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THE ILO POPULATION PROJECTION MODEL (ILO-POP)

A Technical Guide

(Version 1.1. 8/2002)

The International Financial and Actuarial Service (ILO-FACTS)
Financial, Actuarial and Statistical Services Branch
Social Protection Sector
International Labour Office Geneva

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The model described is the latest version of the ILO Population Projection model.

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Aussi disponible en français: *Modèle de projection démographique du BIT* (ISBN 92-2-212749-8)
También disponible en español: Modelo de proyección demográfica de la OIT (ISBN 92-2-312749-1)

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Preface

This technical guide serves as a reference manual for the application of the ILO population projection model.

The population projection model (ILO-POP) is a member of the ILO model family developed by the Financial, Actuarial and Statistical Services Branch of the ILO. The population projection model, however, has a slightly different character to that of the other models. While the methodology for the social budget, pension, or health model was developed by the ILO, the population model largely draws on the methodology developed by the Population Division of the Department for Economic and Social Affairs of the United Nations. The handling of software was developed within the Financial, Actuarial and Statistical Services Branch to ensure compatibility with the other models.

In general, our technical guides and models are made available to experts of the ILO constituency in our member countries as part of technical co-operation activities, or our quantitative training activities. A textbook series *Quantitative methods in social protection* will complement the technical guides with methodological concepts underlying the models.

Our models are subject to constant development. We will be issuing new versions of the models and their technical guides as there are major technical improvements. Whenever major changes are introduced to the model, we will announce andmake it available on our web page: **http://www.ilo.org/public/english/protection/socfas/research/models/models.htm** For any requests for further information or comments on the model, we would like the users to feel free at all times to contact us at **actnet@ilo.org**.

Geneva, September 2001

Michael Cichon
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Karuna Pal

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1. Overview

1.1. Introduction

Population projections provide the framework for the development of labour force and economic growth and therefore are important in estimating the future costs of social protection. The ILO population projection model, called ILO-POP, establishes national population projections on the basis of a certain set of assumptions.

In many developing countries, United Nations' (UN) population projections are generally used in the absence of official national population projections. The UN population projections, published every two years under the title *World Population Prospects*, cover most countries and major regions in the world ([UN1]). The main results of the latest 2000 revision are available in Excel files (See **Annex A**).

ILO-POP adopts the same methodology as the one used by the United Nations. However, the model estimates the population by single age and single year and enables the extension of the projection period for up to 120 years. Furthermore, it can make projections under assumptions different from the standard assumptions made by the UN.

1.2. The modelling environment

(i) Hardware requirements

ILO-POP has been developed for IBM-compatible PCs. The model can be run on an IBM compatible Pentium processor PC with 32 MB of RAM and a CPU speed of at least 120 MHz. The model components require a minimum of approximately 12 MB of hard disk space to load.

(ii) Software used

All components of ILO-POP operate in the Microsoft Excel 2000 for Windows (or higher version) software environment. Both the spreadsheet characteristics as well as the programming characteristics (in Visual Basic for Applications, or VBA) of Excel have been used.

(iii) Programming language

The whole model is essentially a system of interlinked spreadsheets which automatically exchange data. The spreadsheets provide total transparency, as each cell displays a mathematical formula that leads to the result produced by the model.

Calculations are done in the formulae written in the cells in each worksheet. However, several VBA modules have been attached in the result file to draw population pyramids. In principle, the users are not required to modify the VBA programmes. However, the programming

of the VBA modules has been done in a manner which makes it easy for the user to understand what is being done; comments are provided where necessary and variable names describe clearly what they represent.

1.3. Prerequisite

Users of ILO-POP are required to have a basic knowledge of Excel. Ideally, the users should be qualified experts conversant with standard software packages with substantial experience in quantitative aspects of social protection. For users who do not have an in-depth knowledge of Excel, it is recommended that they first read **Annex C** of this manual.

1.4. Key outputs

ILO-POP estimates the sex and age specific population for the next 120 years. It also provides the summarized results by five-year age groups for selected years with graphic presentations. Furthermore, it shows age-total indicators such as growth rates, average age, total fertility rates, life expectancy and infant mortality rates.

Another version of the model which uses less memory but projects for a shorter period (60 years) is also available.

1.5. Files provided

The following files (workbooks) are provided to the users (Excel workbooks are denoted with an extension .xls.):

- ILO Population Projection Model (ILO-POP):
  POP.xls
  MORT.xls
  FERT.xls
  MIG.xls
  RESULT.xls

- UN World Population Prospects (The 2000 Revision) (See **Annex A**)
  INDICATOR.xls
  SEXAGE5Q.xls
  UNfert_mort.xls
  UNAIDS.xls

- UN Model Life Tables (See **Annex B**)
  UNMORTK.xls

It is recommended to place all the files of each model in the same (sub)directory. The generic model files are filled with illustrative data to permit experimentation by users.

Sometimes the files which are transferred from CD-ROM's will retain the "read-only" attribute when they are transferred to the hard disk of your PC. To change this, in **Windows Explorer** select each file individually and in the **File** menu select the **Properties** item. Under the **Attributes** option remove the cross before the read-only option.

1.6. Copyright issues

The copyright of all ILO models rests with the Financial, Actuarial and Statistical Services Branch of the Social Protection Sector of the ILO. Therefore, all users must sign the "Software User-Licence Contract", a copy of which has been attached at the end of this technical guide. The ILO does not accept any responsibility for projection results which are produced with the help of its software programmes by users who do not have a licence. If any requests for further information or software transfer arise, we would like users to feel free at all times to contact our Branch which is shown on the copyright page.

1.7. Downloading files

One can download ILO-POP (and other ILO models) from our webpage:
http://www.ilo.org/public/english/protection/socfas/research/models/models.htm.

To download the files, the user should complete the on-line registration form in the above webpage. The same conditions of the "Software User-Licence Contract" will apply for the on-line distribution of the model. On receipt of youron-line registration form, we will send a return email authorising your application and indicating how to download the files.

2. Projection method

2.1. General

The "cohort component method" is used for population projections. This method is described as follows:

(1) Dividing the total population of the base year into sex-age components (cohorts);

(2) Estimating the year-by-year transition of each cohort taking into account death and migration;

(3) Calculating the newborn by fertility rates and female population.

Figure 1 illustrates the procedure of this method.

