the United Nations Secretariat and they are shown in table 40a and b of the present manual. Out of 43, 28 refer to developed countries.

⁷ See table 40a and b. This point of discussion will be elaborated in chapter VI below.

TABLE 31. HIGHEST SEX-AGE SPECIFIC HEADSHIP RATES EVER ACHIEVED BY THE DEVELOPED COUNTRIES^a AND UNWEIGHTED AVERAGE HEADSHIP RATES AMONG DENMARK, NORWAY AND SWEDEN AROUND THE YEAR 1960

Age group	Headship rate (percentage)	Countries achieving the highest rates	Census year	Average headship rates among Denmark, Norway and Sweden, 1960 (percentage)
<i>Males</i>				
15-24	13.7	Belgium	1961	11.3
25-34	76.8	Belgium	1961	72.6
35-44	90.6	Denmark	1960	89.1
45-54	93.9	Federal Republic of Germany	1961	91.8
55-64	98.9	Federal Republic of Germany	1961	93.2
65+	88.7	Federal Republic of Germany	1961	85.0
<i>Females</i>				
15-24	8.8	Finland	1960	4.6
25-34	11.8	Finland	1960	7.5
35-44	14.1	Finland	1960	8.8
45-54	23.3	Finland	1960	14.8
55-64	32.8	Finland	1960	26.2
65+	47.3	Sweden	1960	44.1

SOURCE: National population censuses. The 38 sets of sex-age specific headship rates each for a different country are shown in table 40a and b.

^a Here referring to all European countries, North America, temperate South America and Japan.

(or by any mathematical functions) without critical evaluation would in some cases be certain to give implausible results.

REGRESSION APPROACH

The regression approach is commonplace in econometrics, but it is not so frequently applied in demographic projections. This projection method is fundamentally based on the ascertainment of the statistical relationship between the headship rates (Y) and some economic and social variables ($X_1, X_2, X_3 \dots$) which may be *per capita* income, percentage share of the agricultural sector in the total economically active population or other similar variable. The headship rate (Y) is treated as the dependent variable and the economic and social variables ($X_1, X_2, X_3 \dots$) as the independent variables. The regression may be based on time-series or cross-sectional data.

The regression approach in estimating future headship rates specific for sex and age will be illustrated here by two examples, one for Sweden and the other for Japan. For Sweden, the independent variable is *per capita* income, while for Japan it is the percentage share of the primary sector in the total economically active population. Both examples are based on cross-sectional data because of the lack of time-series data. In the Swedish case, on the one hand, the national sample survey statistics on headship cross-classified by sex, age and marital status were used and, on the other, seven income brackets. The Japanese regression is concerned with the sex-age specific headship rate and the percentage of agricultural workers based on the 46 prefectures that are the political subdivisions of Japan. This is an example of what are known as ecological or geographical regressions.

If there exists a significant linear relationship between the headship rate and the independent variable or variables,

and if the future behaviour of the independent variable can be predicted with a reasonable degree of accuracy, then future estimates of headship rates can be made from a linear regression equation.

Let Y_c indicate the level of the headship rate and X the level of income so that we may express the headship rate Y_c as

$$(E:16) \quad Y_c = a + bX$$

The values of the constants a and b can be estimated by the use of the method of least squares. The method of least squares is one by which the computed trend line Y_c can be fitted to the observed data so that the sum of the squares of the deviations is at a minimum.⁹ Then, for example, if the regression can be ascertained significantly between the headship rate and the level of income, and if the future level of income can reasonably be projected for year t , then the headship rate for year t can be estimated by substituting the estimated value of income for X in the equation.

The Swedish example: regression by stratified subpopulation data

The Swedish example of the regression approach uses the 1965 census which provides some of the most elaborate data on the relationship between income and headship rate cross-classified both by sex, age and marital status,

⁹ It is impossible in the present manual to explain the basic statistical methods that are used here. For further information and study, the reader may refer to any standard statistical textbook, such as Taro Yamane, *Statistics, An Introductory Analysis*, second edition (New York, Harper and Row, 1967); Margaret Jarman Hagood and Daniel O. Price, *Statistics for Sociologists*, revised edition (New York, Henry Holt and Company, 1952); or Karl A. Fox, *Intermediate Economic Statistics* (New York, London, Sydney, John Wiley & Sons, 1968).

and by urban-rural residence.⁹ In other words, headship rates specific for sex, age and marital status can be obtained for Sweden for at least seven income brackets, namely: under 5,000 Swedish krona; 5,000-9,999 Skr; 10,000-14,999 Skr; 15,000-19,999 Skr; 20,000-24,999 Skr; 25,000-29,999 Skr; 30,000 Skr and above.

This attempt is based on the hypothesis that the variation of the headship rate, especially specific for sex and age or for sex, age and marital status, is closely related to that of household income, income *per capita* or income per worker. The value of the specific headship rate may generally signify the degree of housing privacy enjoyed in each segment of the population, which may, in turn, be considered a function of the standard of living or the level of income. The higher the headship rate the larger the number of households and families per population by sex, age etc. A number of studies in Europe, the United States of America and Japan have documented general increases in headship rates specific for sex and age in association with the general rise in the degree of urbanization, industrialization and modernization and in the level of living, particularly among those under 35 years of age.¹⁰

⁹ Sweden, National Central Bureau of Statistics, *Population and Housing in 1965, Vol. IX, Sample Survey: Income, Occupation, etc.* (Stockholm, 1969).

¹⁰ Louis Winnick, *American Housing and Its Use*, Census Monograph Series (New York, John Wiley & Sons, Inc., 1957), chap. VIII; United States Bureau of the Census, "Illustrative projections of the number of households and families: 1960 to 1980", *Current Population Reports — Population Characteristics*, Series P-20, No. 90 (Washington, D.C., Government Printing Office, 29 December 1958); J. B. Cullingworth, *Housing Needs and Planning Policy* (London, Routledge and Kegan Paul, 1960), chaps. II-IV; L. Needleman, "A long-term view of housing", *The National Institute Economic Review* (London), vol. 18, November 1961, pp. 19-37; Netherlands Central Directorate of Housing and Building, "Monograph on the Housing Situation in the Netherlands" (The Hague, 1964), chap. IV, pp. 41-45; Denmark, Ministry of Housing, "Danish housing requirements, 1960-1980" (Copenhagen, December 1965); Finland, Housing Committee, "Housing situation in Finland" (Helsinki, 1965); Norway, Ministry of Municipal and Labour Affairs, "Housing situation and housing prospects in Norway" (1965); Sweden, The National Housing Board, "Comparison between the housing census in 1945 and that in 1960: some information about the economic development between those years and the measures of housing policy" (Stockholm, 1966); John C. Beresford and Alice M. Rivlin, "Privacy, poverty and old age", *Demography* (Chicago), vol. 3, No. 1, 1966, pp. 247-258; Japan, Ministry of Health and Welfare, Institute of Population Problems, *Future Projections of Number of Households for Japan and 46 Prefectures: October 1965 to 1990 as Projected in August 1966*, Institute of Population Problems Research Series, No. 170 (Tokyo, August 1966); D. E. C. Eversley and Valerie Jackson, "Problems encountered in forecasting housing demand in an area of high economic activity: headship rates in relation to age structure, fertility, education and socio-economic groups", *Proceedings of the World Population Conference, 1965, Vol. IV: Selected Papers and Summaries: Migration, Urbanization, Economic Development* (United Nations publication, Sales No. 66.XIII.8), pp. 418-422; Robert Parke, Jr. and Paul C. Glick, "Prospective changes in marriage and the family" in Marvin B. Sussman, ed., *Sourcebook in Marriage and the Family*, third edition (Boston, Mass., Houghton Mifflin, 1968), pp. 106-115; Hermann Schubnell, "Statement by the organizer of session 6.5: household and family: changes in structure and size", International Union for the Scientific Study of Population, General Conference, London, 3-11 September 1969; S. Kono, "Changes in households and family structure in Japan", in International Union for the Scientific Study of Population, *International Population Conference, London, 1969, vol. III*, pp. 2,223-2,233. The above references are not intended to be an exhaustive list concerning the world-wide phenomena of general increases in sex-ages specific headship rates.

Table 32 shows the headship rates specific for sex, age and marital status for Sweden in 1965, further cross-classified by seven income brackets as mentioned before. Figure III also gives more graphic expression to a relationship between the headship rate and the level of income in each sex-age marital status group. Both the table and the figure evidently indicate that headship rates are positively and strongly associated with levels of income in such a way that the more income a subgroup earns, the higher is the headship rate specific for sex, age and marital status. Figure III also shows the fit of the regression line for the scatter diagrams.

The general feature or relationship described above can be used to estimate the future levels of headship rates for Sweden by means of regression analyses. As already mentioned, there are 26 subgroups for which correlation and regression coefficients have been computed. Technically, correlation and regression coefficients have been computed between the value of the mid-point of each of seven income brackets and the corresponding headship rate specific for sex, age and marital status. These estimating linear equations for each of the 26 sex-age-marital status groups are shown below, together with their zero-order correlation coefficients. It will be noted that the correlation coefficients are mostly higher than 0.70 and in nine cases higher than 0.90. The figures with asterisks are statistically significant at the 95 per cent confidence level.

(E:17-42)

		Coefficient correlation
Single males:		
20-24:	$Y_c = 3.8 + 0.0005299 X$	0.90*
25-34:	$Y_c = 8.7 + 0.0013008 X$	0.99*
35-44:	$Y_c = 23.6 + 0.0012976 X$	0.99*
45-54:	$Y_c = 46.0 + 0.0008749 X$	0.92*
55-64:	$Y_c = 59.9 + 0.0008103 X$	0.84*
65+:	$Y_c = 62.6 + 0.0005220 X$	0.59
Single females:		
20-24:	$Y_c = 11.7 + 0.0008656 X$	0.50
25-34:	$Y_c = 12.4 + 0.0020567 X$	0.95*
35-44:	$Y_c = 23.3 + 0.0019323 X$	0.91*
45-54:	$Y_c = 35.2 + 0.0016989 X$	0.91*
55-64:	$Y_c = 51.0 + 0.0012080 X$	0.84*
65+:	$Y_c = 62.2 + 0.0007446 X$	0.75
Married males:		
15-24:	$Y_c = 81.8 + 0.0005576 X$	0.84*
25-34:	$Y_c = 87.6 + 0.0004008 X$	0.87*
35-44:	$Y_c = 92.8 + 0.0002410 X$	0.79*
45-54:	$Y_c = 96.3 + 0.0001190 X$	0.82*
55-64:	$Y_c = 98.6 + 0.0000384 X$	0.84*
65+:	$Y_c = 95.7 + 0.0001415 X$	0.86*
Widowed and divorced males:		
Under 45:	$Y_c = 25.4 + 0.0014242 X$	0.98*
45-54:	$Y_c = 54.1 + 0.0007671 X$	0.87*
55-64:	$Y_c = 73.3 + 0.0005210 X$	0.77*
65+:	$Y_c = 73.8 + 0.0006096 X$	0.84*
Widowed and divorced females:		
Under 45:	$Y_c = 56.2 + 0.0013110 X$	0.93*
45-54:	$Y_c = 75.1 + 0.0008095 X$	0.79*
55-64:	$Y_c = 82.9 + 0.0005822 X$	0.85*
65+:	$Y_c = 77.6 + 0.0006190 X$	0.78*

The computations of the constant *a* and regression coefficient *b* to estimate each rate specific for sex, age and

TABLE 32a. HEADSHIP RATES BY SPECIFIED INCOME CLASS, SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1965: SINGLE PERSONS
(Percentage)

Age group	No income class	Income class							Total income earners
		4,999 Skr or less	5,000-9,999 Skr	10,000-14,999 Skr	15,000-19,999 Skr	20,000-24,999 Skr	25,000-29,999 Skr	30,000+ Skr	
<i>Males</i>									
Total . . .	18.501	29.216	32.772	30.481	34.207	40.888	50.390	64.150	34.887
20-24 . . .	4.587	4.043	5.781	10.682	16.809	15.407	22.113	18.335	10.774
25-34 . . .	16.344	14.810	18.597	23.176	27.880	37.876	45.975	55.442	29.978
35-44 . . .	23.580	29.500	32.245	40.861	43.063	50.000	60.637	70.964	44.168
45-54 . . .	34.093	42.557	53.957	62.841	63.459	66.896	63.922	77.541	60.095
55-64 . . .	38.480	59.017	70.892	73.171	72.916	66.674	88.880	88.888	70.316
65+ . . .	42.345	57.112	70.508	72.260	73.132	84.205	61.927	83.952	66.690
<i>Females</i>									
Total . . .	24.388	32.070	42.650	40.396	58.981	73.732	80.416	78.994	46.029
20-24 . . .	6.893	5.958	12.735	21.174	28.105	52.782	55.350	14.218	17.904
25-34 . . .	13.527	12.006	24.178	39.548	53.642	66.508	76.685	71.349	42.772
35-44 . . .	20.222	12.693	39.201	60.080	63.177	74.429	73.919	81.418	56.682
45-54 . . .	25.986	31.700	40.821	65.112	73.490	78.819	87.469	81.657	60.899
55-64 . . .	39.489	40.321	60.718	76.104	81.059	82.303	83.125	84.212	65.496
65+ . . .	47.628	52.583	71.122	77.126	86.444	80.603	80.641	82.742	67.486

SOURCE: Sweden, National Central Bureau of Statistics, *Population and Housing Census in 1965, Vol. IX, Sample Survey: Income, Occupation etc.* (Stockholm, 1969), table 1, pp. 46-47.

TABLE 32b. HEADSHIP RATES BY SPECIFIED INCOME CLASS, SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1965: MARRIED MALES
(Percentage)

Age group	No income class	Income class							Total income earners
		4,999 Skr or less	5,000-9,999 Skr	10,000-14,999 Skr	15,000-19,999 Skr	20,000-24,999 Skr	25,000-29,999 Skr	30,000+ Skr	
Total . . .	92.687	93.580	96.497	97.627	98.236	99.213	99.180	99.428	98.624
15-24 . . .	82.347	75.627	90.299	91.760	94.005	95.906	96.621	97.984	94.103
25-34 . . .	90.704	84.500	91.222	94.997	97.170	98.670	98.001	98.850	97.849
35-44 . . .	91.816	89.489	97.145	97.223	97.789	99.166	99.337	99.488	98.931
45-54 . . .	97.018	95.049	97.923	98.754	98.731	99.587	99.588	99.628	99.336
55-64 . . .	98.916	98.980	98.463	98.935	99.271	99.815	99.867	99.712	99.442
65+ . . .	91.048	95.224	96.249	97.873	99.341	99.858	100.000	99.208	97.755

SOURCE: Sweden, National Central Bureau of Statistics, *Population and Housing Census in 1965, vol. IX, table 2, pp. 54-55.*

TABLE 32c. HEADSHIP RATES BY SPECIFIED INCOME CLASSES, SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1965: WIDOWED AND DIVORCED
(Percentage)

Age group	No income class	Income class							Total income earners
		4,999 Skr or less	5,000-9,999 Skr	10,000-14,999 Skr	15,000-19,999 Skr	20,000-24,999 Skr	25,000-29,999 Skr	30,000+ Skr	
<i>Males</i>									
Total . . .	46.709	64.443	74.882	70.334	72.631	73.888	73.784	81.264	72.424
15-44 . . .	29.909	24.393	36.565	46.312	51.355	59.799	67.137	70.354	52.271
45-54 . . .	44.431	53.044	54.810	66.475	75.248	75.633	74.104	75.730	70.609
55-64 . . .	56.761	73.636	80.527	76.390	84.388	88.960	78.551	95.641	82.210
65+ . . .	52.244	68.454	81.802	82.465	90.344	90.375	86.597	93.025	79.593
<i>Females</i>									
Total . . .	64.910	69.743	85.067	88.019	91.617	93.955	97.535	95.864	83.742
15-44 . . .	56.557	49.987	68.060	76.236	85.025	89.865	93.582	94.223	76.081
45-54 . . .	70.484	65.013	85.274	91.278	94.250	96.833	98.285	95.605	88.507
55-64 . . .	74.207	77.344	89.463	94.354	96.027	97.031	100.000	98.816	89.798
65+ . . .	64.418	69.548	85.765	90.906	92.916	91.473	96.629	93.499	81.899

SOURCE: Sweden, National Central Bureau of Statistics, *Population and Housing Census in 1965, vol. IX, table 2, pp. 48-49.*

FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965

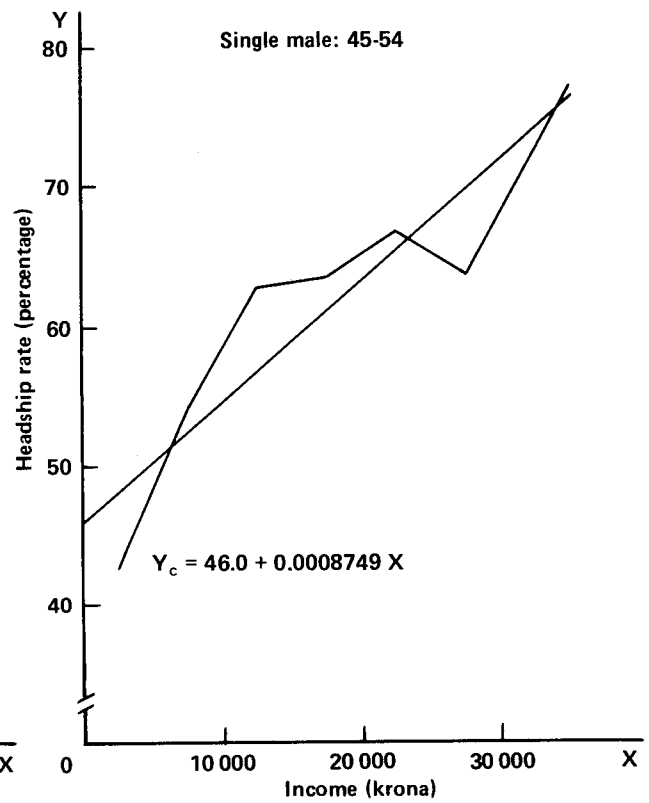
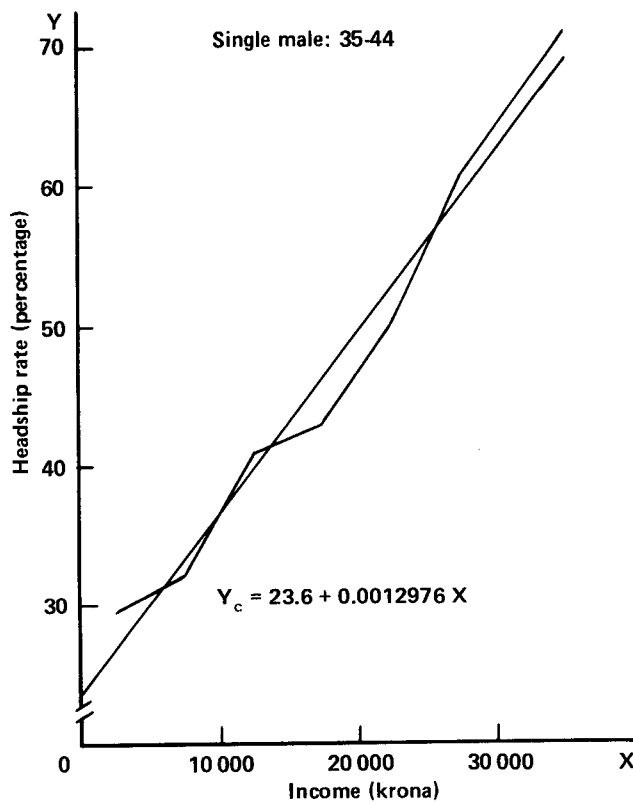
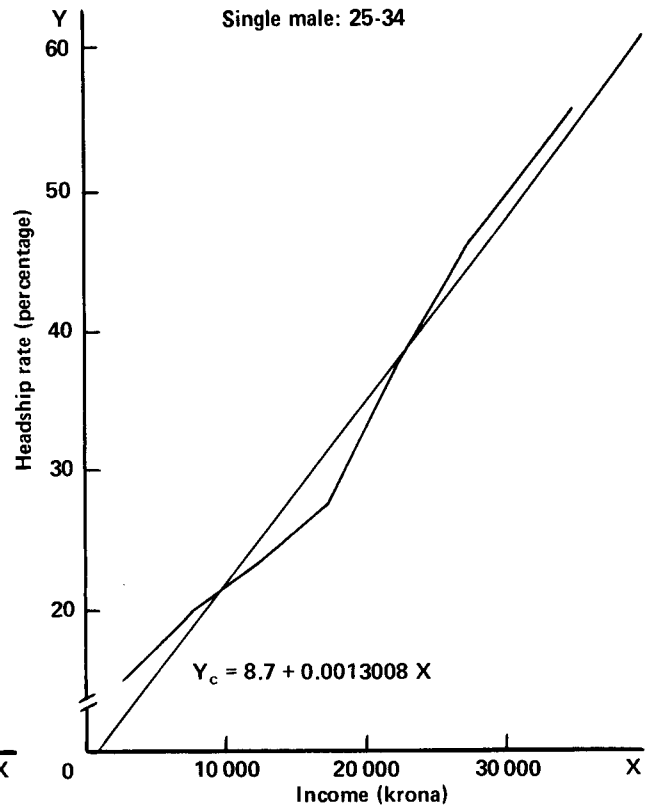
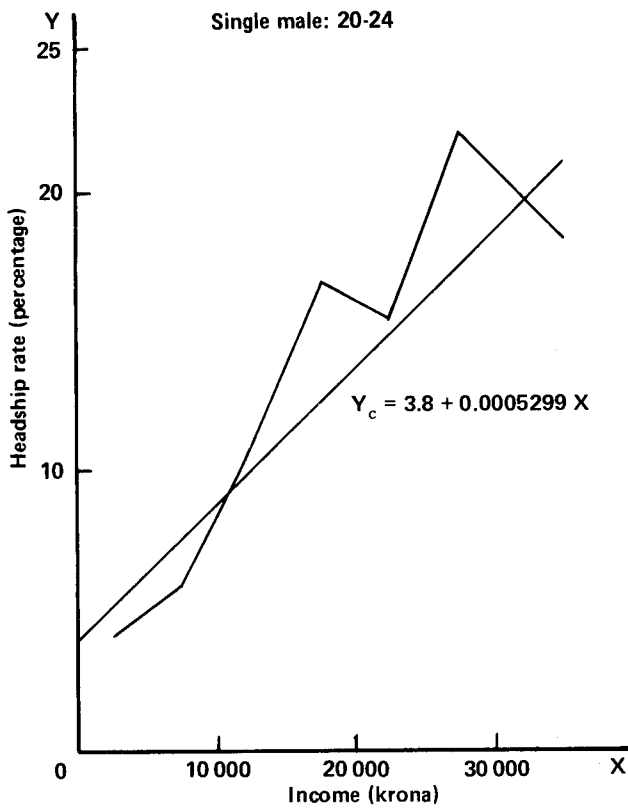