2.2. Methods

In terms of equations, the cohort component method can be explained as follows. Let

$L(x, t, s)$: population of curtate age x [1] at the middle of year t,

$P(x, t, s)$: rate of survival from exact age $(x+½)$ at the middle of year t to exact age $(x+1+½)$ at the middle of year $t+1$,

$N(x, t, s)$: net migration (i.e. immigrants less emigrants) during the period from the middle of year $t-1$ to the middle of year t and whose curtate age is x at the middle of year t,

$F(x, t)$: age-specific fertility rates applicable to the period from the middle of year t to the middle of year $t+1$,

$SR(t)$: sex ratio of the newborn in year t,

where s denotes sex; x varies from 0 to 100, t from 0 to 120.

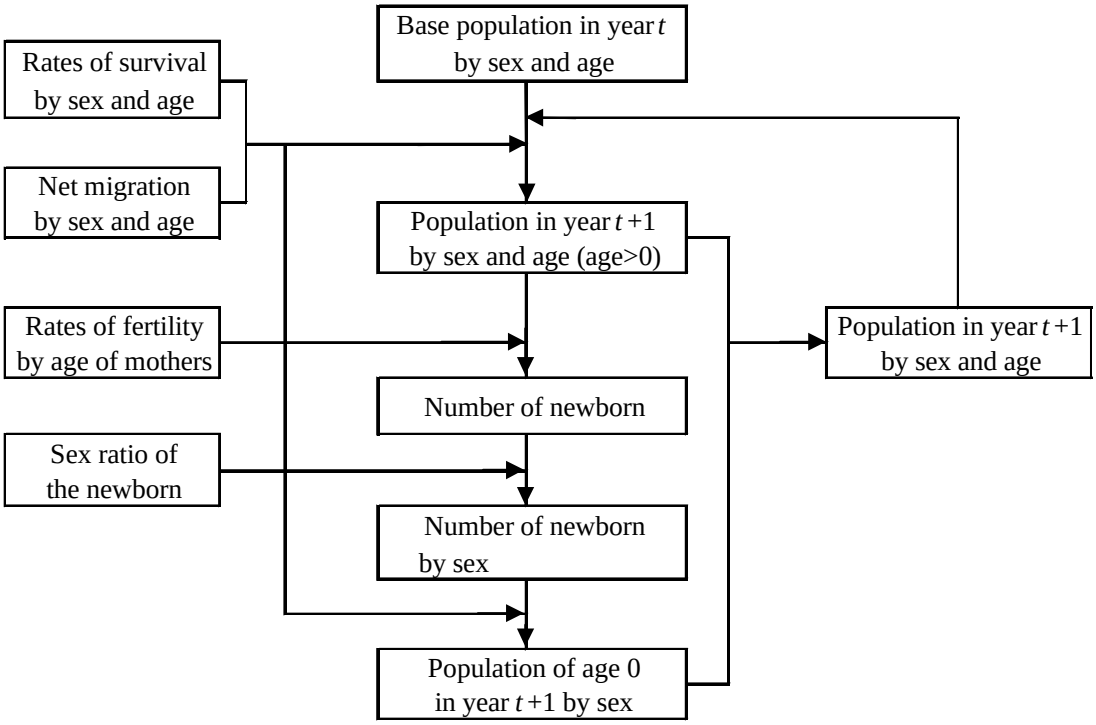
For a cohort already born, its transition is estimated by taking into consideration the survival rates and the net migration:

$$L(x+1, t+1, s) = L(x, t, s) \cdot P(x, t, s) + N(x+1, t+1, s) \qquad [1]$$

(for x = 0,1,2...99 ; t = 0,1,2,... ; s = male, female)

[1] Note that the average age of this population at the middle of the year is equal to $x+½$.

Figure 1. Basic procedure for population projections



The survival rates $P(x, t, s)$ are calculated by using the mortality rates in year t: $q(x, t, s)$.

$$P(x, t, s) = (1 - q(x, t, s)) \div (1 - \tfrac{1}{2} \cdot q(x, t, s)) \cdot (1 - \tfrac{1}{2} \cdot q(x+1, t, s)) \qquad [2]^2$$

For the future cohorts, the number of newborns is estimated by applying fertility rates to the average female population from the middle of year t to the middle of year t+1:

$$NB(t) = \sum_{x=15}^{49} F(x, t) \cdot \tfrac{1}{2} [\, L(x, t, f) + L(x, t+1, f) \,] \qquad [3]$$

Hence, the population of curtate age 0 is calculated as follows:

$$L(0, t+1, s) = k(t, s) \cdot NB(t) \cdot (1 - \tfrac{1}{2} \cdot q(0, t, s)) + N(0, t+1, s) \qquad [4]$$

($k(t, s) = SR(t)/(SR(t)+1)$ if s = male, $k(t, s) = 1/(SR(t)+1)$ if s = female ; for t=0,1,2,...)

2.3. Input data

To carry out the projection as explained in the previous section, the following data are necessary:

(1) Initial population: { $L(x,0,s)$; for all x, s }
(2) Mortality rates: { $q(x, t, s)$; for all x, t, s }
(3) Fertility rates: { $F(x, t)$; for x=15,...,49, for all t }
(4) Sex ratio of the newborn: SR
(5) Net migration: { $N(x, t, s)$; for all x, t, s }

[2] Derivation of equation [2]:

Suppose that the deaths in any given age are spread uniformly during a year. Then, for $0<h<1$, we have:

- ${}_hq_x = h \cdot q_x \quad (\because {}_hp_x = 1 - h \cdot q_x \quad)$
- ${}_{(1-h)}q_{x+h} = (1-h) \cdot q_x / (1-h \cdot q_x) \quad (\because {}_{(1-h)}p_{x+h} = (1- q_x) / (1-h \cdot q_x) \quad)$

Thus,

$${}_1p_{x+\frac{1}{2}} = {}_{\frac{1}{2}}p_{x+\frac{1}{2}} \cdot {}_{\frac{1}{2}}p_{x+1} = (1-q_x) / (1- \tfrac{1}{2} \cdot q_x) \cdot (1-\tfrac{1}{2} \cdot q_{x+1})$$

(See the reference [J] p.34.)

3. Projecting population using ILO-POP

3.1. Contents of the ILO-POP files

ILO-POP consists of 5 Excel files containing in total 31 worksheets and 2 VBA modules. The names of the worksheets provide an indication of their task (for example, PopM undertakes the projection of the male population).