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (continued)

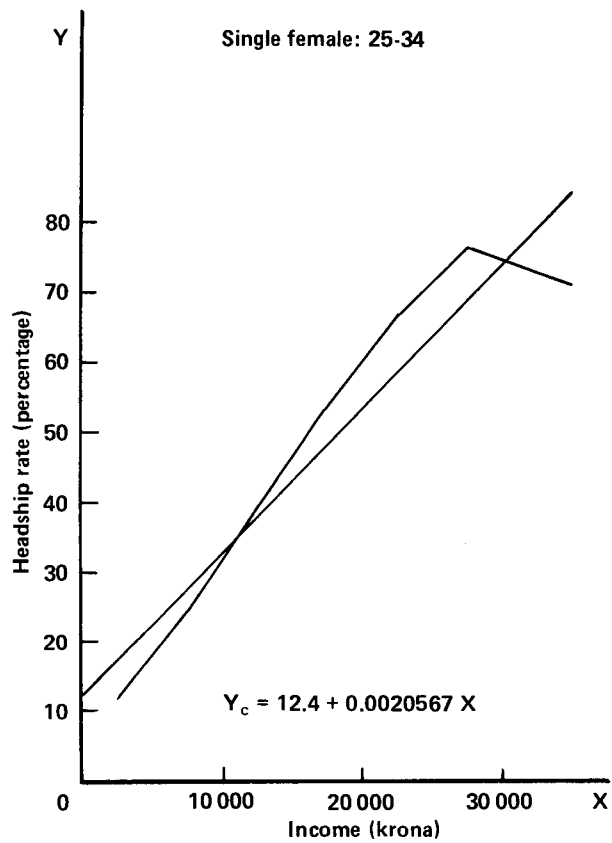
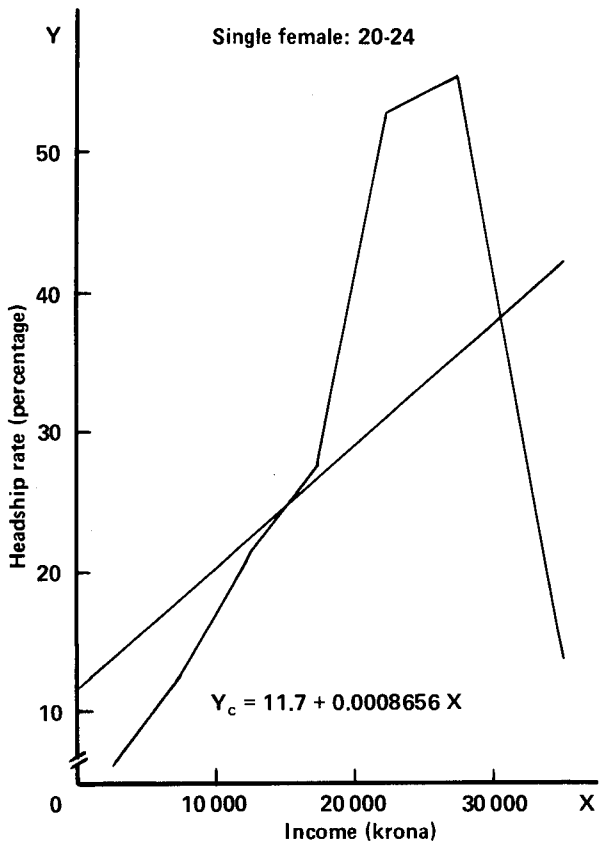
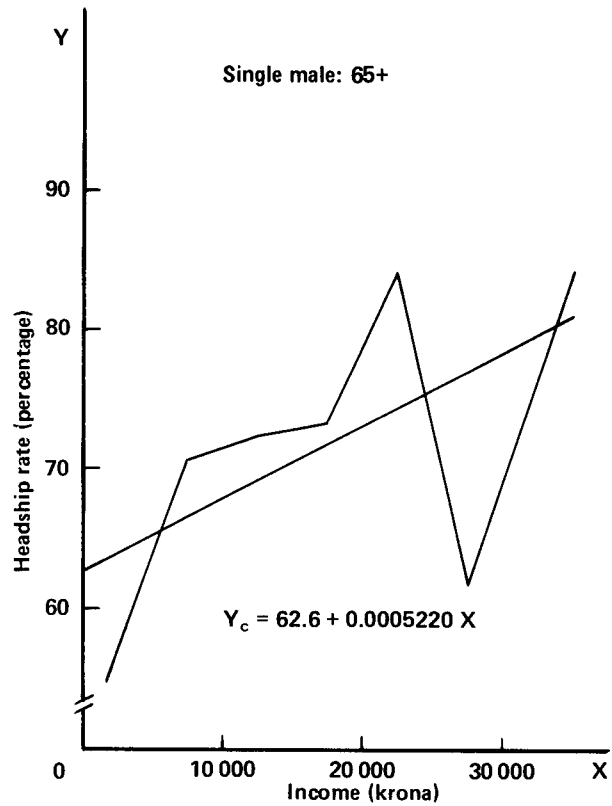
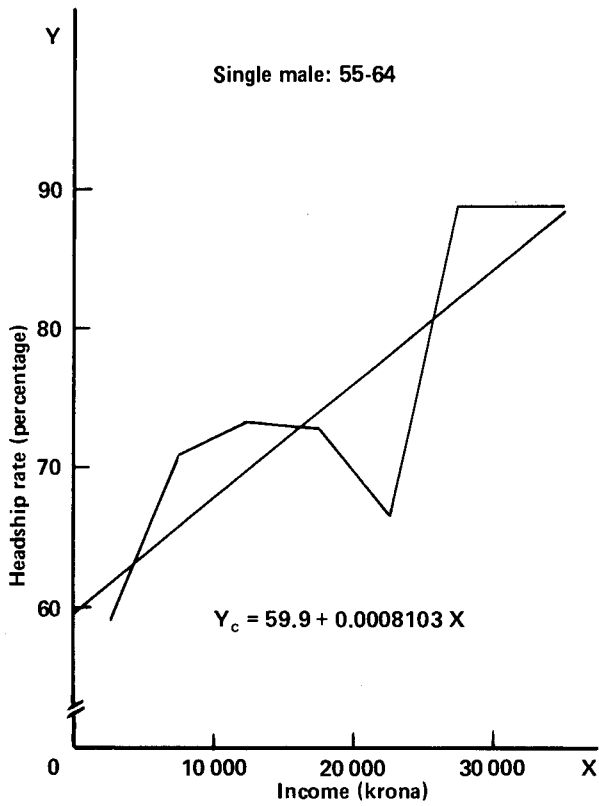


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (continued)

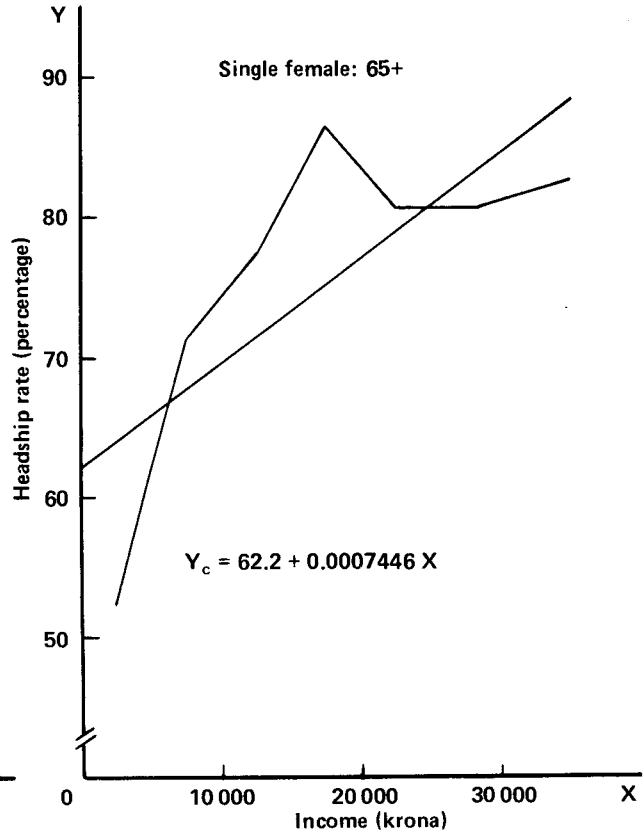
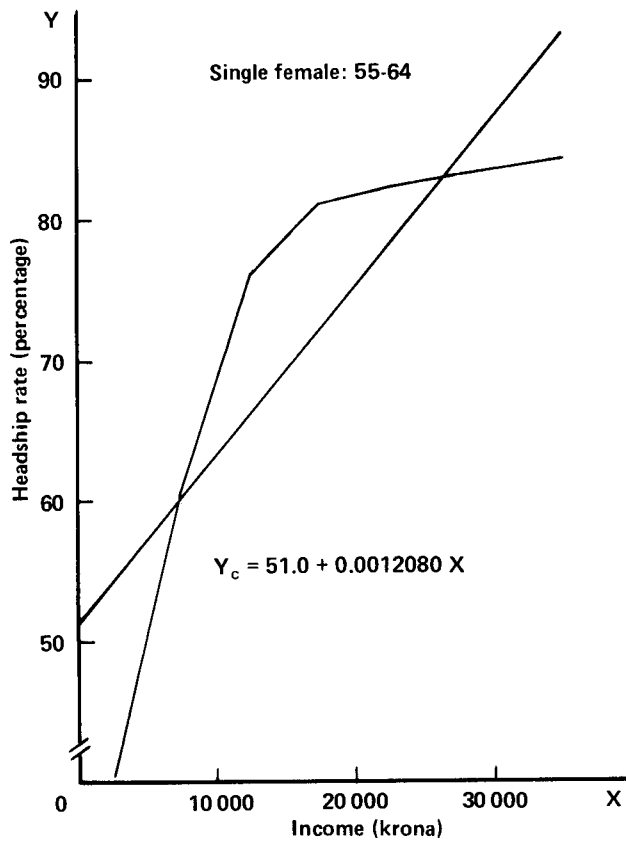
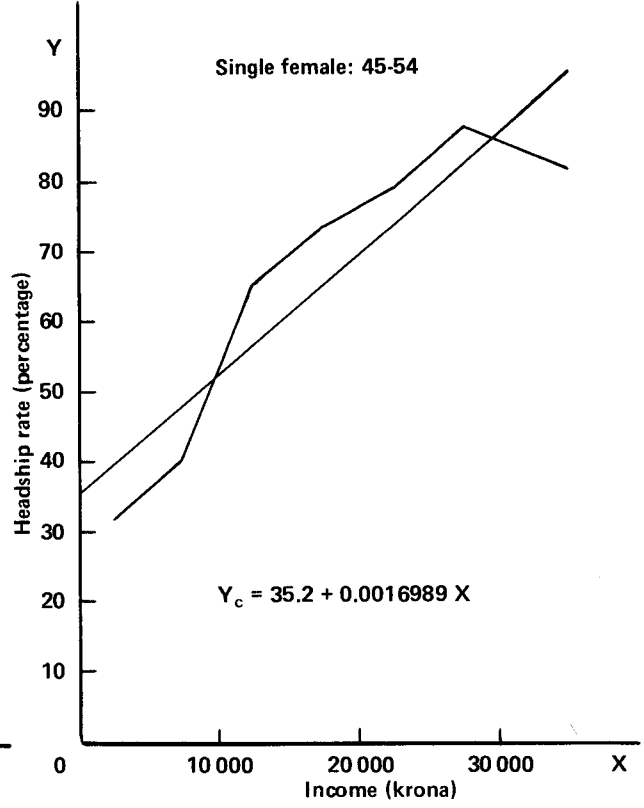
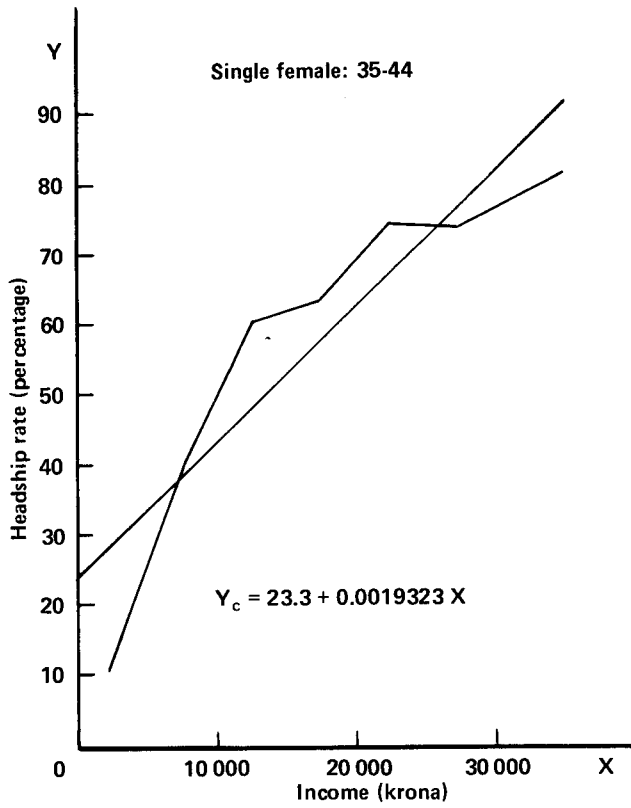


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (continued)

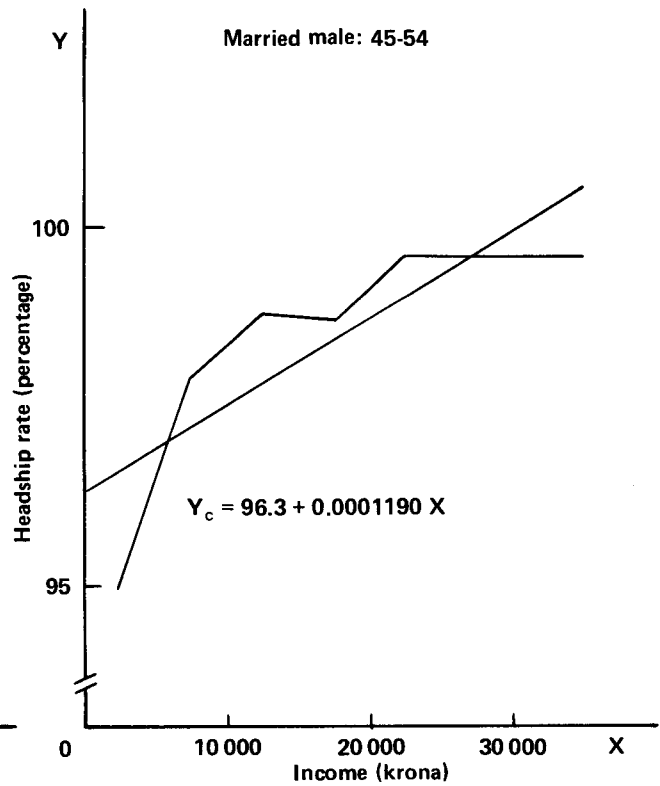
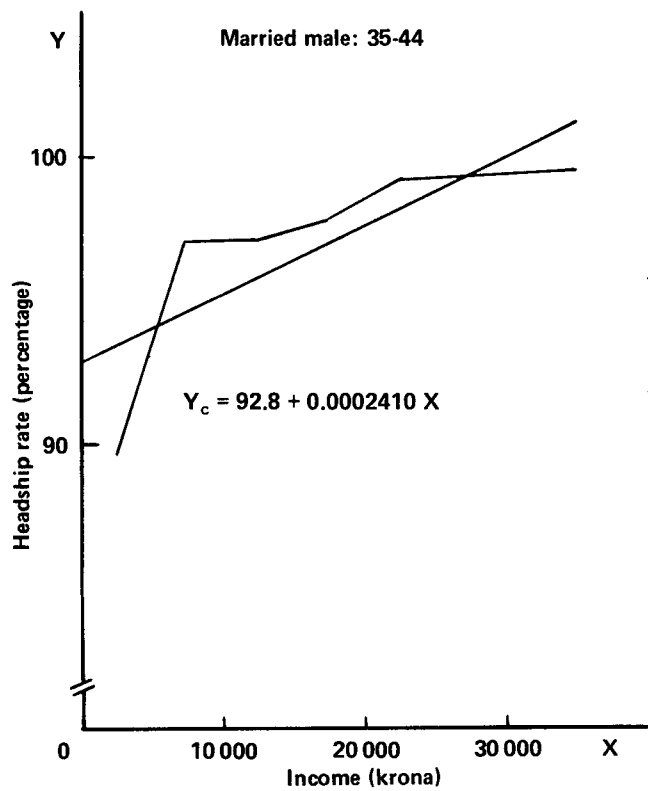
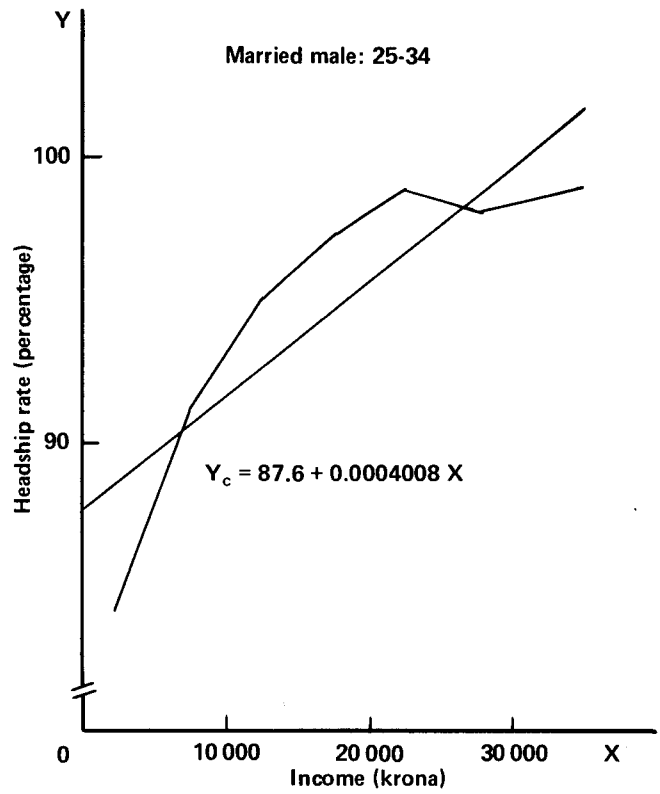
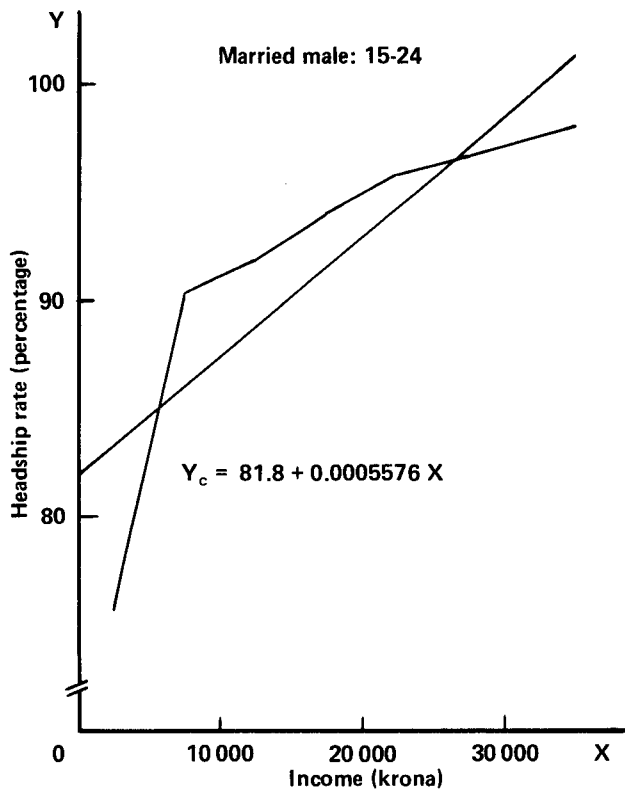


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (continued)

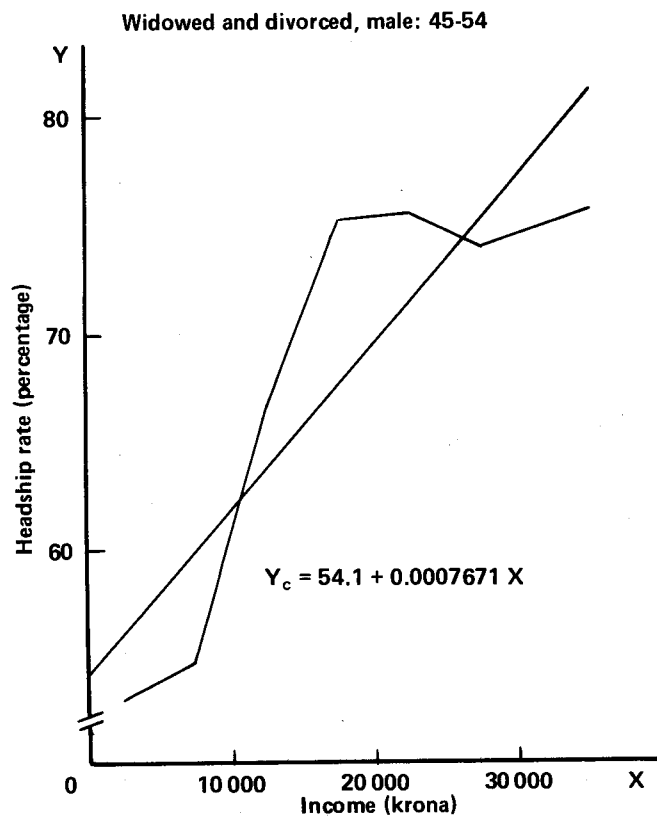
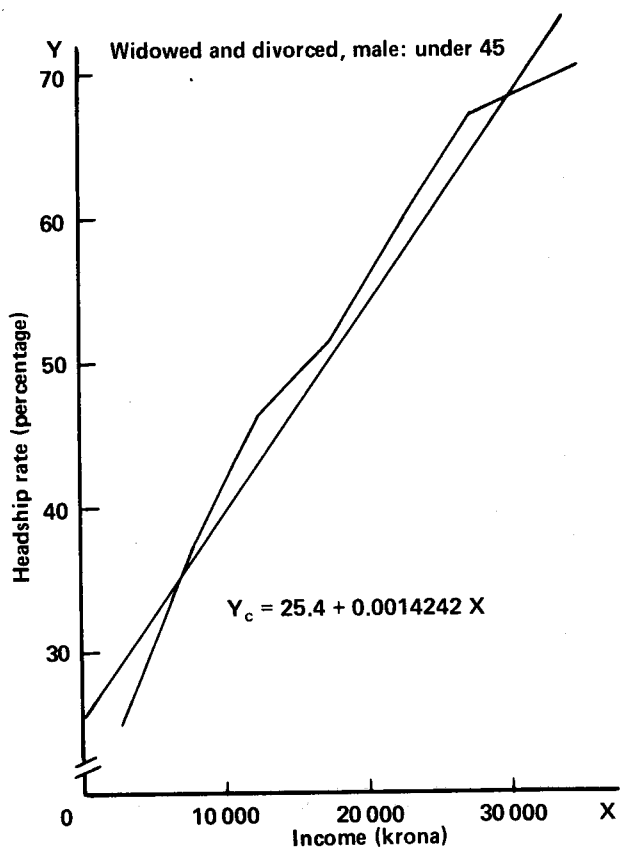
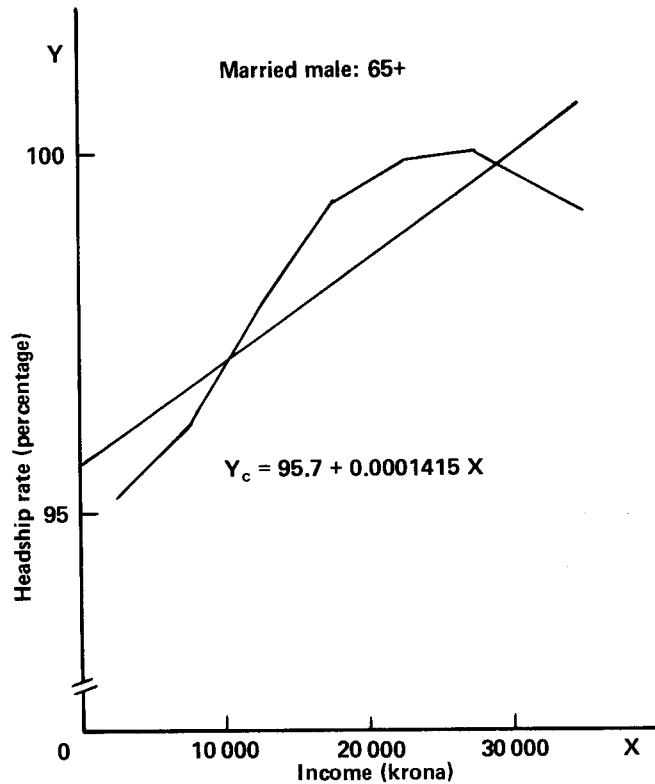
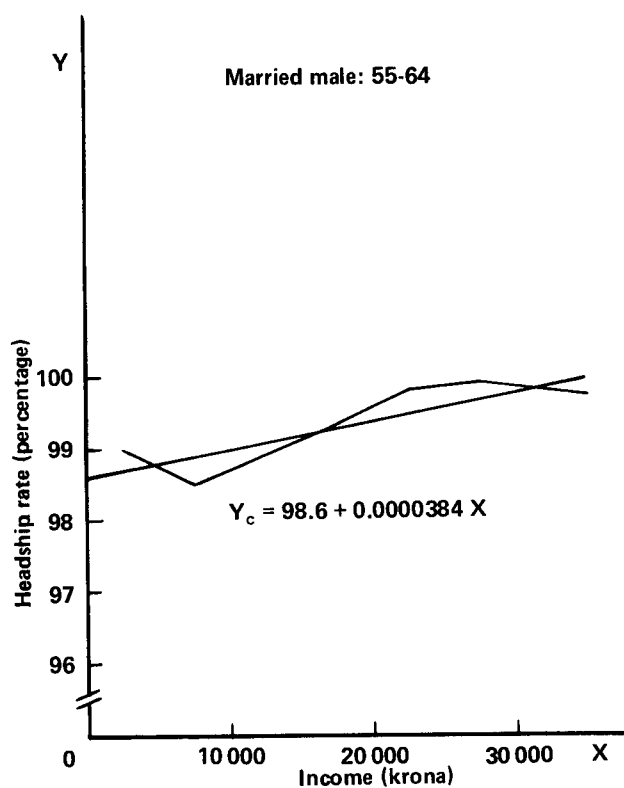


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (continued)

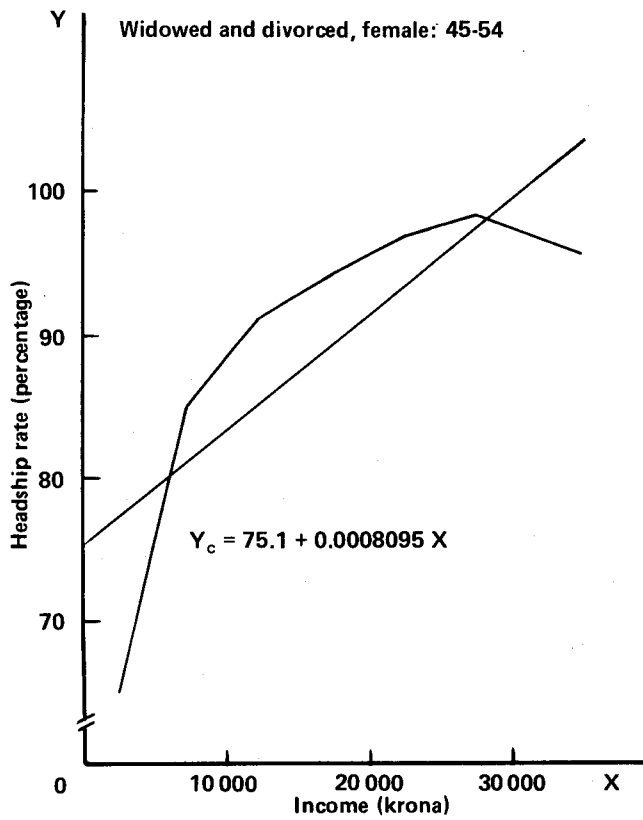
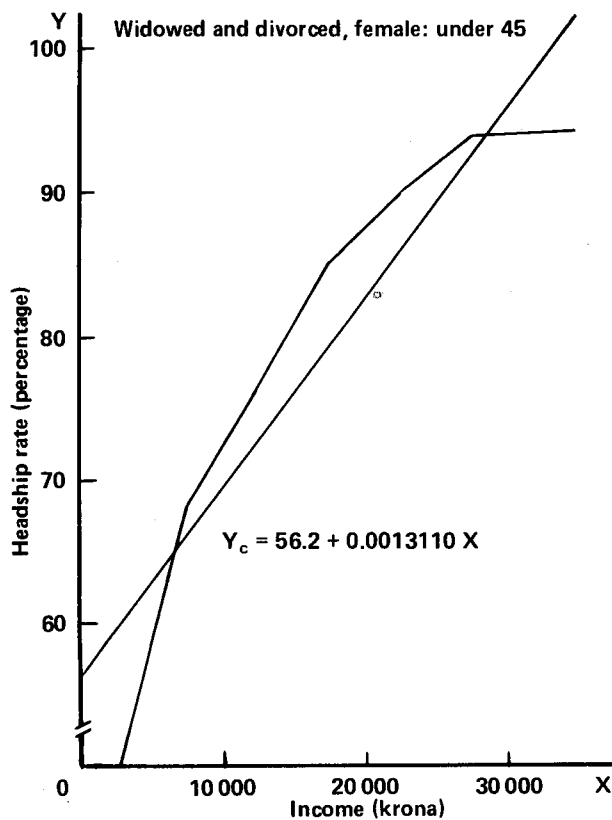
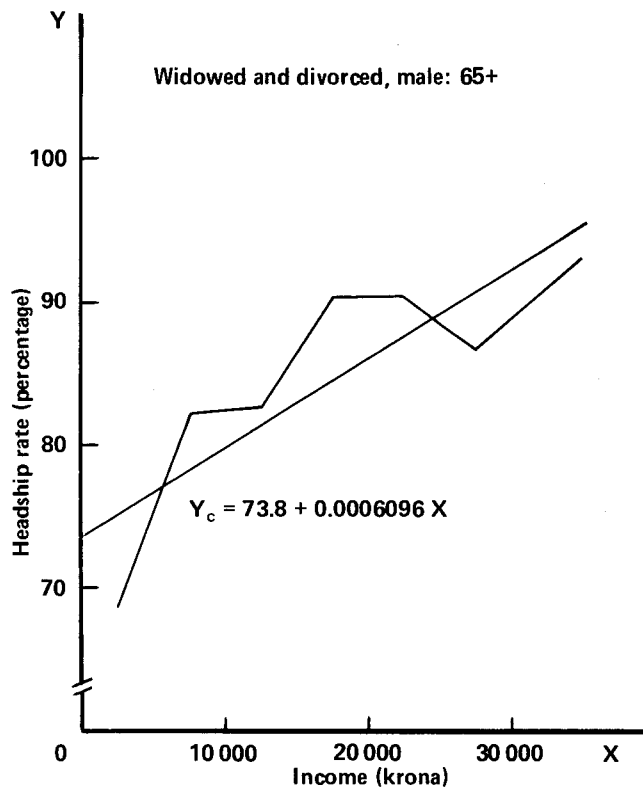
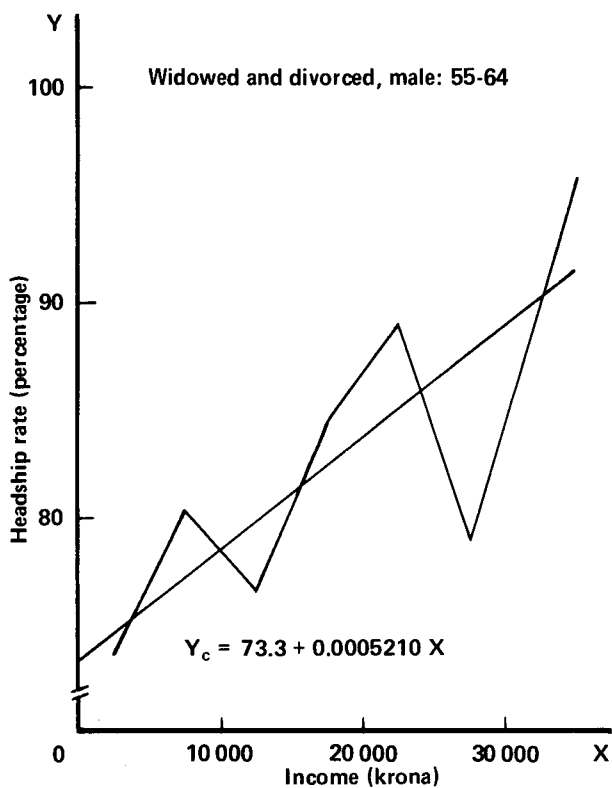
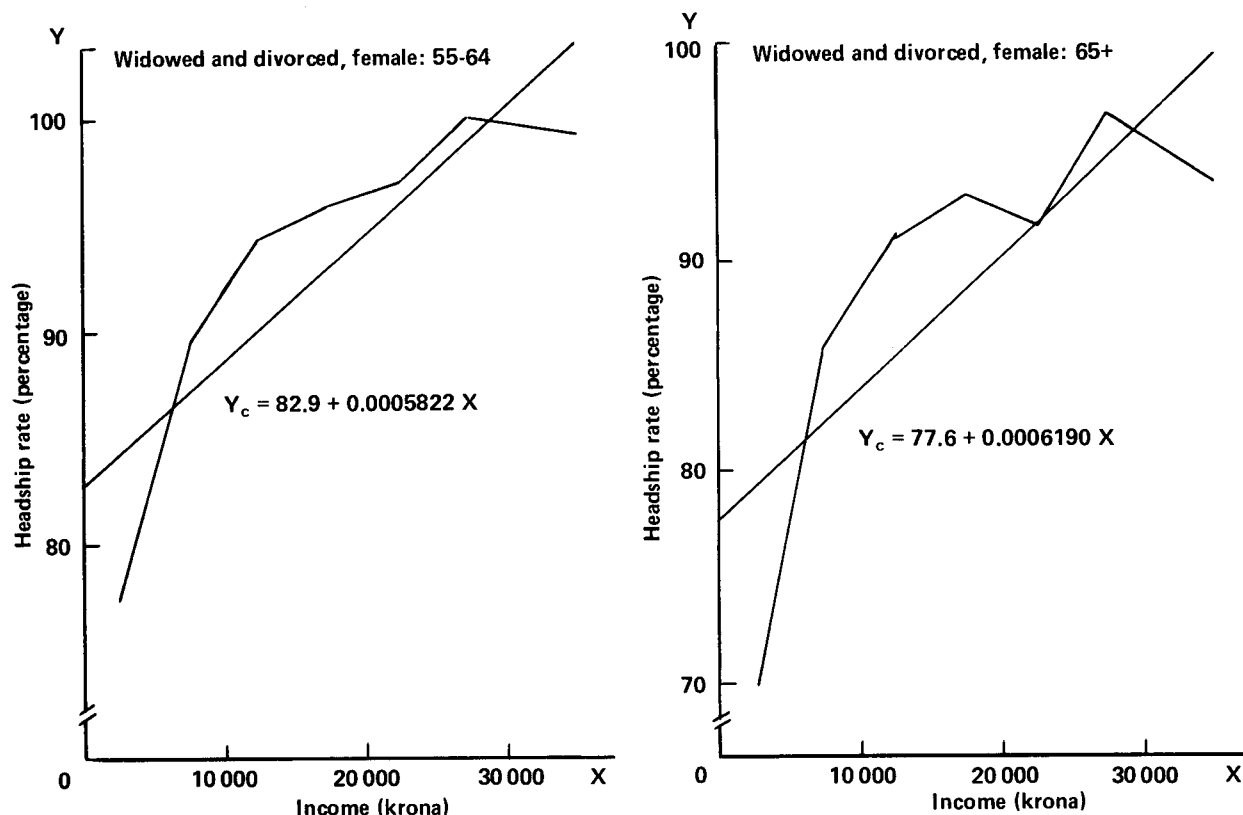


FIGURE III

Relationship between income and headship rate specific for sex, age and marital status, Sweden, 1965 (concluded)



marital status are shown in table 33. The most efficient formulae for actual computations by desk calculator are as follows:¹¹

$$(E:43) \quad r = \frac{N \sum XY - \sum X \sum Y}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}}$$

$$(E:44) \quad b = \frac{N \sum XY - \sum X \sum Y}{N \sum X^2 - (\sum X)^2}$$

$$(E:45) \quad a = \frac{\sum Y - b \sum X}{N}$$

where the notation N is equal to the number of observations or measures. In actual computations of regression coefficient b in table 33, it should be noted that since the same income brackets have been applied to all the groups by sex, age and marital status, the denominator, $N \sum X^2 - (\sum X)^2$ will always be the same for those groups.

Two major steps are still left for the projection of the number of households for Sweden in 1975 by the regression approach. One is to estimate the future income levels of the heads of households in 1975 and the other is to project the population by sex, age and marital status. The procedures and major assumptions involved in the attain-

ment of the final household projections *via* regression analyses will now be briefly described.

The estimates of income levels for 1975 among the household heads are obtained by a very simple method. Herman Kahn and Anthony J. Wiener projected that the *per capita* gross national product (GNP) in 1976 would be \$3,600 for Sweden as compared with \$2,497 for 1965.¹² Using the average annual geometrical growth rate implied by these two figures, the *per capita* GNP in 1975 is estimated as \$3,482, which is 1.39447 times as much as it was in 1965. This factor is applied uniformly to the median income of each sex, age and marital status group in 1965. It is thus assumed that the rates of growth of income for each sex, age and marital status group will be the same as for the total population. The simple computational steps for obtaining the median incomes of each group in 1975 are indicated in table 34. Table 35 shows the derivation of headship rates specific for sex, age and marital status by substituting the rates of median incomes in the equations. It will be observed that the higher the median income, the higher are the headship rates estimated in all cases. Estimated median income for 1975 yields higher headship rates in all cases.

¹¹ For the computation of simple and multiple regression and correlation coefficients, the reader may refer to such standard statistical textbooks as are listed in footnote 8 to the present chapter.

¹² Herman Kahn and Anthony J. Wiener, *The Year 2000: A Framework for Speculation on the Next Thirty-three Years* (New York and London, Macmillan, 1967), p. 149.

TABLE 33. COMPUTATIONS OF REGRESSION COEFFICIENTS (*b*) AND CONSTANTS (*a*) IN THE LINEAR REGRESSION EQUATIONS FOR ESTIMATION OF HEADSHIP RATES SPECIFIC FOR SEX, AGE AND MARITAL STATUS FOR SWEDEN

(1) <i>Age group</i>	(2) $N \sum XY - \sum X \sum Y$	(3) $b = \frac{(2)}{5,462,500,000}$	(4) $125,000 \times (3)$	(5) $\sum Y$	(6) $(5) - (4)$	(7) $a = \frac{(6)}{7}$
<i>Single</i>						
<i>Males:</i>						
20-24 . .	2 894 500	0.0005299	66.24	93.1	26.86	3.8
25-34 . .	7 105 500	0.0013008	162.60	223.8	61.20	8.7
35-44 . .	7 088 250	0.0012976	162.20	327.3	165.10	23.6
45-54 . .	4 779 250	0.0008749	109.36	431.2	321.84	46.0
55-64 . .	4 426 500	0.0008103	101.29	520.5	419.21	59.9
65+ . .	2 851 250	0.0005220	65.25	503.1	437.85	62.6
<i>Females:</i>						
20-24 . .	4 728 500	0.0008656	108.20	190.4	82.20	11.7
25-34 . .	11 234 750	0.0020567	257.09	343.8	86.71	12.4
35-44 . .	10 555 250	0.0019323	241.54	404.9	163.36	23.3
45-54 . .	9 280 500	0.0016989	212.36	459.1	246.74	35.2
55-64 . .	6 598 500	0.0012080	151.00	507.8	356.80	51.0
65+ . .	4 067 500	0.0007446	93.08	531.1	438.02	62.6
<i>Widowed and divorced</i>						
<i>Males:</i>						
Under 45	7 779 500	0.0014242	178.03	356.0	177.97	25.4
45-54 . .	4 190 500	0.0007671	95.89	474.9	379.01	54.1
55-64 . .	2 845 750	0.0005210	65.13	578.1	512.97	73.3
65+ . .	3 329 750	0.0006096	76.20	593.1	516.90	73.8
<i>Females:</i>						
Under 45	7 161 500	0.0013110	163.88	557.0	393.12	56.2
45-54 . .	4 422 000	0.0008095	101.19	626.6	525.41	75.1
55-64 . .	3 180 000	0.0005822	72.78	653.0	580.22	82.9
65+ . .	3 381 500	0.0006190	77.38	620.7	543.32	77.6
<i>Married males</i>						
20-24 . .	3 046 000	0.0005576	69.70	642.2	572.50	81.8
25-34 . .	2 189 500	0.0004008	50.10	663.5	613.40	87.6
35-44 . .	1 316 250	0.0002410	30.13	679.6	649.47	92.8
45-54 . .	650 000	0.0001190	14.88	689.2	674.32	96.3
55-64 . .	210 000	0.0000384	4.80	695.1	690.30	98.6
65+ . .	772 750	0.0001415	17.69	687.7	670.01	95.7

SOURCE: Column (2) computed from table 32; column (3): the figure 5,462,500,000 is the denominator for computing regression coefficient *b*, which is always the same throughout groups by sex, age and marital status; column (4): the figure 125,000 is for $\sum X$ which is always the same throughout groups by sex, age and marital status; column (7): the figure 7 is the number of income brackets for each group by sex, age and marital status and it is the same throughout groups.

Some observations should be made here, concerning the uncritical use of the linear equation in all sex-age-marital status groups. The shape of the curves depicting the relationship between income and headship rate, as seen in figure III, shows that the linear assumption can be held pretty well in most cases. On the other hand, the curves, particularly in the cases of married males and widowed and divorced females, look more like second-degree parabolas, exponential or modified exponential curves with a declining rate of increase in headship rates as income rises. In some of these cases, a curvilinear regression might have been more suitable, but as this manual aims at illustrating rather simple and straightforward methods, only the linear applications are discussed. Interested readers should consult the relevant statistical and econometric textbooks in order to acquaint themselves with the application of curvilinear regression methods.¹³

Caution has also to be observed regarding the unqualified use of the linearity assumption in certain examples, as in the case of single females aged 20-24, where the curve does not necessarily show a monotonically increasing trend along with rising income, but rather exhibits a relatively turbulent and irregular pattern of ups and downs. By the same token, it should be noted that, in some cases of married males aged 25-34, 35-44 and 45-54, headship rates have been shown even higher than 100 per cent, which is indeed unrealistic. In the actual computations of the number of households shown later in table 37, those headship rates exceeding 100 are assumed to be at 99.9 per cent for 1975.