Some worksheets are organized **by sex**. Thus, worksheets whose names end with **M** are for males, **F** for females and **T** for totals. Furthermore, worksheets whose names end with **5** contain data of quinquennial projection years or 5-year summarized data. The following provides a brief description of the files of ILO-POP:

POP.xls (3.6MB; 5 sheets)

-Intpop : Input of the base year population (with interpolation)
-newborn : Calculation of newborn
-PopM : Projection of the male population
-PopF : Projection of the female population
-PopT : Total of male and female population

MORT.xls (4.2MB; 13 worksheets)

-Workmort : UN's working model for mortality improvement
-MortM5 : Male mortality rates for every five years
-MortM : Interpolated male mortality rates for each year
-MortF5 : idem. (for females)
-MortF : idem. (for females)
-YearSp : Presentation of the life tables of a given year
-Unmort (*1) : UN model life tables (8-parameter formula)
-ULTmort (*1) : Ultimate life tables developed by the UN
-General (*2) : Database of the UN model life tables (General pattern)
-South Asia (*2) : idem. (South Asian pattern)
-Latin America (*2): idem. (Latin American pattern)
-Far East (*2) : idem. (Far Eastern pattern)
-Chile (*2) : idem (Chilean pattern)

FERT.xls (0.5MB; 4 worksheets)

-Input : Input of the fertility rates assumptions (base year and target year)
-Fert : Fertility rates for each year (with interpolation)
-DB (*2) : Database of regional fertility rates by 5-year age group 1995-2000 (source UN 2000 revision)
-SingleA : Age-specific fertility rates (base year and target year)

MIG.xls (0.3MB; 3 worksheets)

-UNmig : UN migration model
-NmigM : Male net migration (immigration less emigration) (N.B. temporarily filled with 0)
-NmigF : idem. (for females)

RESULT.xls (2.8MB; 6 worksheets and 2 VBA modules)

-Main_indicators : Age-total demographic indicators
-PopT5 : Total population by 5-year age class and its percentage distribution
-PopM5 : idem. (for males)
-PopF5 : idem. (for females)
-YearSp : Population structure of a selected year with a population pyramid
-Pyramids : Population pyramids for six selected years
-Module1 (*3) : VBA modules to draw population pyramids in "YearSp"
-Module2 (*3) : VBA modules to draw population pyramids in "Pyramids"

Notes:
*1) Ancillary worksheets (Not directly related with the projections. See **Annex C** and [H] in the reference)
*2) Database (Writing is forbidden)
*3) VBA modules (To see them, click **Tools** then select **Macro** and **Visual Basic Editor**.)

3.2. General organization of the worksheets

(i) Data arrangement

All projection worksheets are organized **by year of projection in columns** and **by individual ages in rows**. Thus:

Column B displays data for the base year
Column C displays data for the first year of projection
...
Column DR displays data for the 120^{h} year of projection
and,
Row 5 displays data for population of age 0
Row 6 displays data for population of age 1
...
Row 105 displays data for population of age 100
Row 107 in certain worksheets contains a total of all the entries from ages 0 to 100.

Worksheets which serve for data entry or store intermediary results may have a different organization.

(ii) Convention on colour of cells

In the current version of ILO-POP, the characteristicsof cells are distinguishable by their

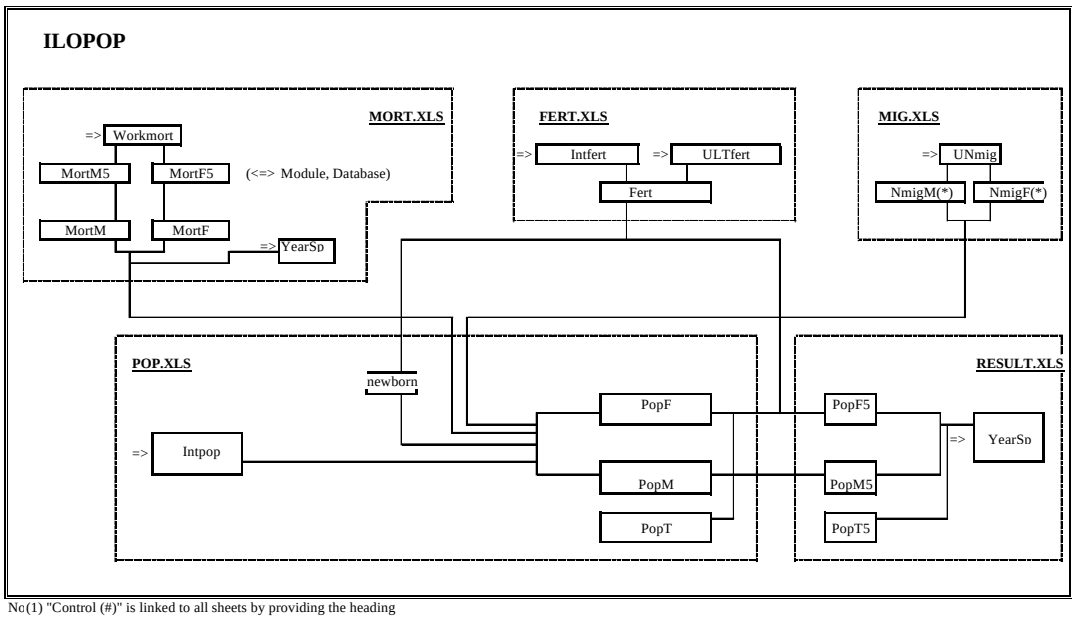
colour. The following convention has been adopted.

Within the worksheets:
Cells with a **white** background contain the formulae which the user may not modify.
Cells with a **green** background contain the formulae which the user can modify as needed.
Cells with a **yellow** background require user input.
Cells with a **blue** font indicate suggested values for the input data.

3.3. Application of ILO-POP

This section provides step-by-step instructions to use ILO-POP for population projections. Figure 2 gives a view of the links between the worksheets. For the methodology of UN population projection, reference should be made to [UN3] or [C-1]. The users may profit by the practical tips provided for Excel in **Annex C**.

Figure 2. Structure chart of ILOPOP



Nc (1) "Control (#)" is linked to all sheets by providing the heading
(2) The sheets with (=>) require input data or specifing assumptions.
(3) The sheets "MigM" and "MigF" have been temporary filled with 0.