The second major step still to be explained concerns the population projections by sex, age and marital status corresponding to the groupings of headship rates. To simplify the situation, the same percentage distribution by

¹³ See, for example, Mordecai Ezekiel and Karl A. Fox, *Methods of Correlation and Regression Analysis* (New York, John Wiley and

Sons, Inc., 1959) and the works referred to in footnote 8 to the present chapter.

TABLE 34. COMPUTATIONS OF MEDIAN INCOMES SPECIFIC FOR SEX, AGE AND MARITAL STATUS GROUPS FOR SWEDEN, 1975, APPLYING THE SAME INFLATOR 1.39447 TO EACH GROUP

(1) Age group	(2) Median income 1965 (krona)	(3) Estimated median income 1975 (krona) (2) × 1.39447
<i>Single</i>		
<i>Males:</i>		
20-24	15 696	21 888
25-34	19 380	27 025
35-44	17 870	24 919
45-54	15 371	21 434
55-64	11 584	16 154
65+	7 278	10 149
<i>Females</i>		
20-24	12 337	17 204
25-34	16 263	22 678
35-44	17 206	23 993
45-54	16 473	22 971
55-64	12 381	17 265
65+	7 818	10 902
<i>Widowed and divorced</i>		
<i>Males:</i>		
Under 45	19 802	27 613
45-54	19 134	26 682
55-64	15 915	22 193
65+	8 046	11 220
<i>Females:</i>		
Under 45	13 610	18 979
45-54	12 815	17 870
55-64	9 368	13 063
65+	7 208	10 051
<i>Married males</i>		
15-24	19 223	26 806
25-34	24 733	34 489
35-44	27 345	38 132
45-54	26 411	36 829
55-64	21 630	30 162
65+	12 023	16 766

SOURCE: Herman Kahn and Anthony J. Wiener, *The Year 2000: A Framework for Speculation on the Next Thirty-three Years* (New York and London, Macmillan, 1967), p. 149.

Note: The inflator 1.39447 is obtained by dividing the per capita GNP estimated for 1975 (\$3,482) by that for 1965 (\$2,497).

marital status in each sex-age group as observed in the 1965 Swedish population census has been maintained throughout the projection period. The computational process of obtaining the population projected by sex, age and marital status is illustrated in table 36.

Table 37 presents the final step of computing the household projections for Sweden in 1975 by multiplying the projected population (table 36) by the estimated headship rates (table 35).

The Japanese example: ecological regression

Only one age group of the Japanese population in 1960 will be employed to illustrate the use of the regression approach to estimate the headship rate in 1975. The group chosen is males aged 35-44. As before, the sex-age specific headship rate for each of 46 prefectures is called *Y* and the corresponding percentage of the economically active

population engaged in agriculture and related industries is called *X*. On the basis of data for the 46 prefectures, a correlation coefficient of -0.5239 is obtained between the two variables and is statistically significant both at the 99.5 and at the 99.9 confidence level. Table 38 shows distribution among the 46 prefectures of the economically active population engaged in the primary sector of industries (*X*) and headship rate (*Y*) specific for males aged 35-44. The estimating regression equation is:

$$(E:46) \quad Y_c = 86.4 - 0.2093 X$$

Figure IV presents a scatter diagram of *X* and *Y*, together with the regression line describing their relation.

The percentage of the total of gainfully employed male workers in agriculture and related industries for the age group 35-44 was 28.3 in 1955, 24.3 in 1960 and 20.0 in 1965. Using this downward trend, the percentage in 1975 can be estimated as 12.7 and substituting this in the regression equation the following is obtained:¹⁴

$$(E:47) \quad Y = 86.4 - 0.2093 \times 12.7 = 83.7 \text{ per cent}$$

When the number of households is projected, this headship rate of 83.7 per cent is multiplied by the population projected for age 35-44 in 1975. The headship rates for the other age groups can be estimated in the same fashion. The sum of the products for all the sex and age groups yields the projection of the number of ordinary households for Japan in 1975.

NORMATIVE APPROACH

The idea of the normative approach has already been mentioned in the last section of chapter IV, above (see pp. 39-40). The present section will illustrate this method. The example is concerned with the household projections for England and Wales prepared by L. Needleman and O. W. Roskill.¹⁵ Table 39 shows the calculations of the future number of households in 1980 by sex, by age in three broad groups of 15-39, 40-59 and 60 and over, and by marital status, on the basis of the 1951 population

¹⁴ According to the labour force projections for Japan made by the Institute of Population Problems, Ministry of Health and Welfare, the share of the agriculture sector in the total male labour force for age group 35-44 will decrease in 1985 to 9.8 per cent. (See Japan, Institute of Population Problems, Ministry of Health and Welfare, *Estimates of Future Labour Force Population in Japan for October 1 from 1965 to 1985. Estimated in December 1966* (Tokyo, 20 January, 1967), Institute of Population Problems Research Series No. 174, p. 17, table 2.)

On the other hand, it is assumed that the share of the primary sector will shrink in 1970 to 15.7 per cent by the same amount (4.3 per cent) as in the percentage share from 1960 to 1965. The value of 12.7 per cent as the percentage share of the primary sector for total male workers is assumed to be the arithmetic mean between the value obtained for 1975 by the linear interpolation connecting the values of 15.7 per cent in 1970 and 9.8 per cent in 1985 and the value obtained for 1975 by assuming the decrease in the percentage share from 1970 to 1975 as being 4.0 per cent.

¹⁵ L. Needleman, "A long-term view of housing", *National Institute Economic Review* (London), No. 18 (November 1961), table 2, p. 22; O. W. Roskill, *Housing in London* (London, Town and Country Planning Association, 1964), table 2.12, p. 35.

TABLE 35. COMPUTATIONS OF HEADSHIP RATES SPECIFIC FOR SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1975, BY EACH DIFFERENT REGRESSION EQUATION

(1) Age group	(2) Median income (krona)	(3) Regression coefficient (b)	(4) (2) × (3)	(5) Constant (a)	(6) Headship rate (percentage) (4) + (5)
<i>Single</i>					
<i>Males</i>					
20-24	21 888	0.0005299	11.6	3.8	15.4
25-34	27 025	0.0013008	35.2	8.7	43.9
35-44	24 919	0.0012976	32.3	23.6	55.9
45-54	21 434	0.0008749	18.8	46.0	64.8
55-64	16 154	0.0008103	13.1	59.9	73.0
65+	10 149	0.0005220	5.3	62.6	67.9
<i>Females</i>					
20-24	17 204	0.0008656	14.9	11.7	26.6
25-34	22 678	0.0020567	46.6	12.4	59.0
35-44	23 993	0.0019323	46.4	23.3	69.7
45-54	22 971	0.0016989	39.0	35.2	74.2
55-64	17 265	0.0012080	20.9	51.0	71.9
65+	10 902	0.0007446	8.1	62.6	70.7
<i>Widowed and divorced</i>					
<i>Males</i>					
Under 45	27 613	0.0014242	39.3	25.4	64.7
45-54	26 682	0.0007671	20.5	54.1	74.6
55-64	22 193	0.0005210	11.6	73.3	84.9
65+	11 220	0.0006096	6.8	73.8	80.6
<i>Females</i>					
Under 45	18 979	0.0013110	24.9	56.2	81.1
45-54	17 870	0.0008095	14.5	75.1	89.6
55-64	13 063	0.0005822	7.6	82.9	90.5
65+	10 051	0.0006190	6.2	77.6	83.8
<i>Married males</i>					
15-24	26 806	0.0005576	14.9	81.8	96.7
25-34	34 489	0.0004008	13.8	87.6	101.4
35-44	38 132	0.0002410	9.2	92.8	102.0
45-54	36 829	0.0001190	4.4	96.3	100.7
55-64	30 162	0.0000384	1.2	98.6	99.8
65+	16 766	0.0001415	2.4	95.7	98.1

SOURCE: see tables 33 and 34.

TABLE 36a. COMPUTATIONS OF THE POPULATION PROJECTED BY SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1975, ASSUMING AS CONSTANT THE 1965 PERCENTAGE DISTRIBUTION BY MARITAL STATUS AT EACH AGE GROUP: SINGLE AND MARRIED

(1) Age group	(2) Single population, 1965	(3) Married population, 1965 (in thousands)	(4) Total population, 1965	(5) Percentage single $\frac{(2)}{(4)}$	(6) Percentage married $\frac{(3)}{(4)}$	(7) Projected total population, 1975	(8) Projected single population, 1975 (5) × (7)	(9) Projected married population, 1975 (6) × (7) (in thousands)
<i>Males</i>								
20-24	255 319		316 299	0.8072		284	229.2	
25-34	140 466	322 360	471 593	0.2979	0.6836	654	194.8	447.1
35-44	80 270	404 553	504 527	0.1591	0.8018	473	75.3	379.3
45-54	71 938	428 941	530 256	0.1357	0.8089	498	67.6	402.8
55-64	63 982	362 307	462 206	0.1384	0.7839	482	66.7	377.8
65+	58 967	289 108	452 180	0.1304	0.6394	538	70.2	344.0
15-24		61 516	632 530		0.0973	556		54.1
<i>Females</i>								
20-24	171 328		298 425	0.5741		268	153.9	
25-34	70 605	366 114	450 595	0.1567	0.8125	610	95.6	495.6
35-44	42 699	424 792	498 251	0.0857	0.8526	452	38.7	385.4
45-54	49 927	420 887	524 657	0.0952	0.8022	498	47.4	399.5
55-64	71 008	321 117	480 541	0.1478	0.6682	496	73.3	331.4
65+	109 381	198 284	549 220	0.1992	0.3610	677	134.9	244.4
15-24		136 574	600 895		0.2273	527		119.8

TABLE 36b. COMPUTATIONS OF THE POPULATION PROJECTED BY SEX, AGE AND MARITAL STATUS FOR SWEDEN, 1975, ASSUMING AS CONSTANT THE 1965 PERCENTAGE DISTRIBUTION BY MARITAL STATUS AT EACH AGE GROUP: WIDOWED AND DIVORCED

(1) Age group	(2) Widowed and divorced population, 1965	(3) Total population, 1965 (in thousands)	(4) Percentage widowed and divorced $\frac{(2)}{(3)}$	(5) Projected population 1975 (in thousands)	(6) Projected widowed and divorced population (4) × (5)
<i>Males</i>					
Under 44 (15-44)	28 950	1 608 650	0.0180	1 683	30.3
45-54	29 377	530 256	0.0554	498	27.6
55-64	35 917	462 206	0.0777	482	37.5
65+	104 105	452 180	0.2302	538	123.8
<i>Females</i>					
Under 44 (15-44)	46 504	1 549 741	0.0300	1 589	47.7
45-54	53 843	524 657	0.1026	498	51.1
55-64	88 416	480 541	0.1840	496	91.3
65+	241 557	549 222	0.4398	677	297.7
Total for both sexes.	628 669	6 157 453		6 461	707.0

SOURCE:

The 1965 marital status distribution in each sex-age group of population: Sweden, National Central Bureau of Statistics, *Population and Housing Census in 1965, Vol. III: Population in the Whole Country and in the Counties by Sex, Age and Marital Status* (Stockholm, 1967), table 1, p. 3. Population projections: made in 1969 by the Population Division, United Nations Secretariat. Note: a blank in the table indicates that the item is not applicable.

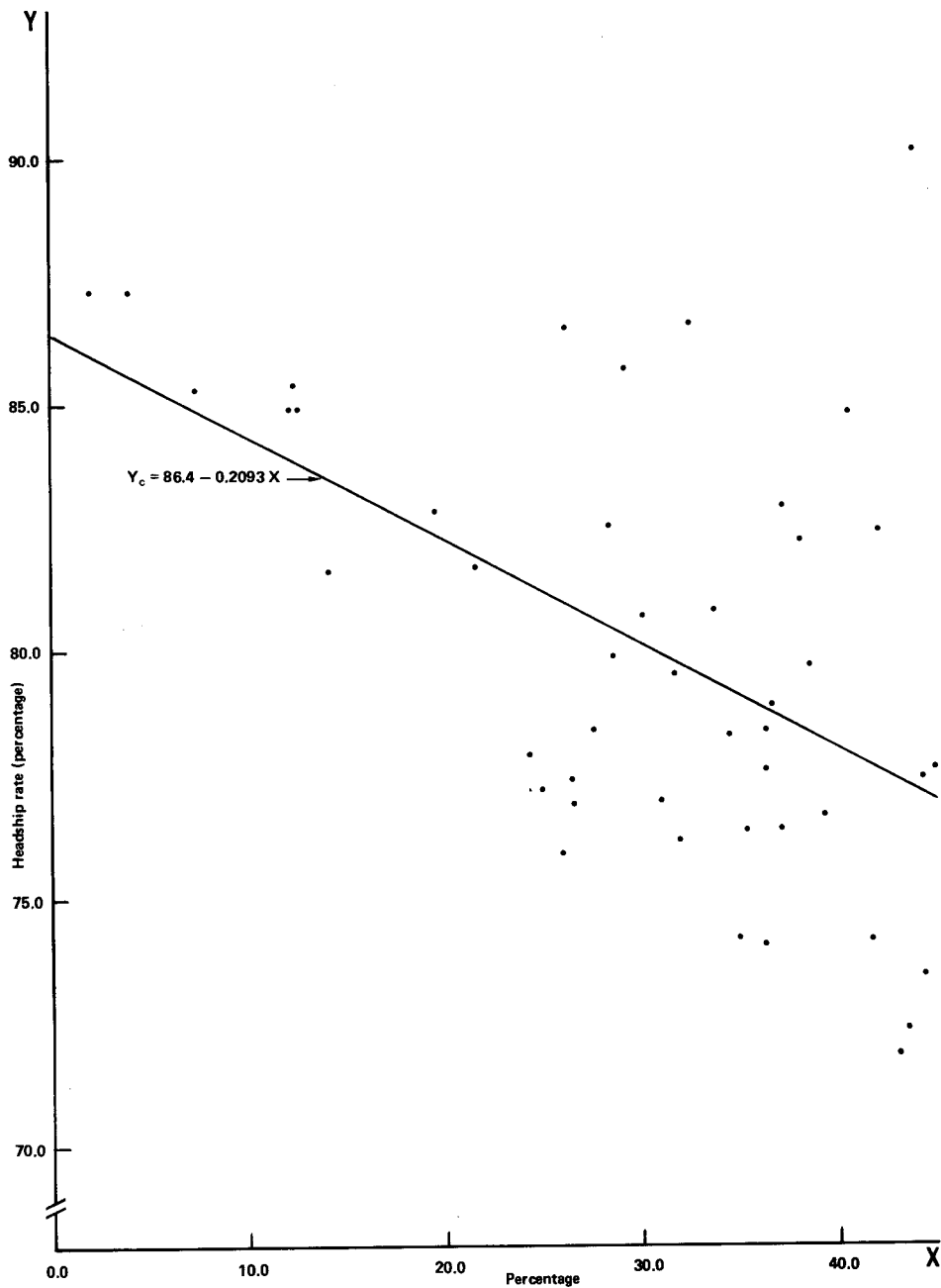
TABLE 37, ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF HOUSEHOLDS FOR SWEDEN, 1975, ESTIMATING HEADSHIP RATES BY THE REGRESSION METHOD (FINAL RESULTS)

(1) Age group	(2) Projected population 1975 ^a (in thousands)	(3) Headship rates 1975 ^b (percentage)	(4) Projected households 1975 (2) × (3) (in thousands)
<i>Single</i>			
<i>Males</i>			
20-24	229.2	15.4	35.3
25-34	194.8	43.9	85.5
35-44	75.3	55.9	42.1
45-54	67.6	64.8	43.8
55-64	66.7	73.0	48.7
65+	70.2	67.9	47.7
<i>Females</i>			
20-24	153.9	26.6	40.9
25-34	95.6	59.0	56.4
35-44	38.7	69.7	27.0
45-54	47.4	74.2	35.2
55-64	73.3	71.9	52.7
65+	134.8	70.7	96.3
<i>Married</i>			
<i>Males</i>			
15-24	54.1	96.7	52.3
25-34	447.1	99.9	446.7
35-44	379.3	99.9	378.9
45-54	402.8	99.9	402.4
55-64	3.778	99.8	377.0
65+	344.0	98.1	337.5
<i>Widowed and divorced</i>			
<i>Males</i>			
15-44	30.3	64.7	19.6
45-54	27.6	74.6	20.6
55-64	37.5	84.9	31.8
65+	123.9	80.6	99.9
<i>Females</i>			
15-44	47.7	81.1	38.7
45-54	51.1	89.6	45.8
55-64	91.3	90.5	82.6
65+	297.8	83.8	249.6
Total for all ages in both sexes	8 317.0		3 194.0
Average household size . .			2.60

SOURCE: Population projections prepared by the Population Division of the United Nations in 1969.
^a Obtained from table 36.
^b Obtained from table 35.

FIGURE IV

Regression of the percentage of agricultural and related workers among the total employed upon the headship rate for males aged 35-44, Japan, 1960



census. A large and heterogeneous group of not married persons between 15 and 40 years was not further subdivided, even by sex.

As seen in table 39, it has been assumed that the headship rates for all the three age groups of married males will reach the level of 98.0 per cent by 1980. Likewise, it is

assumed that the headship rate for the single groups aged 40 and over regardless of sex will be 50 per cent in 1980. All these specific rates by sex, age and marital status were considered the maximum headship rates to be attained (column (3) of table 39) and the results of future nuclearization of households and families in England and Wales.

TABLE 38. PERCENTAGE OF THE ECONOMICALLY ACTIVE POPULATION ENGAGED IN AGRICULTURE AND RELATED INDUSTRIES (X) AND HEADSHIP RATES (Y) FOR MALES AGED 35-44 IN 46 PREFECTURES OF JAPAN, 1960

<i>Prefecture and identity number</i>	<i>Percentage of agricultural workers (X)</i>	<i>Headship rate (Y) (percentage)</i>
1. Hokkaido	26.3	86.5
2. Aomori	44.3	77.4
3. Iwate	43.6	72.4
4. Miyagi	37.2	76.4
5. Akita	44.4	73.5
6. Yamagata	43.0	71.9
7. Fukushima	39.4	76.7
8. Ibaraki	45.0	77.6
9. Tochigi	36.3	78.4
10. Gunma	35.4	76.4
11. Saitama	26.5	77.4
12. Chiba	38.2	82.2
13. Tokyo	2.1	87.3
14. Kanagawa	7.3	85.3
15. Niigata	36.3	74.1
16. Toyama	26.6	76.9
17. Ishikawa	27.7	78.4
18. Fukui	28.6	79.9
19. Yamanashi	34.6	78.3
20. Nagano	36.3	77.6
21. Gifu	25.0	77.2
22. Shizuoka	24.4	77.9
23. Aichi	14.1	81.6
24. Mie	31.3	80.8
25. Shiga	31.8	79.5
26. Kyoto	12.5	85.4
27. Osaka	4.1	87.3
28. Hyogo	12.6	84.9
29. Nara	26.1	75.9
30. Wakayama	28.5	82.5
31. Tottori	35.0	74.2
32. Shimane	41.8	74.2
33. Okayama	32.0	76.2
34. Hiroshima	19.6	82.8
35. Yamaguchi	21.6	81.7
36. Tokushima	36.7	78.9
37. Kagawa	31.0	77.0
38. Ehime	32.6	86.6
39. Kochi	42.2	82.4
40. Fukuoka	12.3	84.9
41. Saga	30.2	80.7
42. Nagasaki	29.4	85.7
43. Kumamoto	38.6	79.7
44. Oita	37.2	82.9
45. Miyazaki	40.7	84.8
46. Kagoshima	44.1	90.1

SOURCE:

Headship data: Heads: Japan, Bureau of Statistics, Office of the Prime Minister, *1960 Population Census of Japan*, unpublished one per cent tabulations of the numbers of heads of households by sex, age and marital status for 46 prefectures made available to the Population Division, United Nations Secretariat in 1968; Population: Japan, Bureau of Statistics, *1960 Population Census of Japan, Vol. 2, One Per Cent Sample Tabulation*, part 1, "Age, marital status, nationality and fertility" (Tokyo, 1962), table 2.

Economically active population data: Japan, Bureau of Statistics, *1960 Population Census of Japan, Vol. 4, Prefectures*, part 1, "Hokkaido" to part 46, "Kagoshima" (Tokyo, 1962-1964), table 9 in each part.

TABLE 39. ILLUSTRATIVE PROJECTIONS OF THE NUMBER OF PRIVATE HOUSEHOLDS FOR ENGLAND AND WALES IN 1980 BY A MAXIMUM SCHEDULE OF HEADSHIP RATES

(1) Age group	(2) Headship rate, 1951 (percentage)	(3) Maximum headship rates, 1980 (percentage)	(4) Projected population 1980 (in thousands)	(5) Projected households 1980 (3) × (4)
<i>Married</i>				
<i>Males</i>				
15-39	78.8	98.0	4 733	4 638.3
40-59	96.3	98.0	5 203	5 098.9
60+	97.3	98.0	3 287	3 221.3
<i>Females</i>		0	13 271	
<i>Single, widowed and divorced</i>				
<i>Both sexes:</i>				
15-24 . . . . .	...	3.0	5 402	162.1
25-39	11.9	30.0	1 378	413.4
<i>Widowed and divorced</i>				
<i>Males:</i>				
40-59	67.8	70.0	153	107.1
60+	63.8	70.0	635	444.5
<i>Females:</i>				
40-59	77.6	80.0	504	403.2
60+	67.9	70.0	2 479	1 735.3
<i>Single</i>				
<i>Males:</i>				
40-59	26.9	50.0	377	188.5
60+	38.8	50.0	269	134.5
<i>Females:</i>				
40-59	29.1	50.0	302	151.0
60+	46.7	50.0	619	309.5
TOTAL				17 007.6
Average number of persons in private households . .				2.85

SOURCE: headship rates: O. W. Roskill, *Housing in Britain* (London, Town and Country Planning Association, 1964) table 2.12, p. 35; Population projections: L. Needleman, "A long-term view of housing", *The National Institute Economic Review* (London), No. 18 (November 1961), table 2.

Chapter VI

USE OF MODEL HEADSHIP RATES

HEADSHIP RATES BY LEVELS OF ECONOMIC DEVELOPMENT

Tables 40a and 40b show age-specific headship rates for the male and female population in countries where pertinent data are available. Both tables contain 43 different sets of census household headship rates of 33 countries. To facilitate analysis, the data are grouped, first by the dichotomy of the more developed and less developed regions (table 41) and secondly by the three *per capita* income groups (table 42).

Levels of development

Table 41 shows unweighted average age-specific headship rates for the more developed and less developed countries. As with economic activity rates, the male headship rates are higher than the female rates in all age groups.¹ It is also noted that country variations in headship rates are larger among females than among males. This reflects the fact that in all societies man in his prime of life assumes the role of chief breadwinner in the household as well as the main responsibilities for family affairs, apart from domestic chores, child-bearing and child-rearing, and therefore the rates for males at certain ages tend to frequent a narrower range than those for females.

As with labour force participation rates, the specific headship rates for males are low in the young ages but increase with increasing age and reach a peak of around 90 per cent or more some time after age 45. In many countries, the peak headship rate for males actually falls in the age group 55–64 years; for example, in the United States of America (1950) it was between 55 and 59 years of age.² In Sweden (1965), it fell in the age group 60–64 years (92.8 per cent); in Japan (1965) in the age group 50–54 years (93.8 per cent); and in Hungary (1960) in the age group 50–54 years (89.3 per cent). Indeed, of 31 countries included in the present analysis, nearly all showed peak headship rates for males either in the age group 45–54 or in that of 55–64 years. These are the ages when men generally reach the apex of social power and prestige, bolstered by the highest earnings of their lifetime.³ As

decreasing employment opportunities and declining health with advancing age increasingly limit the possibilities for the maintenance of separate households by elderly men, it has been noted that whereas more than 9 out of 10 men in their sixties in the United States were listed as household heads, after age 75 the proportion was only about 7 out of 10.²

Differences in age-specific headship rates between the more developed and the less developed countries are less significant for males than for females. In all except the youngest age group, 15–24, male headship rates are uniformly higher in the more developed than in the less developed countries. For the 15–24 age group, the higher average headship rate found in the less developed countries is largely influenced by the high levels reported in India (West Bengal, 1951) and to a lesser extent in Brazil. India, of course, is noted for very early marriages of boys in their teens.⁴ Indeed, for the 38 censuses studied, a very high (+0.80) correlation was found between the headship rate for the young age group and the percentage of the population who were married. Also at this age group, the variation in headship is largest among six age groups.⁵ For the other five age groups, coefficients of correlation were much less significant.

The patterns for females show much wider differences between the more developed and less developed countries than do those for males. There is a similar tendency among groups of both countries for headship rates to be very low in the youngest age group, and then to increase with advancing age. But, beyond this point there are few analogous features between them. Except for the youngest age group the less developed countries show higher rates than the more developed countries in all age groups, precisely the opposite of the pattern found among males. The difference between the two groups is slight at the youngest ages, but it widens at the middle ages, and at ages 35–44 the rate for the less developed is almost twice as high as that for the more developed countries. At ages 55–64, the rate for the less developed countries

¹ This was pointed out by Louis Winnick in *American Housing and its Use: The Demand for Shelter Space* (New York, John Wiley, 1956), p. 94.

² *Ibid.*, p. 94.

³ W. S. Woytinsky, *Earnings and Social Security in the United States* (Washington, D.C. Social Science Research Council Committee on Social Security, 1943), pp. 228–249; Sweden, Statistiska

Centralbyrån, *Folk-och bostadsräkningen den 1 November 1965: IX* (Stockholm, 1969), pp. 46–47, 54–55; United States Bureau of the Census, "Income in 1969 of families and persons in the United States", *Current Population Reports*, Series P-60, No. 75 (Washington, D.C., Government Printing Office, 1970), p. 85.

⁴ For example, see S. N. Agarwala, *Age at Marriage in India* (Allahabad, Kitab Mahal Private Ltd., 1962), chaps. 4, 5, 9; and A. Collver, "The family cycle in India and the United States", *American Sociological Review* (Washington D.C.), vol. 28, No. 1 (February 1963).

⁵ The next most variant group is the last age group, 65 and over.

TABLE 40a. AGE-SPECIFIC HEADSHIP RATES FOR MALES: CURRENT AND PAST CENSUSES
(Percentage of heads among male population of given age group)

Country or territory and year of census	Age group (years)					
	15-24	25-34	35-44	45-54	55-64	65+
Argentina 1960	7.2	60.7	89.4	91.7	73.8	52.0
Brazil 1950	17.7	66.2	87.8	90.4	90.7	80.0
Canada 1961	12.5	73.6	87.0	90.0	88.3	79.3
Costa Rica 1950	11.5	59.1	80.3	86.1	86.2	78.0
Costa Rica 1963	12.0	65.4	82.7	86.7	85.7	76.0
Dominican Republic (Común de San Cristobal) 1950	14.7	59.4	80.6	85.8	89.5	77.2
Greenland 1960	9.0	57.9	84.0	90.8	89.5	80.2
Guadeloupe 1961	11.3	61.2	84.7	94.7	93.8	89.3
Guatemala 1950	18.5	66.4	85.2	91.3	92.1	85.6
Haiti 1950	5.4	52.6	84.5	92.2	93.3	90.8
Martinique 1961	10.5	59.3	77.8	94.0	92.2	87.4
Nicaragua 1950	9.4	46.9	69.4	80.0	82.6	77.5
Panama 1950	13.5	57.0	73.0	74.5	70.0	61.3
Panama 1960	15.0	63.0	81.1	85.8	86.4	80.4
Puerto Rico 1960	12.0	69.3	85.1	90.6	90.7	83.8
Trinidad and Tobago 1960	11.7	64.6	85.1	89.0	87.7	78.3
United States 1930	11.2	61.3	79.2	83.3	83.4	72.8
United States 1940	10.6	62.2	79.5	84.3	84.2	75.4
United States 1950	17.0	71.0	83.4	85.7	85.2	75.9
United States 1960	19.8	80.3	89.3	90.7	89.9	83.0
India (West Bengal) 1951	22.7	51.6	72.4	76.4	76.4	60.4
Japan 1955	4.1	50.4	84.1	93.5	90.6	60.5
Japan 1960	4.3	51.5	81.7	92.7	91.1	63.1
Japan 1965	7.0	58.3	81.8	92.7	92.1	66.8
Singapore 1966	7.1	49.8	80.5	89.0	85.7	63.0
Austria 1961	9.0	64.8	87.6	91.3	89.9	78.3
Belgium 1947	12.5	70.2	88.1	94.0	94.7	86.2
Belgium 1961	13.7	76.8	89.1	92.2	93.2	82.5
Czechoslovakia 1961	13.0	78.0	87.5	91.0	89.7	79.8
Denmark 1960	9.5	71.1	90.6	91.5	93.4	86.4
Finland 1960	15.7	72.1	88.4	93.1	91.9	75.8
France 1947	11.4	65.9	85.2	90.7	92.3	92.9
France 1962	7.1	67.9	86.0	92.3	93.5	85.7
Federal Republic of Germany 1961	12.8	72.6	95.7	93.9	98.9	88.7
Hungary 1960	13.1	76.7	85.8	88.9	86.9	75.8
Italy 1961	5.6	54.3	82.2	91.2	92.1	80.5
Luxembourg 1960	9.2	63.7	80.9	86.3	86.2	71.8
Netherlands 1960	8.5	72.0	90.5	93.0	93.5	81.3
Norway 1960	13.7	66.4	87.6	90.9	92.1	81.3
Sweden 1950	15.6	71.3	88.7	92.3	92.4	79.4
Sweden 1960	10.9	73.8	89.0	92.9	94.3	87.2
Switzerland 1960	7.6	63.2	86.2	90.6	92.0	82.4
Australia 1961	11.4	70.1	86.7	89.6	88.1	80.1

SOURCE: National population censuses.

exceeds that for the more developed by 9.4 per cent. Curiously enough, for the age group 65 and over, the differences narrow to only 2.5 per cent.

Per capita income grouping

Table 42 shows unweighted average sex-age specific household headship rates for three groups of countries classified by income level.⁶ As far as the male rates are

⁶ The 31 countries and territories for which data are available have been classified as follows:

concerned, a typical unimodal curve is observed in each of the three groups of countries. It is noted that inter-group variations are small in the age groups 45-54 and 55-64, with rates in the vicinity of 90 per cent, whereas

(a) High *per capita* income (13 countries): Australia, Belgium, Canada, Denmark, Federal Republic of Germany, Finland, France, Luxembourg, Netherlands, Norway, Sweden, Switzerland and United States of America;

(b) Medium *per capita* income (10 countries): Argentina, Austria, Czechoslovakia, Greenland, Hungary, Italy, Japan, Puerto Rico, Singapore and Trinidad and Tobago;

(c) Low *per capita* income (8 countries): Brazil, Costa Rica, El Salvador, Guatemala, Haiti, India, Nicaragua and Panama.

TABLE 40b. AGE-SPECIFIC HEADSHIP RATES FOR FEMALES: CURRENT AND PAST CENSUSES
(Percentage of heads among female population of given age group)

Country or territory and year of census	Age group (years)					
	15-24	25-34	35-44	45-54	55-64	65+
Argentina 1960	0.6	2.2	4.5	7.2	9.0	8.5
Brazil 1950	0.9	4.2	9.8	17.1	24.7	28.7
Canada 1961	1.6	3.7	6.1	11.7	20.0	33.3
Costa Rica 1950	1.0	5.1	12.9	23.7	33.6	38.7
Costa Rica 1963	1.3	6.3	12.9	20.4	28.3	34.1
Dominican Republic (Común de San Cristobal) 1950	5.7	13.8	21.0	30.5	41.5	53.3
Greenland 1960	1.5	6.2	10.1	19.3	29.5	31.2
Guadeloupe 1961	4.3	16.8	26.4	35.1	48.1	58.5
Guatemala 1950	2.1	7.0	15.6	24.8	31.9	36.4
Haiti 1950	2.6	10.7	20.5	34.0	44.7	54.8
Martinique 1961	4.0	15.4	26.2	34.3	45.2	55.9
Nicaragua 1950	2.2	8.9	18.2	29.8	39.8	45.0
Panama 1950	2.8	9.8	17.5	25.4	29.6	28.0
Panama 1960	3.6	12.3	20.5	29.1	37.2	38.3
Puerto Rico 1960	2.6	9.2	14.7	20.2	29.5	36.3
Trinidad and Tobago 1960	2.3	10.5	19.8	30.4	41.1	46.1
United States 1930	1.0	3.8	8.0	13.7	20.7	27.4
United States 1940	0.9	4.3	9.6	15.1	22.4	32.7
United States 1950	1.5	4.4	8.6	14.5	21.3	31.8
United States 1960	2.7	6.9	10.0	15.3	24.0	36.3
India (West Bengal) 1951	1.9	5.6	10.4	11.9	12.5	9.8
Japan 1955	0.7	3.6	12.7	14.9	13.2	9.4
Japan 1960	1.0	3.3	10.5	17.5	14.4	10.4
Japan 1965	2.3	4.1	8.9	17.6	16.1	12.1
Singapore 1966	1.1	5.3	11.5	22.6	28.3	24.7
Austria 1961	2.4	4.9	14.1	27.4	29.7	46.3
Belgium 1947	0.9	4.3	7.3	13.2	23.8	41.7
Belgium 1961	1.0	3.4	6.4	12.6	22.5	38.7
Czechoslovakia 1961	2.1	4.5	7.7	14.5	24.9	34.4
Denmark 1960	2.6	6.5	9.3	15.7	27.8	46.9
Finland 1960	8.8	11.8	14.1	23.3	32.8	38.3
France 1947	0.3	2.8	6.0	14.5	32.1	59.3
France 1962	2.6	5.5	8.5	16.2	26.5	45.0
Federal Republic of Germany 1961	4.2	6.1	12.1	24.0	31.0	44.1
Hungary 1960	3.1	8.4	11.0	10.3	8.0	11.5
Italy 1961	0.6	2.6	6.9	13.4	21.7	30.6
Luxembourg 1960	1.0	3.0	6.5	12.5	21.6	32.2
Netherlands 1960	2.1	3.6	5.6	11.5	21.0	35.4
Norway 1960	6.1	7.4	7.0	13.1	23.4	38.2
Sweden 1950	8.6	8.5	10.0	16.3	25.8	35.8
Sweden 1960	5.1	8.6	10.2	15.8	27.5	47.3
Switzerland 1960	2.2	5.5	8.8	15.3	26.0	41.4
Australia 1961	1.5	4.1	7.4	13.7	24.3	38.4

SOURCE: National population censuses.

variations are large in the age group 65 and over, and particularly so at ages 25-34. At ages from 25-64, rates were higher in the countries with higher income and lower in the lower income countries. In the age group 15-24, on the other hand, rates for low-income countries are higher than for countries with high or medium income. And, at ages 65 and over, low-income countries show higher rates than medium-income countries. It must be emphasized, however, that the countries with medium and low income for which data are available are probably not very representative of these groups as a whole.⁷ The countries here

included in the medium-income group are, unlike the high-income group, geographically and culturally heterogeneous. If the 31 countries are classified by regions, the averages for all age groups except for the age group 15-24, are arrayed from high to low in the following order: Europe and North America (18 countries), Latin America (10 countries) and Asia (3 countries).

For females the pattern is generally opposite to that for males. Except for the youngest age group, 15-24, and the oldest age group, 65 and over, low-income countries show higher headship rates than high-income countries.

In each income group, peak female headship rates

⁷ They include only 3 countries in Asia and none in Africa.

TABLE 41. UNWEIGHTED AVERAGE SEX-AGE SPECIFIC HOUSEHOLD HEADSHIP RATES IN THE COUNTRIES WITH AVAILABLE HEADSHIP DATA CLASSIFIED ACCORDING TO THE LEVEL OF DEVELOPMENT AROUND 1960
(Percentage of heads among population of given sex-age group)

Sex and level of development	Age (years)					
	15-24	25-34	35-44	45-54	55-64	65+
	<i>Males</i>					
More developed countries ^a	10.8	68.5	87.4	91.3	90.6	79.0
Less developed countries ^b	13.3	59.6	81.3	87.0	87.3	77.5
	<i>Females</i>					
More developed countries ^a	2.7	5.4	8.8	15.5	23.3	34.5
Less developed countries ^b	2.4	8.5	15.9	24.6	32.7	37.0

SOURCE: *Study on Size and Structure of Households and Families*, to be issued as a United Nations publication.

^a Includes data for 20 countries.

^b Includes data for 11 countries. Of the 13 developing countries included in the study, Guadeloupe and Martinique are here excluded, partly because of their rather abnormal age patterns and partly because of their small populations.

TABLE 42. UNWEIGHTED AVERAGE SEX-AGE SPECIFIC HOUSEHOLD HEADSHIP RATES FOR 31 COUNTRIES CLASSIFIED ACCORDING TO THE THREE MAJOR LEVELS OF PER CAPITA INCOME, AROUND 1960^a
(Percentage of heads among population of given sex-age groups)

Age group	High per capita income group ^b (13 countries)	Medium per capita income group ^c (10 countries)	Low per capita income group ^d (8 countries)
	<i>Males</i>		
15-24	11.9	9.2	14.4
25-34	71.3	62.8	58.9
35-44	88.4	84.9	80.5
45-54	91.5	90.6	86.1
55-64	92.1	87.8	87.1
65+	82.3	73.5	78.5
	<i>Females</i>		
15-24	3.2	1.7	2.5
25-34	5.9	5.7	8.6
35-44	8.6	11.1	16.1
45-54	15.5	18.3	24.7
55-64	25.3	23.6	32.6
65+	39.8	28.0	37.6

SOURCE:

Headship rate: population censuses for each country.
Per capita income: *Statistical Yearbook, 1968* (United Nations publication, Sales No. 69.XVII.1), pp. 585-589.

^a The headship data only available for these 31 countries. For six countries headship data available only for years around 1950.

^b \$800 and over.

^c \$400-799.

^d Under \$400.

occur at ages 65 years and over. A particularly sharp increase in rates between the age group 54-64 and the oldest age group studied is found in the high income group. Regionally, the high female headship rates in Latin America above age 25 are noteworthy.

CORRELATION ANALYSIS OF HEADSHIP RATES

The United Nations Secretariat has assembled a collection of headship rate data for more than 40 country schedules including some developing countries in Asia and Latin America. A close examination of these data

and the removal of some abnormal cases shows that sex-age specific data are available for 38 country schedules on headship rates, economic activity rates, percentage of the labour force engaged in non-agricultural industries, and marital status distribution. On the basis of these data, computations were made to obtain correlation and regression coefficients by sex and age between the headship rate, on the one hand, and three socio-economic indices, namely (a) the degree of industrialization in terms of the percentage of the economically active population engaged in non-agricultural industries; (b) the economic activity rate; (c) the marital status composition of the population in terms of the percentage married for males and in terms of the percentage not currently married for females, on the other hand. Table 43 shows those zero-order correlation coefficients. From an examination of this table several observations may be made.

Correlation between the headship rate and the degree of industrialization

In general, the headship rate for males is positively and moderately correlated with the degree of industrialization, which is expressed by the percentage of the economically active population engaged in the non-agricultural industries, at all age groups except the youngest age group, 15-24. The positive correlation can be well understood, since higher headship rates are normally found in urban and high-income areas where non-agricultural activities are naturally more prevalent, bringing a relatively larger number and smaller size of households. Among the age groups, correlation becomes higher in the age span from the very young to the middle age groups, with the age group 35-44 having the highest correlation, then begins to decline towards older age groups. However, because of the relatively small sample of countries, it cannot be asserted that differences are very significant.

The negative correlation coefficient of -0.4035 for age group 15-24 is interesting and would call for some study of the variations in the headship rate at this particular age

TABLE 43. ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN THE HEADSHIP RATE, ON THE ONE HAND, AND THE PERCENTAGE OF LABOUR FORCE ENGAGED IN NON-AGRICULTURAL ACTIVITIES, ECONOMIC ACTIVITY RATE AND PERCENTAGE MARRIED OR NOT MARRIED, ON THE OTHER, FOR 12 SEX-AGE GROUPS ON THE BASIS OF 38 COUNTRY SCHEDULES, AROUND 1960

Age group	Zero-order correlation coefficients between the headship rate and			
	the percentage of labour force engaged in non-agricultural activities ^a	the economic activity rate	the percentage married for males and the percentage not married for females ^b	the percentage of labour force engaged in non-agricultural activities for all age groups ^c
<i>Males</i>				
15-24	-0.4035	0.1696	0.7971	-0.3083
25-34	0.4102	-0.0648	0.4641	0.4065
35-44	0.5687	-0.0417	0.2405	0.5329
45-54	0.5366	-0.1837	0.2924	0.5306
55-64	0.3613	0.0228	0.4111	0.4791
65+	0.2012	-0.2917	-0.0304	0.2173
<i>Females</i>				
15-24	0.1599	0.2159	0.0675	0.0314
25-34	0.1725	-0.0213	0.2406	-0.3367
35-44	-0.0519	-0.0473	0.4347	-0.5258
45-54	0.0624	-0.1024	0.7424	-0.3780
55-64	0.3795	-0.1915	0.4691	-0.1997
65+	0.3934	-0.3443	-0.1685	0.1707

^a The percentage of labour force in non-agricultural activity is expressed in terms of the percentage of the economically active population engaged in the secondary and tertiary industries, excluding agriculture, forestry, fishery and related industries. On this column, correlations were made between the two indices specific for each sex and age.

^b The percentage of the ever married persons in the case of males and the percentage of the not currently married persons in the case of females.

^c The percentage of labour force engaged in non-agricultural activities for all the age groups is expressed by the percentage of the economically active population engaged in the secondary and tertiary industries. In this column, correlations were made between the headship rate for each sex-age group, on one hand, and the percentage of the total economically active population engaged in the secondary and tertiary industries common for all the 12 sex-age groups.

group. A tentative explanation may be given: first, the variation in the headship rate at this age group is more susceptible to the variation in the percentage married, which is presumably more influenced by social and cultural than by economic factors; secondly, it is more related to differences in school enrolment ratios, especially in colleges and universities where young men up to 25 years of age are enrolled. A higher school enrolment ratio is often found in cases where these young men either live together with their parents or live in group quarters with great financial dependence upon their parents, thus largely limiting the chances of their becoming heads of households. Thirdly there are questions of concept definition that are most acute in the younger age group, since many bachelors tend to live in the homes of other families as lodgers and boarders and it is most difficult to distinguish between those terms.⁸ This fact may have considerably blurred a positive correlation between the headship rate and the degree of industrialization.

As for females, their correlation coefficient in general is substantially lower than that for males. It is worth noting that coefficients are higher in both age groups 55-64 and 65 and over, than in the younger groups, and that they are even higher than those for males, although their statistical significance is doubtful.

⁸ In many countries, lodgers are regarded as constituting own households, while boarders are not.

Partial correlation coefficients as shown in table 44 were computed between the headship rate and the percentage of the economically active population engaged in non-agricultural activities, holding constant the effect of marital status structure in each age group. According to this table, partials are generally similar to but somewhat smaller in value than their corresponding zero-order correlation coefficients. Controlling the marital status factor does not improve values of correlation coefficients between the headship rate and the degree of industrialization.

The above correlation coefficients were computed for each of 12 sex-age groups, therefore, each sex-age group had not only its own headship rate but its own particular percentage employed in non-agriculture activities. Different results are obtained when each sex-age specific headship rate is correlated with the total economically active population engaged in non-agricultural activities. The result which is shown in the last column of table 43 indicates that the pattern among females is considerably changed: first, changes occur from positive to negative correlations in the three age groups 25-34, 45-54 and 55-64, and, secondly, while in the former series of correlations lower correlations are found in the central age groups and higher correlations are observed in the older age groups, the pattern is now being reversed in the latter series.