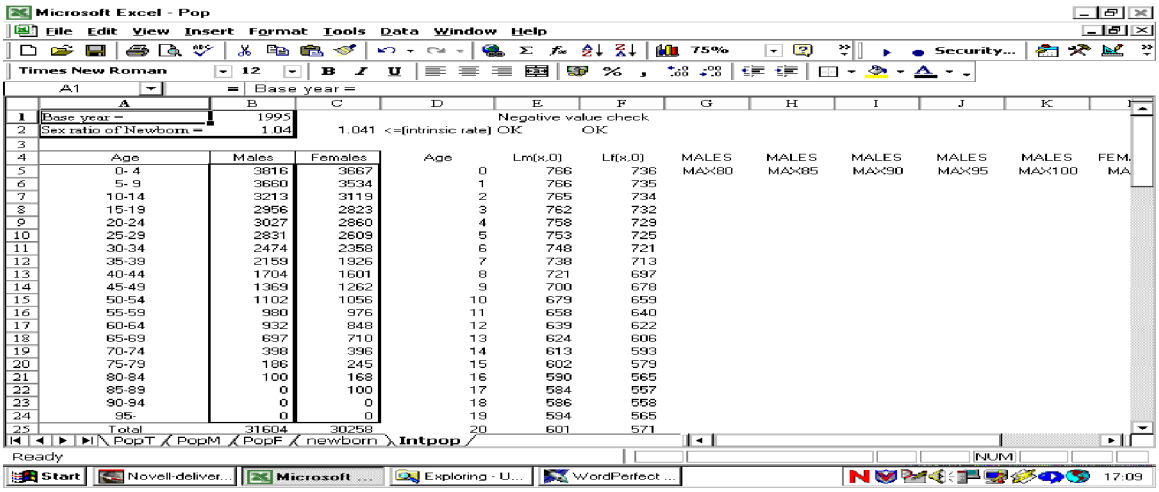
3.3.1. Base year

File: POP.xls

Sheet: “Intpop”

Instructions:

Input the base year in cell B1. The base year is linked to all files and gives the heading for the future years.



3.3.2. Population of the base year

File: POP.xls

Sheet: “Intpop”

Instructions:

1. Input the population of the base year by 5-year age class in columns B and C.

2. In columns E and F, the 5-year population is divided into single-year. These columns are linked to column B in sheets “PopM” and “PopF” in POP.xls.

Remarks:

1. If single age data are available, one can overwrite column B of “PopM” and “PopF”.

2. The best source for the base year population is usually the national population census or official estimates. If no data are available, refer to the estimates provided by the UN, where the estimated population by sex and 5-year age class is available for every quinquennial year from 1950 to 2000 (See **Annex A** or [UN2]).

3. To divide the 5-year grouped data into single-age data, the Sprague interpolation formulae are used. (For the details of these formulae, refer to [H].) Note that the Sprague formula may produce negative values, in particular at the end of the table. The negative number check is done in cells E2 and F2. If these cells indicate "OK", then there is no negative value; if they say "Negative value!", then in the corresponding column there are some negative figures, which appear in red.

3.3.3. Sex ratio of the newborn

File: POP.xls

Sheet: "Intpop"

Instructions:

Input the sex ratio of the newborn in cell B2. The figure in cell C2 indicates the suggested rate calculated from the base year population.

Remark:

The sex ratio is defined as the ratio of the number of newborn boys to that of newborn girls. For example, a sex ratio of 1.0 means the equal probability of boys and girls. For past data, see **Annex A** or [UN1].

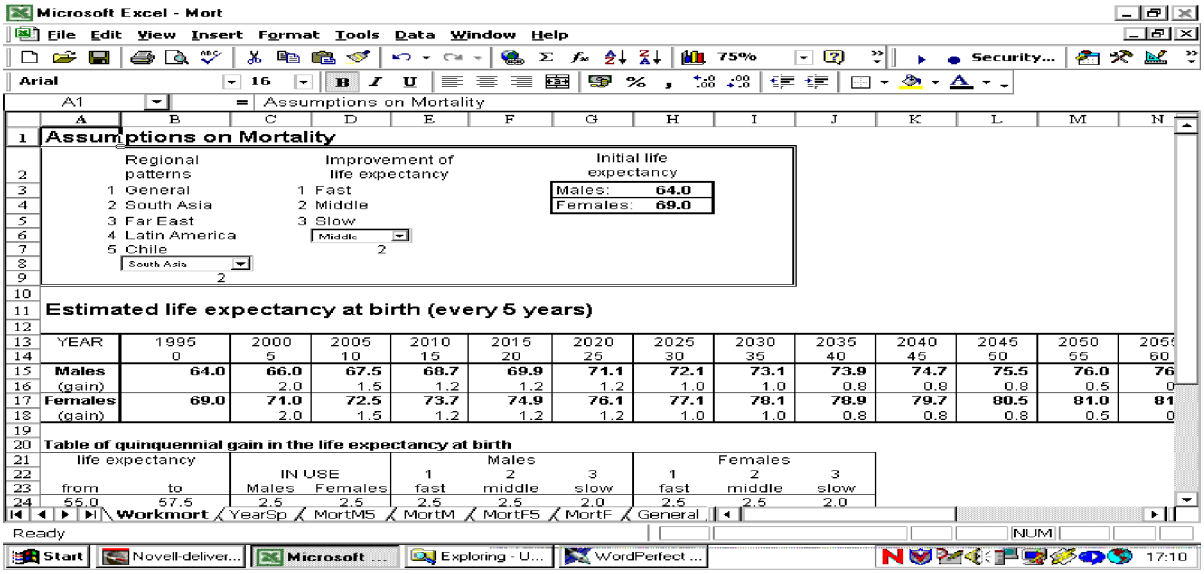
3.3.4. Mortality rates

File: MORT.xls

Instructions:

1. In sheet "Workmort", (i) select the regional age pattern of mortality in the drop-down bar in cell B8; then (ii) select the pattern of mortality improvement in the drop-down bar in cell D6; and (iii) input the life expectancy at birth of both sexes in the base year in cells H3 and H4.

2. In sheets "MortM" and "MortF", the mortality rates by age and projection year are calculated. These sheets are linked to sheets "PopM" and "PopF" in POP.xls.



Description of each worksheet:

(i) Sheet "Workmort"

1. When the user specifies the regional pattern and the pattern of the mortality improvement, the future life expectancy at birth is estimated for every five years by using the "Working Model for Mortality Improvement" developed by the UN. The results are shown in row 15 and row 17.

2. The "Working Model for Mortality Improvement" provides three patterns of mortality improvement: fast, medium and slow.They are shown in the table between row 20 and row 36. This table gives the quinquennial gain in the life expectancy at birth based on the present level of life expectancy at birth (minimum 55 years, maximum 87.5 years). In each case, the gain becomes gradually smaller as the level of life expectancy is higher. Detailed explanations of the "Working Model for Mortality Improvement" is given in [A-1].