TABLE 44. PARTIAL CORRELATION COEFFICIENTS BETWEEN THE HEADSHIP RATE AND THE PERCENTAGE EMPLOYED IN NON-AGRICULTURAL ACTIVITIES, HOLDING CONSTANT MARITAL STATUS, FOR 12 SEX-AGE GROUPS ON THE BASIS OF 38 COUNTRY SCHEDULES, AROUND 1960

Age group	Partial correlation controlling the marital status structure	Original zero-order correlation coefficients
	<i>Males</i>	
15-24	-0.0249	-0.4035
25-34	0.4062	0.4102
35-44	0.5401	0.5687
45-54	0.4898	0.5366
55-64	0.3248	0.3613
65+	0.2104	0.2012
	<i>Females</i>	
15-24	0.1474	0.1599
24-34	0.1348	0.1725
35-44	0.0481	-0.0519
45-54	0.3025	0.0624
55-64	0.5692	0.3795
65+	0.3659	0.3934

SOURCE: computed by the Population Division of the United Nations Secretariat.

Correlation between the headship rate and the economic activity rate

Correlation with age-specific economic activity rates is generally low and negative both for males and females, indicating that their association is relatively insignificant. Partial correlation coefficients controlling the marital status structure are also generally low. It is difficult to find any meaningful and useful relationship between them for the development of model headship rates.

Correlation between the headship rate and the marital status structure

The marital status structure in each sex-age group of the population is expressed here by the percentage ever married for males and by the percentage currently not married (that is, single, widowed and divorced) for females. It was considered that for males the population ever married would have a stronger tendency to become heads of households, whereas for females the population currently not married would show a greater likelihood of being household heads than otherwise. This marital status index is in general moderately correlated with the headship rate in the middle ages of both males and females, and highly correlated in young males aged 15-24 and in females aged 45-54. These results might partly bear out a long-held demographic notion that household headship is very closely related to the marital status structure of population.⁹

⁹ See, for example, H. V. Muhsam, "Population data and analyses needed in assessing present and future housing requirements" (E/CN.9/CONF.2/L.10), paper submitted to the United Nations Seminar on Evaluation and Utilization of Population Census Data

whether ever married or single in the case of males and whether currently married or not in the case of females. Indeed, as observed in part two, chapter IV above from the data for various countries, headship rates are definitely and universally higher among married than among non-married males, and among single, widowed and divorced than among currently married females. Accordingly, correlation becomes higher where there are larger variations concerning the percentage married among countries and where there are correspondingly larger variations in the headship rate.

Correlation between the headship rate and the per capita income and the degree of urbanization

The ability of the individual or family to afford the type of household arrangement it desires is also important. While this depends mainly on the income level of the family or individual, it is also related to the level of living in the country or region and to the housing market, which governs the relative levels of rentals, prices of houses and mortgages. *Per capita* income may be a good indicator of the average economic ability of a country.

It was not possible to obtain data on *per capita* income or urbanization by sex and age for countries. Accordingly, correlations were calculated between the sex-age specific headship rate and both the over-all national figure of *per capita* income and the degree of urbanization. Table 45 shows their correlation coefficients.

In correlation with the *per capita* income, coefficients are generally not high. But it is interesting to note that correlation is negative for all the female groups, while it is positive in four out of six cases for males. Correlation with the degree of urbanization is again not high except in age group 25-34, which shows a coefficient of +0.57 that is statistically significant. All positive correlations for males and negative correlations for females in the middle age groups present tendencies similar to the correlation with the *per capita* income. In both series of correlations, positive correlation for males and negative correlation for females seem to be complementary and suggest an intervening effect of the marriage factor upon the female sex-age specific headship rate.

USE OF REGIONAL MODEL HEADSHIP RATES

The above preliminary analyses by two approaches, that is, a cross-sectional approach and a correlation analysis, have been made in order to find certain patterns and relationships between the headship rate and the level of economic development. The original purpose of these

in Asia and the Far East, 20 June-8 July 1960, Bombay, India, pp. 18-27; J. B. Cullingworth, Housing Needs and Planning Policy (London, Routledge and Kegan Paul, 1960), pp. 39-55; The Netherlands Central Directorate of Housing and Building, Monograph on the Housing Situation in the Netherlands (The Hague, 1964), pp. 27-48; Principles and Recommendations for the 1970 Housing Censuses, Statistical Papers Series M., No. 45 (United Nations publication, Sales No. 67.XVII.4), para. 354, tabulation (2); Shigemi Kono, "Changes in households and family structure in Japan", in International Union for the Scientific Study of Population, International Population Conference, London 1969, vol. III, pp. 2223-2233.

TABLE 45. ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN HEADSHIP RATE AND PER CAPITA INCOME AND THE DEGREE OF URBANIZATION, FOR 12 SEX-AGE GROUPS ON THE BASIS OF 38 COUNTRY SCHEDULES, AROUND 1960

Age group	Correlation between headship rate and per capita income	Correlation between headship rate and the degree of urbanization ^a
<i>Males</i>		
15-24	-0.4729	0.1134
25-34	0.0045	0.5698
35-44	0.3103	0.4112
45-54	0.4656	0.2501
55-64	0.2734	0.3115
65+	-0.2089	0.3875
<i>Females</i>		
15-24	-0.0955	0.1824
25-34	-0.3597	-0.1478
35-44	-0.3569	-0.4591
45-54	-0.2824	-0.3750
55-64	-0.3968	-0.0877
65+	-0.2863	0.3228

SOURCE: computed by the Population Division, United Nations Secretariat.

^a The degree of urbanization is expressed in terms of the percentage of the population in localities of 20,000 and over.

preparatory studies was to derive model schedules of headship rates which could be graded according to different levels in the economic development of countries and which could be applied to those countries without adequate household headship data.¹⁰

Unfortunately, the correlation analysis approach did not produce significantly high correlation results and, therefore, it is not possible to construct model schedules of headship rates directly applicable to those countries lacking the necessary data. Several other different economic variables have been tried, but the results are much the same and are not greatly promising. Coefficients of multiple determination, that is squares of multiple correlation coefficients, computed at the same time, seldom exceed 0.5, thus mostly failing to explain more than half the total variance of the headship rate, even if marital status structure and economic activity rate are controlled.

The reasons why these analyses did not show very strong correlations between the household headship rate and the level of economic development may stem from the following factors:

(a) The number of countries with available data was limited to about 40, mostly European, Northern American and Latin American countries. Asia and Africa are greatly under-represented;

(b) The definition of the household still differs substantially among countries and regions, blurring some

¹⁰ On the analogy of model life tables and stable populations, the idea of model headship rates for estimating and projecting households and families in statistically underdeveloped countries is not new to demographers and statisticians. Siegel suggested that if the data on heads by sex and age were lacking, model schedules of headship rates by sex and age might be employed. See Jacob S. Siegel, "Projections of urban and rural population and other socio-economic characteristics", background paper for the United Nations World Population Conference, Belgrade, 30 August-10 September 1965, p. 38.

presumably intrinsic associations between the headship rate and economic indicators;

(c) Cultural and regional differences, which are not always parallel with levels of economic development, may strongly affect the level of the headship rate as much as do economic factors. Such cultural and regional variations may sometimes be considered as disturbing the direct bearing and influence of economic factors, if any, upon the headship rate.

Therefore, at the present stage of statistical development among the countries of the world, it would be a little too premature a judgement to rule out possibilities of constructing model schedules of headship rates. Perhaps the returns of the 1970 round of censuses might increase the number of countries that have useful household headship data for the present purpose.

On the other hand, some meaningful results have been obtained from cross-sectional comparisons of headship rates by levels of economic development and *per capita* income groups. By this approach, it is possible to assume the approximate future course of the change in the headship rate for a country with medium or low income, and to set up approximate target levels of headship rate which may be achieved by a given country group or level of economic development in a certain number of years from the base year of projection. For example, if a medium-income country group at present may be assumed to attain in 20 years from 1965 approximately the same level of *per capita* income as is now enjoyed by the high-income country group, then an estimation of the levels of headship rates for every fifth year between the target year and the base year for projection can be made by interpolation. Again, this type of estimation is not very precise for individual countries, but it would serve to set some guidelines for the course of country groups of medium or low income.

Because it is difficult to determine very precisely the future levels of headship rates by the correlation and regression method, it would be reasonable not to try at this stage an interregional, unified system of model headship rates, but rather to look into regional models which may be constructed on or borrowed from the experience of countries within the same region with similar cultural background or similar demographic and economic conditions.

Table 46 presents comparisons of sex-age specific headship rates for the countries in Middle America (mainland) and Western and Northern European regions where the availability of household data is good, with those for the United States of America, Australia, Japan and India (West Bengal) which are outside the above-mentioned regional groups. First of all, this table demonstrates that, while the "in-group" similarities and the relatively small variations between countries within each of the three regions, Middle America, Western and Northern Europe, differentiate each from the other, the distinction is far more marked between these three regions taken together and, for example, India or Japan.

For both males and females, the differences in the patterns of headship rates in Northern Europe, Western

TABLE 46a. COMPARISON OF SEX-AGE SPECIFIC HEADSHIP RATES FOR MIDDLE AMERICA (MAINLAND) AND WESTERN AND NORTHERN EUROPEAN COUNTRIES WITH THOSE FOR UNITED STATES OF AMERICA, AUSTRALIA, JAPAN AND INDIA, AROUND 1960: MALES
(Percentage of heads among male population of given age group)

Region and country	Year	Age group					
		15-24	25-34	35-44	45-54	55-64	65+
<i>Middle America (mainland)</i>							
Costa Rica . . .	1963	12	65	83	87	86	76
Guatemala . . .	1950	19	66	85	91	92	86
Nicaragua . . .	1950	9	47	69	80	83	77
Panama . . .	1960	15	63	81	86	86	80
Unweighted average of the above 4 . . .		14	60	80	86	87	80
<i>Western Europe</i>							
Austria . . .	1961	9	65	88	91	90	78
Belgium . . .	1961	14	77	89	92	93	83
Federal Republic of Germany . . .	1961	13	73	96	94	99	89
France . . .	1962	7	68	86	92	94	86
Luxembourg . . .	1960	9	64	81	86	86	72
Netherlands . . .	1960	9	72	90	93	94	81
Switzerland . . .	1960	8	63	86	91	92	82
Unweighted average of the above 7 . . .		10	69	88	91	92	82
<i>Northern Europe</i>							
Denmark . . .	1960	9	71	91	91	93	86
Finland . . .	1960	16	72	88	93	92	76
Norway . . .	1960	14	66	88	91	92	81
Sweden . . .	1960	11	73	88	92	93	86
Unweighted average of the above 4 . . .		12	71	89	92	93	83
United States of America . . .	1960	20	80	89	91	90	83
Australia . . .	1961	11	66	81	84	83	75
Japan . . .	1960	4	52	82	93	91	63
India (West Bengal)	1951	23	52	72	76	76	60

SOURCE: National population census results. See also tables 40a and 40b.

Europe and the United States of America are relatively small, except in the age group 15-24, for both sexes, whereas disparities between the above European regions and the United States of America, on the one hand, and Middle America, India and Japan, on the other, are large. Australian males show somewhat lower rates than European countries in all age groups except for the age group 15-24. It should also be noticed that India and Japan are quite different in age patterns and levels of headship rates for males. This table therefore suggests some use in applying regional schedules of headship rates to those countries within the same region, or the same cultural region, which lack their own sex-age specific headship rate data.

ILLUSTRATION BY USE OF REGIONAL MODEL RATES

When making projections of households and families for a country, the first step is to estimate a schedule of sex-age specific headship rates for the country at the base year of the projection. When the country concerned lacks its own schedules, use may be made of schedules of headship rates for countries within the same region that have

cultural similarities and are at much the same level of economic development. These borrowed rates from adjacent countries are taken as the standard weights, multiplied by population sizes in the corresponding age groups to get at first the estimated number of household heads by sex and age, which are then adjusted by prorating to give the number of total households observed or estimated for the base year.

Adjusted numbers of household heads by sex and age are then divided by the corresponding population to get the adjusted headship rates for the country at the base year.

To estimate the number of total households for the base year of the projection (in this case 1 July 1965), a simple ratio of the number of total households to the population aged 20-64 is first estimated for the base year by extrapolation of previous trends on the basis of past census results, and is then applied to the 1965 population.¹¹ If the ratio is

¹¹ For individual countries with a population of 250,000 or more, population projections by sex and age have been prepared by the United Nations Population Division for the years 1965-2000. See *World Population Prospects as Assessed in 1968* (United Nations publication, Sales No. 72.XIII.4).

TABLE 46b. COMPARISON OF SEX-AGE SPECIFIC HEADSHIP RATES FOR MIDDLE AMERICA (MAINLAND) AND WESTERN AND NORTHERN EUROPEAN COUNTRIES WITH THOSE FOR UNITED STATES OF AMERICA, AUSTRALIA, JAPAN AND INDIA AROUND 1960: FEMALES
(Percentage of heads among female population of given age group)

Region and country	Year	Age group					
		15-24	25-34	35-44	45-54	55-64	65+
<i>Middle America (mainland)</i>							
Costa Rica . . .	1963	1	6	13	20	28	34
Guatemala . . .	1950	2	7	16	25	32	36
Nicaragua . . .	1950	2	9	18	30	40	45
Panama	1960	4	12	21	29	37	38
Unweighted average of the above 4		2	9	17	26	34	38
<i>Western Europe</i>							
Austria	1961	2	5	14	27	30	46
Belgium	1961	1	3	6	13	23	39
Federal Republic of Germany	1961	4	6	12	24	31	45
France	1962	3	5	8	16	27	44
Luxembourg	1960	1	3	6	12	22	32
Netherlands	1960	2	4	6	11	21	35
Switzerland	1960	2	6	9	15	26	41
Unweighted average of the above 7		2	5	9	17	26	41
<i>Northern Europe</i>							
Denmark	1960	3	6	9	16	28	41
Finland	1960	9	12	14	23	33	38
Norway	1960	6	7	7	13	23	38
Sweden	1960	5	9	10	16	27	47
Unweighted average of the above 4		6	9	10	17	28	43
United States of America							
Australia	1960	3	7	10	15	24	36
Japan	1961	1	4	7	13	23	36
India	1960	1	3	11	18	14	10
India (West Bengal)	1951	2	6	10	12	11	10

SOURCE: as for table 40b.

available for two censuses or more, it is extrapolated on the basis of these more than two points and normally has an increasing trend. But if the ratio is available only for one census year, it is assumed to remain constant.

As has already been understood in previous chapters, the two most important steps in making household projections are: first to estimate levels of sex-age specific headship rates for the base year; secondly, to make an assumption on the timing and speed of changes in sex-age specific headship rates from one level to another. The second step is concerned with an assumption of how fast a schedule of sex-age specific rates at the base year will evolve and move into the next level of the headship schedule, which may be adopted from some more developed countries as a target level of projection. The first step involves finding similar countries and borrowing their headship rates, and the second step, estimating the timing pattern and speed of headship rate changes over time. This estimation may be made on the basis of comparative studies of the present and past levels of headship rates in relation to the degree of industrialization, the *per capita* income, and the degree of urbanization of countries, as

well as their regional characteristics and cultural similarities.

As examples, two countries have been selected, El Salvador in Middle America (mainland) and New Zealand in Oceania, for which no breakdowns of heads of households by sex and age have been readily available.¹²

The case of El Salvador

El Salvador has had two population censuses since the end of the Second World War, in 1950 and 1961. As already mentioned, however, these censuses did not tabulate the number of household heads by sex and age. The ratio of the number of total households to the population aged 20-64 was 0.43720 for 1950 and 0.43098 for 1961.¹³

¹² The recent publication of the New Zealand census reports for 1966 includes some information on household heads by sex and some broad age groups.

¹³ The household figure for 1950 was taken from United Nations, *Demographic Yearbook, 1955* (United Nations publication, Sales No. 55.XIII.6), table 9, p. 218 and that for 1961 from El Salvador, Ministerio de Economía, Dirección General de Estadística y
(Continued on next page)

According to general observations made on it,¹⁴ however, it appears very doubtful that the ratio would continue to decrease, so that it is assumed for the present purpose that by 1965 it would come back to the same level as in 1950. Thus, the estimation of the number of total households for 1965 is made by applying the 1950 ratio as constant to the 1965 population aged 20-64 as follows:

$$1,183,000 \text{ (population aged 20-64)} \times 0.43720 \\ = 517,200 \text{ (households)}$$

As the next step, the estimation of sex-age specific headship rates for 1965 is made by taking as the model schedule the unweighted sex-age headship rates of four Middle American countries, namely Costa Rica (1963), Guatemala (1950), Nicaragua (1950) and Panama (1960) for which the headship rates are available by sex and age. The schedules of headship rates for these four countries have already been shown in table 40.

Table 47 shows the computational steps for estimating sex-age specific headship rates for El Salvador for 1965 by proration, on the basis of the average headship rate for the above four Middle American countries. In columns (4) and (5) of table 47, it should be noticed that the hypothetical number of heads of households for El Salvador for 1965, obtained by multiplying the population by sex and

(Footnote 13 continued)

Censos, *Tercer Censo Nacional de Población, 1961* (San Salvador, 1965), cuadro 44, p. 828.

¹⁴ This point has already been fully discussed in chapter IV above.

age for El Salvador by the average headship rates for the four Middle American countries, gives a slight edge to the estimated total number of household heads for the same year by the simple households-to-population ratio. Thus, it is necessary to make an adjustment by prorating the heads of households by a deflating correction factor of 0.98066.

In table 47, a special assumption is made so that the headship rates for male age groups 35-44, 45-54 and 55-64 should not reach unreasonably low levels. The assumption was made because, as discussed earlier, these three age groups usually show the highest headship rates among the age groups in practically all countries and also have relatively large populations, so that the prorating method used here gives the largest numbers of additions to and subtractions from the heads of households at these age groups. At the same time, as seen in table 40a and elsewhere, these three age groups for males generally show the smallest inter-country variations among all the sex-age groups, perhaps reflecting the fact that these ages are the prime years of life for men in headship as well as in economic activity. Accordingly, these age groups for El Salvador are assumed to maintain high rates similar to the average rates for the four countries and smaller by just 0.5 per cent than those for the four countries at each of the three age groups. After predetermining the rates for these age groups, the rest of the age groups were prorated. The steps are explained by columns (7), (8) and (9) in table 47. The last column of this table, column (9), indicates such series of headship rates, adjusted to the total estimated number of households for 1965.

TABLE 47. COMPUTATIONAL STEPS FOR ESTIMATING HEADSHIP RATES FOR EL SALVADOR, 1965

(1) Age group	(2) Average headship rates for the four Middle American countries (percentage)	(3) Population estimates for El Salvador, 1965	(4) Expected number of heads of households (2) × (3) (thousands)	(5) Prorated number of heads of households (4) × 0.98066 ^a	(6) First adjusted headship rates (5)/(3) (percentage)	(7) Assumed headship rates for age groups 35-64 only (2) - 0.5	(8) For age groups 35-64: (3) × (7) for the other age groups: (4) × 0.97050 ^b (thousands)	(9) Second adjusted headship rates (8)/(3) (percentage)
Males								
15-24	13.8	265	36.6	35.9	13.5		35.5	13.4
25-34	60.4	191	115.4	113.2	59.3		112.0	58.6
35-44	79.6	136	108.3	106.2	78.1	79.1	107.6	79.1
45-54	85.9	89	76.5	75.0	84.3	85.4	76.0	85.4
55-64	86.7	55	47.7	46.8	85.1	86.2	47.4	86.2
65+	79.9	44	35.2	34.5	78.4		34.2	77.7
Females								
15-24	2.3	262	6.0	5.9	2.3		5.8	2.2
25-34	8.6	192	16.5	16.2	8.4		16.0	8.3
35-44	16.8	137	23.0	22.6	16.5		22.3	16.3
45-54	26.0	92	23.9	23.4	25.4		23.2	25.2
55-64	34.3	58	19.9	19.5	33.6		19.3	33.3
65+	38.4	48	18.4	18.0	37.5		17.9	37.3
TOTAL for all ages in both sexes		2 928	527.4	517.2			517.2	

SOURCE:

Headship rates for the four Latin American countries (Costa Rica, 1963, Guatemala, 1950, Nicaragua, 1950 and Panama, 1960), taken from table 40a.

Population by sex and age for El Salvador, 1965, estimated by the Population Division of the United Nations Secretariat.

^a The number 517.2 (thousand) in column (5) represents the estimated number of households for 1965 on the basis of the ratio of number of

households to the population aged 20-64 in 1950. Dividing 517.2 by 527.4 (column (4)) gives the correction factor of 0.98066.

^b The correction factor 0.97050 is obtained by (517.2 - 231.0) divided by (527.4 - 232.5). In this equation, the value 231.0 is the total estimated number of heads of households for the three age groups 35-44, 45-54 and 55-64 in column (8). The value 232.5 is the total estimated number of heads of households for the three age groups in column (4).