3. Once the improvement pattern is specified, the life expectancy in year 5 is calculated by starting from the life expectancy in year 0 and adding the quinquennial gain obtained by the model. Then, applying the same procedure to the value of year 5, the value of year 10 (the gain between year 5 and 10 is equal to or smaller than that of the previous 5 years) is obtained. By iteration, we can obtain the life expectancy of every quinquennial year up to year 120.

(ii) Sheets "MortM5" and "MortF5" (linked to databases "General", "South Asia", "Far East", "Latin America", "Chile"):

1. In the model, mortality rates are taken from the UN Model LifeTables. There are 5 regional patterns concerning the age pattern of mortality rates, namely, "General", "South Asia", "Far East", "Latin America", and "Chile". These five mortality tables are stored in the sheets of the same name.

2. When the user selects the regional age pattern of mortality, the worksheet finds the age and sex-specific mortality rates that match the estimated life expectancy and the age pattern from the database for quinquennial projection years. The life expectancy is measured to the first decimal place. In the calculations, the linear interpolation is applied between the two tables which have the closest life expectancy (integer values) to the estimated value.

(iii) Sheets "MortM" and "MortF":

1. The exponential interpolation is applied to the quinquennial data created in MortM5 and MortF5 for the years in between. These sheets are linked to sheets "PopM" and "PopF".

2. Alternatively, one can overwrite these sheets and fill with data different from the UN Model Life Tables.

(iv) Sheet "YearSp":

When the user specifies a year, the major life table functions of that year (q_x, l_x, e_x) are tabulated. This sheet can be used for checking or for presentation in a report.

(v) Sheet: "UNmort":

This sheet is filled with the 8-parameter formulae of the UN Model Life Tables. By specifying these parameters, one can obtain the life tables (See also [HP1] and **Annex B**).

(vi) Sheet "ULTmort":

1. This contains the "Ultimate Life Tables" developed by the UN. They are constructed by selecting the lowest mortality rates of the world for each sex and age. The life expectancy at birth is 82.5 for males, 87.5 for females (see [A-1]).

2. The original tables give 5-year age abridged rates, therefore an interpolation method was applied to have the single year age results (For details, see [H]).

Note on UN assumptions

The country-specific mortality rates assumptions in the UN projection (2000 revision) are available in Unfert_mort.xls. These assumptions take into account the impact of HIV/AIDS on mortality. To obtain data, follow the instructions shown in **Annex A**.

3.3.5. Fertility rates

File: FERT.xls

ILO-POP provides two methods to set out the future fertility rates.

Standard method : Two-points estimation

Sheet "Input"

(i) Base year

1. In the drop-down bar in cell C5, select the age-pattern of the fertility rates for the base year. There are 30 regional patterns drawn from the UN WPP 2000 revision, contained in the database worksheet "DB".

2. Input the total fertility rate (TFR) in the base year in cell C6. The figure in cell C7 indicates the suggested rate calculated from the base year population.

3. The 5-year age fertility rates which incorporate the age-pattern and the total fertility rate are shown in cells C12-C18. Interpolated single-age fertility rates are calculated in column B of worksheet "SingleA". If data are available, one can overwrite cells C12-C18 of worksheet "Input".

(ii) Target year

1. Input the year in which the TFR attains the ultimate level in cell D4.

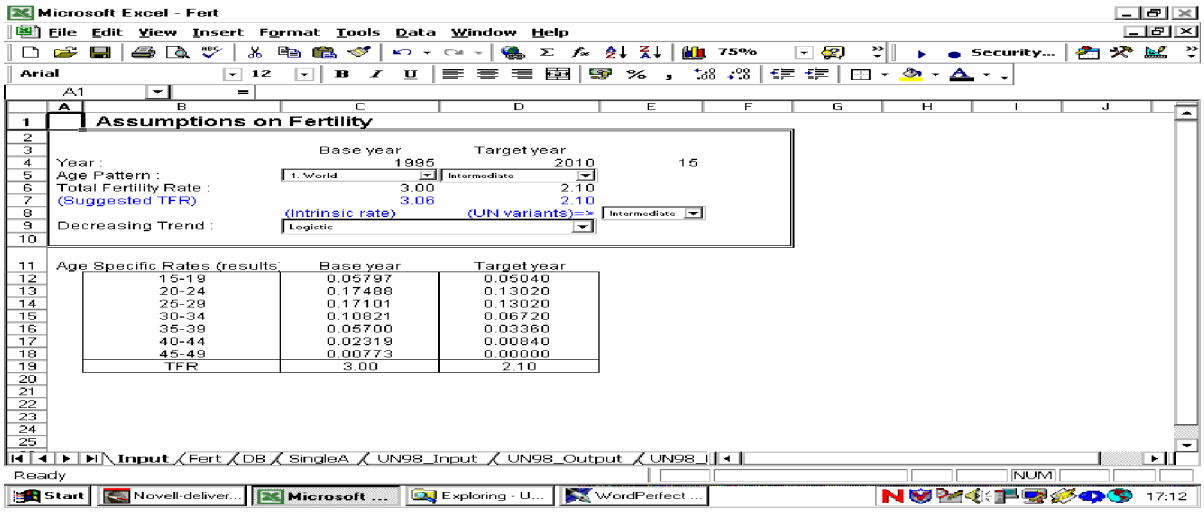
2. Select the child-bearing schedule for the fertility rates of the target year in drop-down bar in cell D5.

3. Input the TFR of the target year in cell D6. If one selects the UN assumption in the drop-down bar in cell E8, the resulting value is shown in cell C6.

(iii) Other years

1. TFR in years between the base year and the target year are calculated by interpolation. In the drop-down bar in cells C9-D9, select the interpolation method. Age distributions of fertility rates are calculated by exponential interpolation. Age-specific fertility rates are then obtained by multiplying TFR by age distributions.

2. Age-specific fertility rates after the target year are the same as those of the target year.



Results:

In sheet "Fert", the age-specific fertility rates are calculated in the following way. This worksheet is linked to the worksheet "newborn" in "POP.xls".

1. The TFR is set out throughout the projection years by the specified values of the base year and target year and by the specified interpolation method.

2. The age pattern of fertility is set out by linearly interpolation the values of the base year and the target year (shown in columns H and I in worksheet "SingleA").