TABLE 48. COMPUTATIONAL STEPS FOR ESTIMATING FUTURE HEADSHIP RATES FOR EL SALVADOR
(Percentage)

(1) Age group	(2) United States of America, 1966	(3) Headship rate for El Salvador, 1965	(4) (2) - (3)	(5) (4) × $\frac{2}{15}$	(6) 1970 (3) + (5)	Headship rates for El Salvador			(10) 1990 (5) + (9)	(11) (4) × $\frac{1}{15}$	Headship rates for El Salvador					(16) (11) + (14) + (15) + (16)
						(7) 1975 (5) + (6)	(8) 1980 (5) + (7)	(9) 1985 (5) + (8)			2000 (11) + (12)	2005 (11) + (13)	2010 (11) + (14)	2015 (11) + (15)		
															(12) 1995 (10) + (11)		(13)	(14)	(15)
<i>Males</i>																
15-24	18.6	13.4	5.2	0.7	14.1	14.8	15.5	16.2	16.9	0.3	17.2	17.5	17.8	18.1	18.4	
25-34	79.9	58.6	21.3	2.8	61.4	64.2	67.0	69.8	72.6	1.4	74.0	75.4	76.8	78.2	79.6	
35-44	88.2	79.1	9.1	1.2	80.3	81.5	82.7	83.9	85.1	0.6	85.7	86.3	86.9	87.5	88.1	
45-54	91.2	85.4	5.8	0.8	86.2	87.0	87.8	88.6	89.4	0.4	89.8	90.2	90.6	91.0	91.4	
55-64	88.3	86.2	2.1	0.3	86.5	86.8	87.1	87.4	87.7	0.1	87.8	87.9	88.0	88.1	88.2	
65+	85.7	77.7	8.0	1.1	78.8	79.9	81.0	82.1	83.2	0.5	83.7	84.2	84.7	85.2	85.7	
<i>Females</i>																
15-24	3.2	2.2	1.0	0.1	2.3	2.4	2.5	2.6	2.7	0.1	2.8	2.9	3.0	3.1	3.2	
25-34	9.4	8.3	1.1	0.1	8.4	8.5	8.6	8.7	8.8	0.1	8.9	9.0	9.1	9.2	9.3	
35-44	11.4	16.3	-4.9	-0.7	15.6	14.9	14.2	13.5	12.8	-0.3	12.5	12.2	11.9	11.6	11.3	
45-54	16.0	25.2	-9.2	-1.2	24.0	22.8	21.6	20.4	19.2	-0.6	18.6	18.0	17.4	16.8	16.2	
55-64	26.7	33.3	-6.6	-0.9	32.4	31.5	30.6	29.7	28.8	-0.4	28.4	28.0	27.6	27.2	26.8	
65+	41.5	37.3	4.2	0.6	37.9	38.5	39.1	39.7	40.3	0.3	40.6	40.9	41.2	41.5	41.8	

SOURCE: headship rates for the United States of America, 1966 based on the United States Bureau of the Census, "Summary of demographic projections", Current Population Reports, Series P-25, No. 388 (Washington, D.C., United States Government Printing Office, 14 March 1968), table 2, pp. 37-39 and table 13, pp. 62-63; headship rates for El Salvador, 1965 taken from column (9), table 47.

The second major step of the calculation is to estimate sex-age specific headship rates for El Salvador for future years. This portion of the calculation is methodologically by far the most difficult, therefore it is necessary to take some bold and speculative assumptions. In the case of El Salvador, the United States schedules of rates estimated for 1966 are used as the target rates to be reached by El Salvador in 50 years by the year 2015. A time lag of 50 years behind the United States of America has been assumed for El Salvador in respect to the development of headship rates by sex and age, when considering their respective current and future *per capita* income levels, degrees of industrialization in terms of the percentage of labour force engaged in non-agricultural activities, and degrees of urbanization.

Comparing their age patterns of headship rates, it may be noted that except in some middle age groups among women, sex-age specific rates are higher in the United States of America than in El Salvador. This point is in full conformity with previous observations that, first, developed countries with higher income *per capita* have generally higher headship rates than developing countries with lower income *per capita*; and secondly, among the countries where historical data are available, headship rates have increased almost in all age groups except for females in the middle age groups.¹⁵ By making an inter-regional comparison, it was found that the age patterns of headship rates for Middle America are more similar to those of the United States of America than to those of European countries. This is why the United States of

¹⁵ The main reason for the relatively low headship rates in the United States of America among middle-aged women is their relatively low widowhood, which is, in turn, attributable to a relatively high rate of survival among their husbands.

America rates rather than the European ones were taken as the target rates.

Table 48 represents such a sequence of computations for estimating the future levels of headship rates. In this table, it is assumed that a faster increase in headship rates will take place in the early stage of transition during the first 25 years to 1990, narrowing two thirds of the gap estimated for the base year between the headship rates for El Salvador and the United States of America and that for the following 25 years between 1990 and 2015 the slope of increase will be less steep, closing the remaining one third of the gap. It is considered that in El Salvador the family nuclearization process is already on the way, but the rate of its increase will eventually taper off when reaching the levels the United States of America has now. The final stage of household projections is illustrated in table 49. It is obtained by multiplying the sex-age headship rates by the corresponding population and by summing up the cross-products.

The case of New Zealand

In the projection of households for New Zealand, two country schedules of headship rates are taken as models in different ways. For estimating sex-age specific headship rates in New Zealand for the base year 1965, the schedule for Australia in 1961 is taken as the model and for projecting future headship rates from 1965 through 1985, use is made of the rates estimated for the United States of America in 1966.

There are, of course, great demographic, economic and social similarities between New Zealand and Australia. As for New Zealand and the United States of America, a closer resemblance is found between these two former frontier countries with small population density and high

TABLE 49. COMPUTATIONAL STEPS FOR PROJECTING HOUSEHOLDS FOR EL SALVADOR, 1970-1985

(1) Age group	(3) Estimated headship rate (percentage)				(7) Population projections				(11) Household projections			
	(2) 1970	(3) 1975	(4) 1980	(5) 1985	(6) 1970	(7) 1975	(8) 1980	(9) 1985	(10) (2) × (6)	(11) (3) × (7)	(12) (4) × (8)	(13) (5) × (9)
<i>Males</i>												
15-24 . . .	14.1	14.8	15.5	16.2	321	381	461	566	45.3	56.4	71.5	91.7
25-34 . . .	61.4	64.2	67.0	69.8	216	252	307	366	132.6	161.8	205.7	255.5
35-44 . . .	80.3	81.5	82.7	83.9	152	178	202	238	122.1	145.1	167.1	199.7
45-54 . . .	86.2	87.0	87.8	88.6	105	120	138	162	90.5	104.4	121.2	143.5
55-64 . . .	86.5	86.8	87.1	87.4	65	74	89	103	56.2	64.2	77.5	90.0
65+ . . .	78.8	79.9	81.0	82.1	50	59	69	85	39.4	47.1	55.9	69.8
<i>Females</i>												
15-24 . . .	2.3	2.4	2.5	2.6	318	377	456	559	7.3	9.0	11.4	14.5
25-34 . . .	8.4	8.5	8.6	8.7	215	251	306	365	18.1	21.3	26.3	31.8
35-44 . . .	15.6	14.9	14.2	13.5	153	179	203	239	23.9	26.7	28.8	32.3
45-54 . . .	24.0	22.8	21.6	20.4	108	123	141	165	25.9	28.0	30.5	33.7
55-64 . . .	32.4	31.5	30.6	29.7	69	78	94	108	22.4	24.6	28.8	32.1
65+ . . .	37.9	38.5	39.1	39.7	55	67	80	97	20.8	25.8	31.3	38.5
				TOTAL	3 454	4 107	4 922	5 929	604.5	714.4	856.0	1033.1
Average household size									5.71	5.75	5.75	5.74

SOURCE: estimated headship rates from table 48; Population projections prepared by the Population Division of the United Nations Secretariat

industrialization, than between New Zealand and the Western European countries. In spite of these similarities, however, it is assumed here for statistical purposes that the United States of America is ahead of New Zealand by about 20 years in terms of industrialization, urbanization and *per capita* income.

According to the three recent population censuses, the number of households, the population aged 20-64 and the ratio between them are shown in the following table:

(1) Year	(2) Households	(3) Population aged 20-64	(4) Ratio (2)/(3)
1956	563 052	1 135 598	0.49582
1961	633 707	1 221 174	0.51893
1966	716 104	1 336 060	0.53598

SOURCE:
Households: New Zealand Department of Statistics, *New Zealand Official Yearbook*, 1970, 75th issue (Wellington, 1970), p. 549.
Population: New Zealand Department of Statistics, *New Zealand Census of Population and Dwellings, 1966, Ages and Marital Status* (Wellington, 1968), table 1, p. 11.

TABLE 50. COMPUTATIONAL STEPS FOR ESTIMATING HEADSHIP RATES FOR NEW ZEALAND, 1965

(1) Age group	(2) Headship rates for Australia, 1961 (percentage)	(3) Population estimates for New Zealand 1965	(4) Expected num- ber of heads of households (2) × (3) (thousands)	(5) Prorated num- ber of heads of households (4) × 1.09043 ^a	(6) Adjusted headship rates (5)/(3) (percentage)
<i>Males</i>					
15-24	10.673	220	23.5	25.6	11.636
25-34	65.817	159	104.6	114.1	71.761
35-44	81.426	164	133.5	145.6	88.780
45-54	84.132	139	116.9	127.5	91.727
55-64	82.717	108	89.3	97.4	90.185
65+	75.208	90	67.7	73.8	82.000
<i>Females</i>					
15-24	01.414	210	3.0	3.3	1.571
25-34	03.806	153	5.8	6.3	4.118
35-44	06.955	156	10.8	11.8	7.564
45-54	12.827	140	18.0	19.6	14.000
55-64	22.822	108	24.6	26.8	24.815
65+	36.092	124	44.8	48.8	39.355
TOTAL			642.5	700.6	

SOURCE: headship rates from the Australian 1961 population census report.
^a The correction factor 1.09043 is derived by dividing the already estimated number of households (700.6) by the expected number of total households using the Australian rates (642.6).

TABLE 51. COMPUTATIONAL STEPS FOR ESTIMATING FUTURE HEADSHIP RATES FOR NEW ZEALAND, 1965-1985 (Percentage)

(1) Age group	(2) Headship rates for		(3) New Zealand 1965	(4) Target headship rates for 1985	(5) (4) - (3)	(6) (5) × 1/3	(7) Headship rates for New Zealand		(8) (6) + (7)	(9) (5) × 1/6	(10) Headship rates for New Zealand		(11) (9) + (10)
	United States of America 1966						1970 (3) + (6)	1975 (6) + (7)			1980 (8) + (9)	1985 (9) + (10)	
<i>Males</i>													
15-24	18.858	11.636	18.858	7.222	2.407	14.043	16.450	1.204	17.654	18.858			
25-34	79.936	71.761	79.936	8.175	2.725	74.486	77.211	1.363	78.574	79.937			
35-44	88.217	88.780	91.000 ^a	2.220	0.740	89.520	90.260	0.370	90.630	91.000			
45-54	91.239	91.727	93.562 ^b	1.835	0.612	92.339	92.951	0.306	93.257	93.563			
55-64	88.337	90.185	92.440 ^a	2.255	0.752	90.937	91.689	0.376	92.065	92.441			
65+	85.705	82.000	85.705	3.705	1.235	83.235	84.470	0.618	85.088	85.706			
<i>Females</i>													
15-24	3.205	1.571	3.205	1.634	0.545	2.116	2.661	0.272	2.933	3.205			
25-34	9.421	4.118	9.421	5.303	1.768	5.886	7.654	0.884	8.538	9.422			
35-44	11.432	7.564	11.432	3.868	1.289	8.853	10.142	0.645	10.787	11.432			
45-54	16.025	14.000	16.025	2.025	0.675	14.675	15.350	0.338	15.688	16.026			
55-64	26.706	24.815	26.706	1.891	0.630	25.445	26.075	0.315	26.390	26.705			
65+	41.533	39.355	41.533	2.178	0.726	40.081	40.807	0.363	41.170	41.533			

SOURCE: headship rates for the United States of America computed from the figures in United States Bureau of the Census, "Summary of demographic projections", *Current Population Reports - Population Estimates*, Series P-25, No. 388 (Washington, D.C., United States Government Printing Office, 1968); headship rates for New Zealand, 1965 from column (6), table 50.

^a Obtained by multiplying the corresponding New Zealand rates by 1.025.

^b Obtained by multiplying the corresponding New Zealand rates by 1.02.

The 1961 census was taken on 18 April 1961 and the 1966 census on 22 March 1966. According to the assumption that the rate of increase between 1 July 1965 and 22 March 1966 was the same as the annual average rate of increase between April 1961 and March 1966, the ratio of households to the population aged 20-64 was estimated as 0.53319 for 1 July 1965. Therefore, multiplying the population aged 20-64, namely 1,314,000, by 0.53319 would yield approximately 700,600 as the number of households for mid-year 1965.

Using the Australian model rates, the estimation of headship rates for New Zealand for 1965 is shown in table 50. Table 51, on the other hand, shows the computational steps used to derive the future schedule of headship rates, applying the United States 1966 rates as the target levels to be realized by 1985. Before proceeding with the estimation, however, an adjustment is necessary. It is noted that in columns (2) and (3), table 51, the male headship rates for three age groups 35-44, 45-54 and 55-64 for the United States of America in 1966 are lower than the corresponding rates estimated for New Zealand in 1965 and, as mentioned earlier in this manual, it is considered unreasonable to assume that the rates for these three age groups will decrease rather than increase. On the basis of the time-series data of age-specific headship rates available for developed countries shown in table 40a, it is noted that among six age groups of males the percentage increase has

been substantially large at both ends, namely at young age groups of 15-24 and 25-34 and at the oldest age group 65 and over, but it has been relatively small at the middle age groups, namely 35-44, 45-54 and 55-64. Thus, in accordance with the experience of developed countries as shown in table 40a where percentage increases for these three middle age groups are generally found somewhere between 1 and 2 per cent for ten years, it has been assumed in table 51 that for the age group 45-54 the headship rate estimated for New Zealand in 1965 will increase by 2 per cent in 20 years by 1985 and similarly for each of the age groups 35-44 and 55-64 it will increase by 2.5 per cent. Accordingly, the headship rates for these three age groups, 35-44, 45-54 and 55-64, have been assumed to attain, respectively, the levels of 91.000, 93.562 and 92.440. The assumed rates for 1985 are given in column (4) of table 51.

In estimating headship rates for the period 1965-1985 by five years, it has been assumed that, as in the previous cases, there will be a steeper slope for the first ten years, narrowing the two thirds of the difference between the United States of America and New Zealand, but a less steep slope for the second decade, closing the remaining one third of the gap in ten years. The procedures are much the same as in the previous examples. Table 52 shows the last stage of household projections.

TABLE 52. COMPUTATIONAL STEPS FOR PROJECTING HOUSEHOLDS FOR NEW ZEALAND, 1970-1985

(1) Age group	(2) (3) (4) (5) Estimated headship rates				(6) (7) (8) (9) Population projections				(10) (11) (12) (13) Household projections			
	1970	1975	1980	1985	1970	1975	1980	1985	1970	1975	1980	1985
	(percentage)				(thousands)				(2) × (6)	(3) × (7)	(4) × (8)	(5) × (9)
	<i>Males</i>											
15-24	14.043	16.450	17.654	18.858	254	286	314	321	35.7	47.0	55.4	60.5
25-34	74.486	77.211	78.574	79.937	177	216	257	289	131.8	166.8	201.9	231.0
35-44	89.520	90.260	90.630	91.000	161	161	179	216	144.1	145.3	162.2	196.6
45-54	92.339	92.951	93.257	93.563	148	160	158	156	136.7	148.7	147.3	146.0
55-64	90.937	91.689	92.065	92.441	120	124	132	142	109.1	113.7	121.5	131.3
65+	83.235	84.470	85.088	85.706	102	114	127	135	84.9	96.3	108.1	115.7
	<i>Females</i>											
15-24	2.116	2.661	2.933	3.205	244	275	301	309	5.2	7.3	8.8	9.9
25-34	5.886	7.654	8.538	9.422	174	210	247	277	10.2	16.1	21.1	26.1
35-44	8.853	10.142	10.787	11.432	152	156	174	212	13.5	15.8	18.8	24.2
45-54	14.675	15.350	15.688	16.026	149	155	151	154	21.9	23.8	23.7	24.7
55-64	25.445	26.075	26.390	26.705	123	132	140	146	31.3	34.4	36.9	39.0
65+	40.081	40.807	41.170	41.533	136	148	164	179	54.5	60.4	67.5	74.3
TOTAL for all ages in both sexes					2 860	3 120	3 420	3 760	778.9	875.6	973.2	1 079.3
Average household size									3.67	3.56	3.51	3.48

SOURCE: headship rates from table 51; Population projections prepared by the Population Division of the United Nations Secretariat.

Annex



SYNOPSIS OF THE PAST PROJECTIONS AMONG COUNTRIES
CALCULATED BY THE HEADSHIP RATE METHOD

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
1	Australia	1960	A. R. Hall and M. R. Hill	1959 1964 1969 1974	Sex and marital status	4 (Assumptions A, B, C and D according to the combinations of 2 headship assumptions and 2 marital-status assumptions)	(a) The lower limit: constant proportions ever married as in 1959; (b) the upper limit: the proportion of ever married males will increase to 1974 at the same percentage rate as between 1947 and 1959	(a) Constant rates as in 1959; (b) theoretical targets were set that the headship rate for married persons would be 95 per cent by 1974, considering the three factors: (1) the current proportion of non-private dwellings; (2) economic preference among the people for doubling-up due to economic reasons; (3) frictional non-headships in private households. For the other groups, a continuation of the trends (same percentage increase evident between 1933 and 1954 was assumed for the period 1959 to 1974)
2	Belgium	Nov. 1965	Institut national du logement	1965 1970 1975 1980 1985	Sex, age and marital status	1	Graphic extrapolation of the trend observed in the years 1880 to 1963	Constant based on the figures in 1959 survey
3	Chile	Nov. 1959	Julio Vergara Morales	1952 1957 1962 1967 1972 1977 1982	Sex, age and marital status	3 (According to 3 different population projections)	Constant proportion of the population in each marital status class in each 5-year sex-age group on the basis of data for 4 censuses from 1920 to 1952. The residual ever married group was principally subdivided by the ratios borrowed from Belgium and Ireland	Each married male and each widowed and divorced male and female under 60 years of age were assumed to have headship rate of 100. The other categories of population (single, widowed over 60 years of age and divorced over 60 years of age) were assumed to have headship rate of 0
4	Denmark	1965	Ministry of Housing	1980	Sex, age and marital status	3 (According to 3 different assumptions in headship rates)	Constant proportion as of 1 January 1963 with modest corrections for increasing rates in the younger age groups	(a) Constant rates observed in 1960; (b) "economic" headship rates where married men attain 100 per cent in headship; the other groups of rate were determined by income elasticities. The values of income elasticities were adopted from Swedish experience; (c) "welfare" rates were applied assuming that extensive housing policy further raises headship rates, particularly in younger and older ages
5	Finland	1965	Finnish Housing Committee	1970 1980	Sex, age, marital status and urban-rural	1	In urban areas, the proportion of non-married males will decrease in 1960-1970 and 1970-1980 by half the per cent decline in 1950-	As a result of the rise in income level, the headship rates of married people were expected to grow in the urban area in the decades

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
							1960. Male married and female married and non-married were adjusted accordingly. Ratio between presently and formerly married will be the same as in 1960. In rural areas, the composition remains the same as in 1960	1960-1980. For married people, one half the percentage increase of headship rate during 1950-1960 was applied to each decade of 1960-1980. However, upper ceilings were set for the headship rate of 95.0 for age group 20-24, 98.0 for age group 25-29, 99.0 for age group 30-34, 99.5 for age group 35-64 and 96.0 for age group 65. In rural areas the maximum rates were assumed to be slightly lower. For previously married and single people up to 65 years, linear extrapolation was applied. For age group 65+ of previously married and single people, the same percentage increase as in the decade 1950-1960 was assumed for each decade of 1960-1980. The urban-rural projections are partly dependent on migration projections as an important element based on the pace of changes in the economic structure in the 1950s
6	France	1959	Roland Pressart	1957 1962 1967	Sex, age and marital status	1	Percentages married and non-married were extrapolated on the basis of the past trends of percentage married among the cohort groups in 1947, 1952 and 1957	Constant assumptions on the basis of the data in 1954
7	France	1961	Gerard Calot	1954 1955 1956 1957 1958 1959 1960 1961 1966 1971 1976	Sex, age and marital status	1	Graphic extrapolation on the basis of the data on marital composition in 1901, 1911, 1931, 1936, 1946 and 1954	Constant assumptions on the basis of the data in 1954
8	France	1964	M. Febvay, M. Croz�, B. Grais and G. Calot	1970 1978	Sex, age and marital status	2 with assumption of no migration	Constant on the basis of the 1962 census population	Constant on the basis of the 1962 statistics. According to an assumption of migration taking place, adjustments

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
9	France	1970	Jean-Louis Bodin and Gerald Calot, Institut national de la statistique et des études économiques	1970 1971 1972 1975 1980 1985	Sex, age and marital status	2 (constant and changing)	(1) Age at marriage is assumed to decrease, thus influencing an increase in the proportion married at age 25-29 for males; (2) The proportion of widowed and divorced is assumed to decrease rapidly. Future projections of marital status structure in each age group are made by extrapolation of past trends	were made to the projections of households for 1970 and 1978, prepared under an assumption of there being no migration (1) Constant assumption; (2) Changing assumption extrapolation of the 1954-1962 trends on the assumption of further nuclearization
10	Federal Republic of Germany	1971	H. Schubnell, L. Herberger and H.-J. Borries, Statistisches Bundesamt	1975 1980	Sex, age and marital status; household size	4 (constant, I, II and III)	Marital status structure in each age group is assumed to change; projections were made previously by the Statistisches Bundesamt	(a) Constant assumption: headship rates based on the 1969 micro-census were kept constant for 1975 and 1980 (b) assumption I: the non-linear extrapolation of headship rates by sex, age and marital status based on the 1961 census and the 1964, 1966 and 1968 microcensuses, projected until 1980; (c) assumption II: the non-linear extrapolation of headship rates based on the 1961 census and the 1964, 1966 and 1968 microcensuses; (d) assumption III: the non-linear extrapolation of headship rates by sex and age, based on the 1961 census and the 1964, 1966 and 1968 microcensuses
11	Hungary	1965	József Tamásy	1966 1971 1976 1981	Sex, age and marital status	1	Constant on the basis of the 1960 population	Constant on the basis of the 1960 statistics
12	Italy	1966	Istituto di Statistica dell'Università Degli Studi di Firenze, Florence	1971 1976 1981	Sex, age and primary and secondary nuclear family	1		Headship rates specific for sex and age were kept constant. Ratio between primary and secondary family nucleuses is assumed to be changed. By 1971, half the secondary family nuclei will dissolve. By 1976, three quarters will dissolve and by 1981 all the secondary nuclei will be transformed into primary nuclei

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
13	Japan	1961	Shigemi Kono	1961 1962 1963 1964 1965 1970 1975	Sex, age and marital status	1	Constant on the basis of the marital-status distribution in the 1955 census for all age groups except one 15-24 which was assumed to have higher never-married rate in the future	Constant on the basis of the 1955 census statistics
14	Japan	1965	Koichi Takami	1965 1970 1975 1980 1985	Sex, age and marital status	1	Constant on the basis of the marital-status distribution in the 1960 census	A normative goal was set in such a way that by 2000 all married couples will come to have their own households. Likewise all the never-married, widowed and divorced were assumed to form their own households by 2000. The transformation is linear
15	Japan	1966	Institute of Population Problems, Ministry of Health and Welfare	1966 1967 1968 1969 1970 1975 1980 1985 1990	Sex, age and marital status	2 assumptions A and B	On the basis of data for 46 prefectures, regression was drawn between the proportion married and indices of urbanization. Accordingly, it was assumed that the marital status distribution under 40 will change linearly by 1975 to become the same as the distribution in the "all urban" classification indicated in the 1960 census. No changes were assumed for age groups 40 and over and after 1975	By regression analyses on the basis of 46 prefectures, the rate was assumed to pass through the following stages linearly: <i>Assumption A</i> : the level on the average of "all urban" and "all densely inhabited districts" in the 1960 census will be attained by all Japan by 1970, "all densely inhabited districts" by 1975, "all densely inhabited districts within urban areas" by 1980 and no change after 1980. <i>Assumption B</i> : the level of "all densely inhabited districts" by 1970, "all densely inhabited districts" until 1975 and no change after 1975
16	Netherlands	1964	Central Directorate of Housing and Building	1967 1972 1977 1982	Sex, age and marital status	2 according to future courses of mortality, viz., "stable" mortality and "further decreasing mortality"	Constant marital status distribution as of 31 December 1962	Between the 1956 and the 1960 census the rates in general show an increase. Assumptions were made that the rates would increase rectilinearly on the basis of the 1956 and 1960 values, except for the married females whose rates were kept the same as in 1960. For divorced males and females they were assumed to increase by about 5 per cent per 5-year period in all age groups. Adjustments were made to the linear extrapolations bringing the values of over 100 to these marital status groups

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
17	Norway	1966	Ministry of Municipal and Labour Affairs	1970 1980	Sex, age, marital status and rural-towns (urban)	1	Constant distribution on the basis of the situation in 1960. Rural-urban projections of the population were not specified	Normative series of sex-age marital specific rates were set up to increase appreciably, reflecting general economic and social development. The rates for 1980 were assumed to be constant as for 1970
18	Sweden	1966	The National Housing Board	1975	Sex, age and marital status	1	Continued increase in percentage married. Detailed assumptions are not clear	Using income elasticities, specific headship rates, by sex, age and marital status were estimated. Real income was assumed to increase by 3 per cent annually and income elasticities vary from 0.1 to 1.5
19	United Kingdom (England and Wales)	1955	Registrar-General	1955 1965 1975	Sex, age and marital status	1	Not known	Practically constant in all sex-age-marital status groups except for the married males aged 15-39 for whom the level of 90.0 was assumed
20	United Kingdom (England and Wales)	1960	J. B. Cullingworth	1978	Sex, age and marital status	4 (assumptions A, B, C and D)	Taken from the <i>Report by the Government Actuary on the First Quinquennial Review of the National Insurance Scheme 1954</i> . It was assumed to continue in accordance with current experience (based on the experience of the years prior to 1954) in regard to rates of marriage at each age	<i>Assumption A</i> : the 1951 rates were kept constant <i>Assumption B</i> : all the rates were kept the same as for 1951 except for ages 15-39 for which the level of 90.0 was assumed <i>Assumption C</i> : all the family nuclei recorded in the 1951 census will form separate households and the resultant increase in headship rates will be maintained. All age specific rates for married males increased and an overall rate for all the non-married groups was set at 26.7, a slight increase from 26.2 in 1951 <i>Assumption D</i> : 100 per cent rates for all married males and the 1951 rates for non-married groups
21	United Kingdom (England and Wales)	1961	L. Needleman (National Institute of Economic and Social Research)	1980	Sex, age and marital status	3 (projections A, B and C)	Taken from the <i>Report by the Government Actuary's Department on the Second Quinquennial Review of the National Insurance Scheme, 1959-60</i> (London, Her Majesty's Stationery Office, June 1960), pp. 27 and 46. In view of a pronounced increase in the	<i>Projection A</i> : the 1951 rates were kept constant for all the groups <i>Projection B</i> : ("medium" headship rates) 98.0 for all married males; considerable increase for single, widowed and divorced males and females aged 15-39; 1951 rates for all the rest

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
							marriage rates of bachelors and spinsters under age 25 and some declines in divorce rates, percentages married in each age group were expected to increase and percentages never-married particularly for women, and widowed and divorced were assumed to decrease. The detailed assumptions relevant to this synoptic table are not known	<i>Projection C:</i> married males' rates are the same as in projection B (98.0 for all); Further increase for single, widowed and divorced aged 15-39; substantial increase for the rest (70 per cent for widowed and divorced males and females 40+ and 50 per cent for single males and females 40+)
22	United Kingdom (3 areas in England and Wales)	1961	A. H. Walkden	1957 1971	Sex, age and marital status	1	Same as in the 1951 census distribution	The headship rates estimated for the three areas in England and Wales for 1951 were kept constant
23	United Kingdom (England and Wales)	1964	O. W. Roskill	1982 2002	Sex, age and marital status	3 (projections A, B, C, and D, according to variant assumptions in headship rates)	Based on the projections made by the Government Actuary's Department	<i>Projection A:</i> the 1951 rates were kept constant for all the groups for all years <i>Projection B:</i> "medium" headship rates. 98.0 for all married males; considerable increase for single, widowed and divorced males and females aged 15-39; generally the same rates for all the rest with some upward modifications <i>Projection C:</i> "maximum" headship rates. Married males' rates are the same as in projection B (98.0 for all); further increases for single, widowed and divorced aged 15-39; 70 per cent for widowed and divorced males and females 40 and over, except for widowed and divorced females 40-59, and 50 per cent for single males and females aged 40 and over. Nearly the same assumptions were applied both to 1982 and 2002 in three variant projections

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
24	United Kingdom	1965	D. C. Paige (National Institute of Economic and Social Research)	1960 1975 1990	Sex, age and marital status	1	Not clearly known but very likely to have been based on the Government Actuary's projections	It is assumed that the rates observed in the 1951 census will increase further continuously in 1960, 1975 and 1990, though the increase will taper off towards 1990. Married men were assumed to have 98 per cent as the headship rate
25	United States of America	1938	National Resources Committee (Report of the Committee on Population Problems)	1935 1940 1945 1950 1955 1960 1965 1975 1980	Sex and age (projections of "families")	3 (three variants of population projection: (a) low fertility; medium mortality; no immigration; (b) medium fertility; medium mortality; no immigration; (c) medium fertility; medium mortality, net immigration 100,000 per year after 1940)	The projections (a) and (c) did not take into consideration marital-status distribution in sex-age groups. The projection (b) applied the 1930 age-specific marital status ratios to 5-year age classes as being constant in the future years	The 1930 rates remained constant
26	United States of America	1943	Bureau of the Census	1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1955 1960	Sex and age (projections of "families")	3 (high, medium and low estimates)	No marital status breakdowns	<i>High estimates:</i> assumed to change at the same rather rapid rate as between 1930 and 1940 <i>Medium estimates:</i> assumed to change at one half of the rate of change between 1930 and 1940 <i>Low estimates:</i> were based on the headship rates remaining the same as in 1940
27	United States of America	1946	Bureau of the Census	1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1955 1960	Sex, age and marital status (projections of "families")	3 (high, medium and low estimates)	No marital status breakdowns	<i>Medium estimates:</i> determined by projecting one half of the annual change observed in the headship rate between 1930 and 1940 in each sex and age group. The estimates under actual or expected conditions were obtained by adjusting the number of families under normal conditions for the unusual number of marriages and divorces since 1940, the delay in

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
							forming new families, the induction into the armed services of men with families, the formation or continuation of families as a result of wartime conditions, the post-war readjustments of families temporarily doubled-up or temporarily formed, and the loss of families as a result of battle casualties	
							<i>High estimates:</i> the headship rates were expected to change at the same rather rapid rate as between 1930 and 1940; marriages being 2½ per cent above the normal number and divorces being 5 per cent below the normal number	
							<i>Low estimates:</i> headship rates were expected to remain the same as in 1940; marriages being 2½ per cent below the normal number and divorces being 5 per cent above the normal number	
28	United States of America	1952	Bureau of the Census	1955 1960	Sex, age marital status and type of family unit	3 (high medium and low)	Percentage of single persons: in the "high series" the percentage of single persons was projected by age cohort on the basis of changes observed from 1945 to 1950. The "low" projections were based on the assumption that the percentage of single persons will gradually rise by 1960 to a level half way between that for 1940 and that for 1950 (again by using age cohort). The "medium" projection was a weighted average of the high and low projection, with the values for the high projections being given twice the weight for the low projections. Percentages married of all ever-married were projected by a conventional method linearly to 1955 and 1960. The same assumptions for the three series	Percentage of married couples without own households: the "high series" assumed that between 1952 and 1960 the rate of change in the percentage of married couples without own households would be one and a half times that observed for the period 1940-1952. The "medium series" assumed that it would change from 1952 to 1960 at three fourths the rate observed from 1942 to 1952. The "low series" assumed that the percentage of married couples without own households in 1960 would be the same, age for age, as in 1950

ANNEX (continued)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
29	United States of America	1956	Bureau of the Census	1960 1965 1970 1975	Sex, age, marital status and type of family unit	4 (series I, II, III and IV)	<p>The assumptions are basically the same as in the 1952 projections, using rate of change in the age cohort during a certain period</p> <p><i>Series I:</i> the rates of change in percentage of single persons, etc., for each 10-year period, 1955-1975, were assumed to be equal to the rate of change for the 8-year period 1947-1955</p> <p><i>Series II:</i> the average annual rates of change between 1950 and 1955 were assumed to continue to 1975</p> <p><i>Series III:</i> half the annual average rates of change between 1950 and 1955 will extend to 1975</p> <p><i>Series IV:</i> no change will occur after 1955</p>	<p><i>Series I:</i> the rates of change in headship rates specific for sex, age and marital status for each 10-year period, 1955-1975, were assumed to be equal to the rate of change for the 8-year period 1947-1955</p> <p><i>Series II:</i> the average annual rates of change between 1950 and 1955 were assumed to continue to 1975</p> <p><i>Series III:</i> half the average annual rates of change between 1950 and 1955 were assumed to extend to 1975</p> <p><i>Series IV:</i> no change will occur after 1955</p>
30	United States of America	1958	Bureau of the Census	Single years from 1959 to 1970 and 1975 and 1980	Sex, age, marital status and type of family unit	5 (series A, B, C and D and an alternative series)	<p>"Lowest" series (<i>series D</i>): holding constant the average of 1956, 1957 and 1958 marital-status distribution in each sex-age group through 1980. For the other series, for "single" in each sex, in the age groups 18-19 and 20-24, by linear extrapolation to 1980 of the annual average between 1949-1951 and 1956-1958 in the proportion of single persons for the 4 sex-age groups combined (the total annual change was extrapolated in <i>Series A</i>, to two thirds the annual change in <i>Series B</i> and one third the change in <i>Series C</i>). For those aged 25 and over, cohort ratio change from 1951-1953 to 1956-1958 was used for the changes during each of the 5-year periods up to 1980 (<i>Series B and C</i>); in <i>Series A</i>, the ratio change from 1949-1951 to 1956-1958 was similarly used. The proportion "married, spouse-present" among the ever-married in each sex-age group is assumed to remain the same in all</p>	<p>The basic approach was to extrapolate to 1980 the changes between 1950 and 1956-1958 by age for each of the five groups according to the following assumptions:</p> <p><i>Series A:</i> the average annual change from 1950 to 1956-1958 in headship rate would continue to 1965. One half of this average annual change was assumed for the period 1965-1975, one quarter for the period 1975-1980</p> <p><i>Series B:</i> one half of the average annual change from 1950 to 1956-1958 for the period 1957-1965, one quarter of this change for the period 1965-1975 and no change occurring after 1975</p> <p><i>Series C:</i> one quarter of the average annual change from 1950 to 1956-1958 for the period 1957 to 1965. No change occurring after 1965</p> <p><i>Series D:</i> the 1956-1958 rate was assumed to continue until 1980. This is a conservative assumption. Besides these, an alternative</p>

ANNEX (concluded)

Identification number	Country	Date of publication	Name of institution or author	Years projected	Classification of heads and population	Number of variants in projections	Basic assumptions of projections	
							Marital-status distribution in sex-age groups	Sex-age (and marital status) specific headship rates
							future years in each series	method was developed by using an exponential formula for the future course of headship rates specific for sex, age and marital status
31	United States of America	1963	Bureau of the Census	1965 1970 1975 1980	Sex, age, marital status and type of family unit	2 (series A and B) A and B correspond to series A and B in the 1958 projections	The methods were the same as in the previous projections in 1958. For the age groups 18-24, linear extrapolation was made for the percentage of single persons on the basis of past trends of average annual changes between 1949-1951 and 1956-1958; for ages 25 and over, on the basis of the ratios of the cohort changes in headship rate from 1951-1953 to 1956-1958 and from 1949-1951 to 1956-1958 respectively for series A and B. The proportion married, spouse-present among the ever-married was held constant all the way through both series	The methods were the same as in the 1958 projections on the basis of the average annual change in headship from 1950 to 1956-1958. For series A; this change would continue to 1965. One half of this change was assumed for the period 1965-1975 and one quarter for the period 1975-1980. For series B: one half of this change would continue for the period 1957-1965, one quarter for the period 1965-1975 and no change would occur after 1975. For male primary individuals, for 1965, a new assumption was made by using the base period 1950 to 1960-1962
32	United States of America	1967	Bureau of the Census	Single years from 1967 to 1985	Sex, age marital status and type of family unit	2 (series H1 and H2)	<p>Series H1 (assumption of marital status corresponding to H1 series) assumes that the propensity to marry and the age at marriage will remain at the levels observed for the 1959 to 1964 period</p> <p>Series H2 assumes that there will be compensation for marriage rates by a sharp reduction in marriages for females and no adjustment in marriages for males</p>	<p>Series H1: the trends exhibited during the period 1957 to 1964 were used to establish projected proportions for age-sex-marital status groups in 1985; proportions for the intervening years were obtained by fitting the curve to the observations for 1957 and 1964 and the projected values for 1985. The resulting proportions constituted the higher household assumptions.</p> <p>Series H2: the second set was produced by averaging the first series of projected proportions with current levels. These figures constitute the lower household assumptions</p>

SOURCES FOR ANNEX

(Identification number corresponds to that in the table)

1. A. R. Hall and M. R. Hill, "Housing demand in Australia, 1959-1974", *Economic Record* (Melbourne), vol. XXXVI, No. 76 (December 1960), pp. 550-567.
2. Belgium, Institut National du Logement, *Estimation des besoins en logements au cours de la période, 1965-1984* (Brussels, November 1965).
3. Julio Vergara Morales, "Estimación de las necesidades de viviendas en Chile entre 1952 y 1982" (E/CN.9/CONF.1/L.18, Spanish only), contribution to United Nations Seminar on the Utilization and Evaluation of Census Data in Latin America, November 30-December 18, 1959, Latin American Demographic Centre, Santiago, Chile.
4. Denmark, Ministry of Housing, "Danish housing requirements 1960-1980" (Copenhagen, December 1965), unpublished paper contributed to the preparation of the study by the Economic Commission for Europe entitled, "The Housing Situation and Perspectives for Long-term Housing Requirements in European Countries", December 1965.
5. Finland, Housing Committee, "Monograph on the housing situation in Finland" (Helsinki, September 1965), unpublished paper contributed to the preparation of the ECE study mentioned in 4 above.
6. Roland Pressart, "Un essai de perspectives de ménages", International Union for the Scientific Study of Population, *International Population Conference* (Im selbstverlag, Wien, 1959), pp. 112-121.
7. Gerard Calot, "Perspectives du nombre des ménages de 1954 à 1976", *Etudes Statistiques*, supplément trimestriel du *Bulletin Mensuel de Statistique* (Paris), No. 2, Avril-Juin 1961 (12^e année), pp. 149-159.
8. M. Febvay, M. Crozé, B. Grais and G. Calot, "Perspectives d'évolution de la population totale, population active et scolaire, ménages", *Etudes Statistiques*, supplément trimestriel du *Bulletin Mensuel de Statistique* (Paris), No. 3, Juillet-Septembre, 1964 (15^e année), pp. 155-219.
9. G. Calot, J.-L. Bodin, R. Salais and S. Hémy, "Population totale, population active et scolaire, nombre de ménages", *Projections démographiques pour la France* (Paris, Institut national de la statistique et des études économiques), No. 6, 1970.
10. H. Schubnell, L. Herberger and H.-J. Borries, "Households and families: analysis and projections with census and micro-census in the Federal Republic of Germany", German Foundation for Developing Countries and Federal Statistical Office of Germany, *Population Data and Use of Computers, with Special Reference to Population Research* (West Berlin/Wiesbaden, 1971).
11. József Tamásy, "Projections of families in Hungary", paper presented to the United Nations World Population Conference, Belgrade, 1965 (WPC/WP/288).
12. Istituto di Statistica dell'Università Degli Studi di Firenze, "La situation du logement en Italie", monograph prepared for the Committee for Housing, Building and Planning of the Economic Commission for Europe, paper No. 4, April 1966.
13. Shigemi Kono, "Wagakuni shotaisu no suikei, 1960-1975" (Household projections for Japan, 1960 to 1975), *Jinko Mondai Kenkyu* (Tokyo), No. 83 (July 1961), pp. 1-13.
14. Koichi Takami, "Nihon no jutaku mondai no shorai" (The future of housing problems in Japan) in Hiroshi Iwai, *et al.*, *Toshi Mondai Koza* (Lectures on urban problems), Vol. 2, *Jutaku, Tochi, Mizu* (Housing, land and water) (Tokyo, Yuhikaku, 1965), pp. 76-98.
15. Japan, Ministry of Health and Welfare, Institute of Population Problems, *Zenkoku Todofuken-betsu Setaisu no Shorai Suikei, Showa 40-65-nen, Showa 41-nen 8-gatsu Suikei* (Future projections of number of households for Japan and 46 prefectures, October 1965 to 1990, as projected in August 1966), *Institute of Population Problems Research Series*, No. 170 (August 1966).
16. Netherlands, Central Directorate of Housing and Building, "Monograph on the housing situation in the Netherlands", specimen statement, 1964, chaps. II-IV (ME/52/64/C.10 (d): GE.64-16071).
17. Norway, Ministry of Municipal and Labour Affairs, "Housing situation and housing prospects in Norway" (November 1965).
18. Sweden, National Housing Board, "Comparison between the housing census in 1945 and that in 1960 — some information about the economic development between these years and the measures of housing policy" (October 1966).
19. United Kingdom, Registrar-General, *Annual Estimates of the Population of England and Wales and Local Authority Area* (London, Her Majesty's Stationery Office, 1955).
20. J. B. Cullingworth, *Housing Needs and Planning Policy* (London, Routledge and Kegan Paul, 1960).
21. L. Needleman, "A long-term view of housing", *National Institute Economic Review* (London), No. 18, November 1961, pp. 19-37.
22. A. H. Walkden, "The estimation of future numbers of private households in England and Wales", *Population Studies* (London), vol. XV, No. 2, pp. 174-186.
23. O. W. Roskill, *Housing in Britain* (London, Town and Country Planning Association, 1964), particularly pp. 34-37.
24. D. C. Paige, "Housing" in W. Beckerman *et al.*, *The British Economy in 1975* (Cambridge, Cambridge University Press, 1965), chap. XII, pp. 366-403 and appendix 12, "Note on housing improvements and subsidies", pp. 579-594.
25. United States National Resources Committee, *The Problems of a Changing Population* (Washington, D.C., United States Government Printing Office, 1938), p. 25.
26. United States Bureau of the Census, "Estimated number of families in the United States: 1940 to 1960", *Population — Special Reports*, Series P-1943, No. 2 (Washington, D.C., United States Government Printing Office, 30 September, 1943).
27. United States Bureau of the Census, "Estimates of number of families in the United States: 1940 to 1960", *Population — Special Reports*, Series P-46, No. 4 (Washington, D.C., United States Government Printing Office, 1 June, 1946).
28. United States Bureau of the Census, "Projections of the number of households and families: 1955 and 1966", *Current Population Reports — Population Characteristics*, Series P-20, No. 42 (Washington, D.C., United States Government Printing Office, 28 December 1952).
29. United States Bureau of the Census, "Projections of the number of households and families", *Current Population Reports — Population Characteristics*, Series P-20, No. 69 (Washington, D.C., United States Government Printing Office, 31 August 1956).
30. United States Bureau of the Census, "Illustrative projections of the number of households and families: 1960 to 1980", *Current Population Reports — Population Characteristics*, Series P-20,

- No. 90 (Washington, D.C., United States Government Printing Office, 29 December 1958).
31. United States Bureau of the Census, "Interim revised projections of the number of households and families: 1965 to 1980", *Current Population Reports — Population Characteristics*, Series P-20, No. 123 (Washington, D.C., United States Government Printing Office, 11 April 1963).
 32. United States Bureau of the Census, "Projections of the number of households and families, 1967 to 1985", *Current Population Reports — Population Estimates*, Series P-25, No. 360 (Washington, D.C., United States Government Printing Office, 20 February 1967).

United States Bureau of the Census, "Summary of demographic projections", *Current Population Reports — Population Estimates*, Series P-25, No. 388 (Washington, D.C., United States Government Printing Office, 14 March 1968), pp. 28-30 and pp. 61-63.

United States Bureau of the Census, "Projections of the number of households and families, 1967 to 1985", *Current Population Reports — Population Estimates*, Series P-25, No. 394 (Washington, D.C., United States Government Printing Office, 6 June 1968).

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 librairie 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.