3. The age-specific fertility rates are calculated from the thus estimated TFR and age pattern.

Remarks:

1. The division of the 5-year grouped data into single-age data is done by the Sprague interpolation formulae. In "Intfert" necessary modification is made so that it does not produce negative values. (If a negative figure is found, it is regarded as zero and the other ages in the same class are adjusted so that the total of that class adds up to the given value.)

2. There is no theory for determining the target year for the ultimate fertility level. For the assumption of the UN, refer to [UN3] or [C-1].

3. In addition, three alternatives are set for a child-bearing pattern, namely, late, intermediate and early. For the construction of three child-bearing schedules see [A-2].

4. Concerning the UN assumption of the ultimate TFR level, three variants – low, medium, and high – are set out. The ultimate TFR level is determined according to the TFR in the base year as shown in the table below.

	– Ultimate level of TFR –		
Initial TFR level	Low	Medium	High
2.6 or over	1.6	2.1	2.6
2.1 to 2.6	1.6	2.1	remain
1.5 to 2.1	1.5	1.85	2.1
1.5 or below	remain 1.7	2.1	

5. There are 4 options to interpolate the TFRs in the base year and the target year. They are set out as follows. Let t=0 the base year; t=T the target year; TFR_0 the TFR in the base year; TFR_1 the TFR in the target year. Then, the TFR in year t ($0<t<T$) is obtained by:

Linear :	$TFR_t = (1 - t/T)\cdot TFR_0 + t/T \cdot TFR_1$
Logistic :	$TFR_t = \frac{1}{2}(TFR_0 + TFR_1) + \frac{1}{2}(TFR_0 - TFR_1)\cos(\pi t / T)$
Rapid :	$TFR_t = TFR_0 + (TFR_1 - TFR_0)\sin(\pi t / 2T)$
Slow :	$TFR_t = TFR_1 + (TFR_0 - TFR_1)\cos(\pi t / 2T)$

Note on UN assumptions

The above-explained method was used by the United Nations until the 1994 revision. Since the 1996 revision, however, the UN has adopted a different method. The fertility assumption in the UN projection (2000 revision) is described as follows.

In the first step, countries are grouped into the following three categories. (i) High-fertility countries: those that until 2000 have had no fertility reduction or only a small decline, (ii) Medium-fertility countries: those where TFR has been declining but whose level is still above the replacement level (2.0 children per woman) and, (iii) Low-fertility countries: those with TFR below the replacement level or alike.

Four alternative assumptions are then set out for each group.(1) Under Medium variant, the TFR in high-fertility countries declines on average by 1 child per woman for every decade; the TFR in medium-fertility countries reaches the replacement level before 2050; the TFR in low-fertility countries remains below the replacement level and reaches by 2045-2050 the fertility of the cohort born in the early 1960s. (2) Under Low (resp. High)-fertility variant, in high and medium-fertility countries the ultimate TFR is set lower (resp. higher) than Medium variant by 0.5 children per woman; in low-fertility countries the ultimate TFR is set lower (resp. higher) than Medium variant by 0.4 children per woman. (3) Under Constant fertility assumption, for each country the TFR remains constant at the 1995-2000 level.For detail , see [UN3] or [C-1].

The country-specific fertility rates assumption in the UN projection (2000 revision) are available in UNfert_mort.xls. To obtain data, follow the instructions shown in **Annex A**.

Remark:

The data in UNfert_mort.xls are shown by 5-year age group. The current version of ILO-POP does not automatically produce the single-age interpolated fertility rates from these results. In most cases, however, the two-points method can approximate the UN assumptions by adequately adjusting the input parameters. It is therefore suggested that the user use the UN database as reference and produce the fertility assumptions by using the two-points

method described earlier.

3.3.6. Migration

File: MIG.xls

International migration could fluctuate largely from year to year as a result of changes in world socio-economic conditions or due to political decisions by governments. Because of its high unpredictability, migration is tentatively assumed to be zero. This assumption approximately holds true in a country where the international migration is small relative to the total population.

However, the UN Migration Model is included in sheet "Unmig". This model assumes that the age distribution of immigrants and emigrants are expressed as a weighted sum of two distributions (children and adults), namely:

$Dist(x) = t \cdot c(x) + (1 - t) \cdot a(x)$,
where $c(x) = k \cdot exp(-kx)$, $a(x) = u \cdot exp[\ -u(x-r) - exp(-w(x-r))\ ]$

For more details, reference is made to [CR], [A-3] and [A-4].

To apply the UN migration model, the user has to input the following data in "UNmig":

- Net migration (= Immigrants - Emigrants) in cell Q3.
- Migration rates (= Immigrants / Emigrants) in cell Q4.
- Maximum age of migration in cell Q1.

The results are shown in column B for males and column E for females. These results are not linked with POP.xls.

3.3.7. Projection

File: POP.xls

The projections are made in sheets "PopM", "PopF", and "newborn". Sheet "PopT" gives the population of both sexes:

1. In sheets "PopM" and "PopF", the basic estimation equation [1] is applied to the population older than 1 year of age.

2. In sheet "newborn", the number of newborns is estimated by summing up the product of the female population and the age-specific fertility rates (equation [3]). The total number of newborns is divided into boys and girls using the assumed sex ratio of the newborn. Finally, the population aged-0 is calculated by taking into account the mortality rates and net migration (equation [4]).

3.3.8. Result

File: RESULT.xls

(i) Sheet "Main_indicators"

This sheet shows major age-total demographic indicators, including:
- Total population (males, females, both sexes)
- Growth rates (males, females, both sexes)
- Sex ratio
- Average age (males, females, both sexes)
- Total fertility rate
- Life expectancy at birth (males, females)
- Infant mortality rates
- Population change by cause (death, birth, net migration)
- Rates of population change by cause (death, birth, net migration)

(ii) Sheets "PopM5", "PopF5", and "PopT5"

These sheets give the following results concerning male population, female population, and both sexes, respectively:

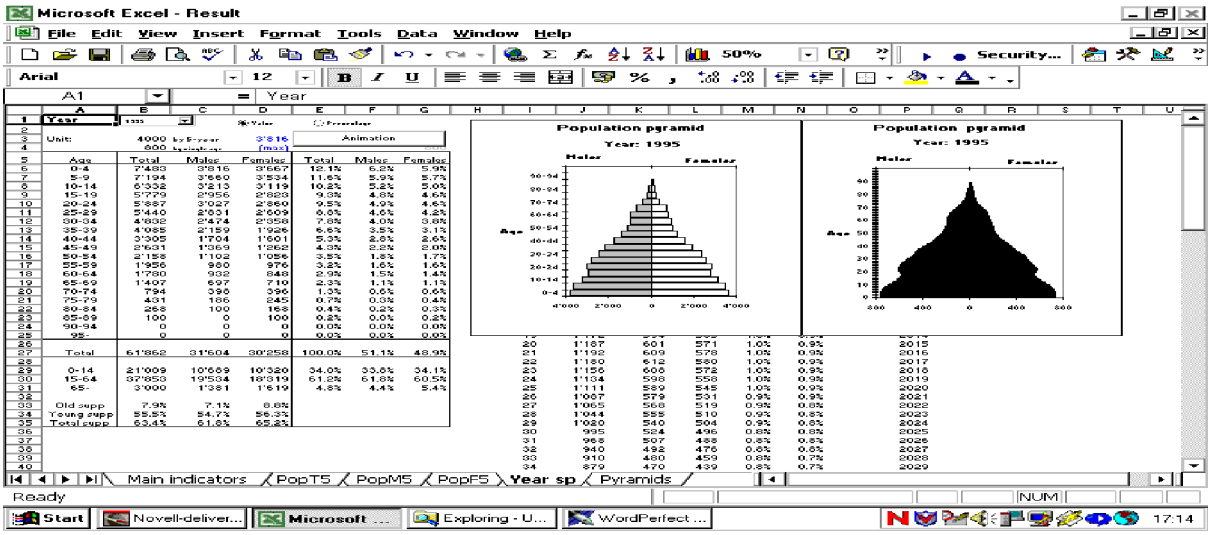
- number and percentage of the population by 5 year age class (0-5, ..., 95 and over);
- number of young population (0-14), active age population (15-64), old population (65 and over);
- the ratio of the young population, the old population and both young and old in terms of the active age population (called the demographic dependency ratio).

(iii) Sheet "YearSp"

This sheet gives the detailed information for a selected year. To specify the year, one should select the year in the drop-down bar in cell B1. This sheet also produces population pyramids by 5-year and by single-year.

1. Choose the measure (nominal values or percentage) from the two **tool buttons** in cells D1 and F1. In the nominal value presentation, the user has to input in cell B3 the maximum scale of the horizontal axis of the 5-year pyramid. The maximum scale should be set at larger than the value in cell D3, which is the size of the largest 5-year age group shown in the table. The maximum scale for the single age pyramid is automatically calculated in cell B4 as one-fifth of the 5-year pyramid. The user may change this figure by overwriting it.

2. If one clicks the button "Animation" located in cells E3-G3, it will show the development of the population ageing by sequentially changing the year from the first year to the final year of projection.

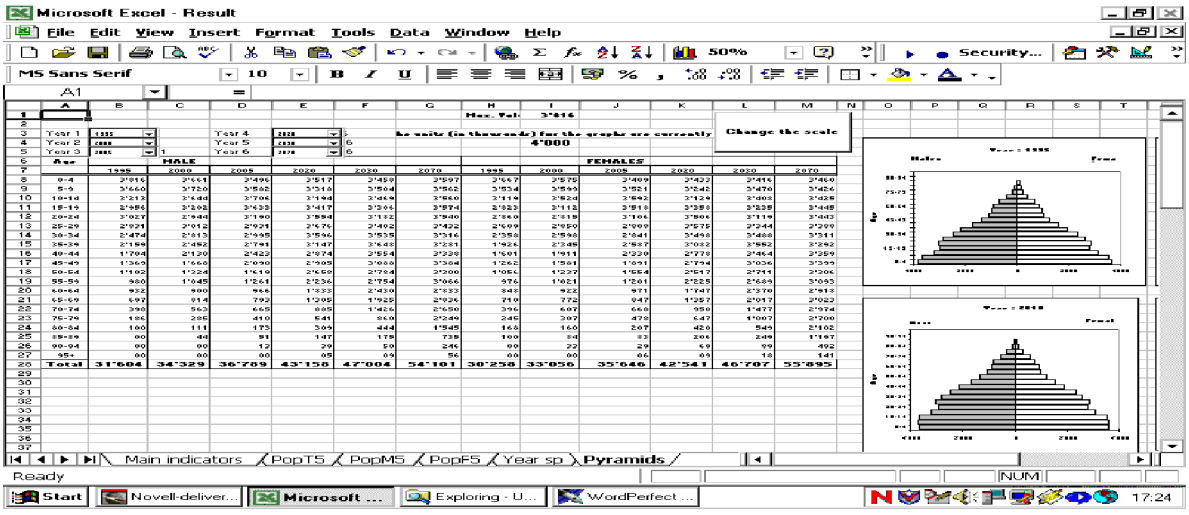


(iv) Sheet "Pyramids"

This sheet produces the population pyramids by 5-year age-class for six selected years (in nominal values only).

1. The user should select six years in the drop-down bars in cells B3-B5 and E3-E5.

2. The maximum scale of the horizontal axis is linked to the input value in "Yearsp". The value in cell I1 shows the size of the maximum 5-year age-group in the table. If the user changes the scale, then click the **button** <change the scale> shown in cells L1-L4 Otherwise, a message "press the <change the scale> button" appears in red.



Annex A: United Nations World Population Prospects (The 2000 Revision)

1. Introduction

Population projections provide a general framework for the development of various demographic and economic indicators. In the absence of official population projections, which is often the case in developing countries, projections by the United Nations are widely used.

The results of United Nations World Population Prospects 1950-2050 (The 2000 Revision) are available in electronic form (copyright UN). To have easy access to these data with the software used by the ILO, these data have been converted into Excel workbooks and supplemented with a user-friendly interface.

The UN projections are revised and updated every two years. The latest revision was made in 2000. The results have been presented in the following UN publications:

World Population Prospects (The 2000 Revision)[3]:

- *Volume I : Comprehensive Tables*

- *Volume II : Sex and Age Distributions of the World Population*

- *Volume III : Analytical Report*

- *DATA IN DIGITAL FORM*

The key data contained in these publications have been put into three Excel workbooks: INDICATOR.xls, SEXAGE5Q.xls and UNfert_mort.xls. These workbooks can be opened with Excel 2000.

2. United Nations population projections

The UN projections have the following features:

(i) Geographical coverage

The UN projections cover 261 countries and regions in the world – a list of these countries and regions is found in Appendix 1. Small countries or areas with less than 140,000 inhabitants

[3] Reference was made to the following document: "World Population Prospects, The 2000 Revision, Highlights (DRAFT, ESA/P/WP.165, 28 February 2001)", which is available from web site: http://www.un.org/esa/population/unpop.htm

in 2000 (there are 41 cases in total) are not shown separately, but they are included in the regional aggregated figures.

(ii) Projection period

Data are presented for each quinquennial year from 1950 to 2050. Results comprise of the estimates of the past development, i.e. 1950-2000, and the projections of the future development, i.e. 2005-2050.

(iii) Methods and Assumptions

The cohort component method is used for the projection. Four alternative assumptions have been made concerning the development of future fertility rates (medium, high, low and constant); and one assumption has been made on the development of future mortality rates.

In summary, for each country or region, the following five projection results are provided[4]:

(A) Estimates (1950-2000)
(B) Medium fertility variant projection (2005-2050)
(C) High fertility variant projection (2005-2050)
(D) Low fertility variant projection (2005-2050)
(E) Constant-fertility variant projection (2005-2050)

3. Main demographic indicators

The Excel file INDICATOR.xls contains the data of *"World Population Prospects (The 2000 Revision) Volume I : Comprehensive Tables" (to appear)*

(i) Outputs

For each country/region and for each type of result, the demographic indicators listed below are presented.

1. Total population (in thousands)
2. Male population (in thousands)
3. Female population (in thousands)
4. Sex ratio (per 100 females)
5. Median age
6. Population below 15 (in thousands)
7. Population aged 15-64 (in thousands)
8. Population aged 60 or over (in thousands)
9. Population aged 65 or over (in thousands)
10. Population aged 80 or over (in thousands)
11. Dependency ratio (per 1,000)

[4] In addition, projection results under constant-mortality variant and zero-migration variant are available in the 2000 revision.

12. Women aged 15-49 (in thousands)
13. Child-women ratio (per 1,000 females)
14. Number of births (in thousands for five years)
15. Number of both sexes deaths (in thousands for five years)
16. Number of male deaths (in thousands for five years)
17. Number of female deaths (in thousands for five years)
18. Number of net migration (in thousands for five years)
19*. Sex ratio at birth (per female birth)
20. Average annual rate of growth (in per cent)
21. Crude birth rate (per 1,000)
22. Crude death rate (per 1,000)
23. Rate of natural increase (per 1,000)
24. Net migration rate (per 1,000)
25. Net reproduction rate (per woman)
26. Total fertility rate (per woman)
27. Life expectancy at birth for both sexes combined (in years)
28. Male life expectancy at birth (in years)
29. Female life expectancy at birth (in years)
30. Infant mortality rate (per 1,000 births)
31**. Mortality under age 5 (per 1,000 births)

* 1995-2050 only
** 1990-2050 only

Notes:

- Sex ratio = Male population / Female population
- Median age : the age such that the population above and below that age are equal
- Dependency ratio= (Population aged 0-14 +Population 65 and over) / Population aged 15-64
- Child-women ratio = Population aged 0-4 / Female population aged 15-49
- Sex ratio at birth = The number of male newborn / The number of female newborn
- Crude birth (death) rate = The number of newborn (deaths) / Total population
- Rate of natural increase = Crude birth rate – Crude death rate
- Net migration rate = (Immigration – Emigration) / Total population
- Gross reproduction rate = Sum of age-specific fertility rates of daughters for all ages 15-49
- Net reproduction rate = Sum of the product of age-specific fertility rates of daughters of age x and the rate of survival until age x for x = 15 to 49
- Total fertility rate (per woman) = Sum of age-specific fertility rates for all ages 15-49
- Infant mortality rate = The number of infant deaths (within one year) / The number of live births

(ii) Structure

INDICATOR.xls is about 6.9 MB and has 8worksheets. Appendix 2 illustrates its structure.

(iii) How to get the results

1° Open INDICATOR.xls, then go to the worksheet "Input"

2° The user has to find the code of the relevant country/region.

- To find the code: (i) Highlight column C, (ii) Click "Edit" then "Find" (then, a dialogbox will appear), (iii) In the dialogbox "Find What", write the name of the country/region, (iv) Click "Find Next", (v) Continue until you arrive at the desired country/region. The code is found in column B against the name of the country/region.

3° Input the code of the relevant country/region in cell B4 of this sheet.

Results:

1° Main results are tabulated in the worksheet "Output".

2° Worksheet "Comparison" shows the comparison of the main results and the assumptions for the four different alternative projections.

(iv) Remark

Worksheets "DB_Estimates", "DB_Medium", "DB_High", "DB_Low" and "DB_Constant" are databases. Writing in these sheets is not permitted.

4. Sex and age distributions

The Excel file SEXAGE5Q.xls contains the data of *"World Population Prospects (The 2000 Revision) Volume II : Sex and Age Distributions of the World Population" (to appear).*

(i) Outputs

For each country/region and for each type of result, population by sex and 5 year age group is presented.

(ii) Structure

SEXAGE5Q.xls is about 9.8 MB, and has 18 worksheets and 2 module sheets of VBA. Appendix 2 illustrates its structure (the module sheets are not shown).

(iii) How to get the main results

1° Open SEXAGE5Q.xls, and go to the worksheet "Input"

2° The user has to find the code of the relevant country/region.

- To find the code: (i) Highlight column C, (ii) Click "Edit" then "Find" (then, a

dialogbox will appear), (iii) In the dialogbox "Find What", write the name of the country/region, (iv) Click "Find Next", (v) Continue until you arrive atthe desired country/region. The code is given in column B against the name of the country/region.

3° Input the code of the relevant country/region in cell B4 of this sheet.

Main results

Results are presented in four worksheets, namely, "Medium", "High","Low" and "Constant". Estimates for past years are identical in all sheets.

(iv) How to draw a population pyramid

Once the main results are obtained, one can also draw the population pyramid for a specific year. To do this, follow the procedures indicated below:

1° Go into the worksheet "Year sp".

2° Choose the option which shows results in values (button in D3) or in percentages (button in F3). In the former case, input the maximum range of the scale in cell D5.

3° Select the variant from the drag-bar in cell B2.

4° Select the year from the drag-bar in cell B3.

5° If necessary, readjust the maximum range in D5, in case the input value in step 2 is not appropriate.

In addition, there is a function to see the dynamical development of the population pyramid. Follow the procedure below:

1° Adjust the maximum range so that the pyramid fits into the scale for all projection years. (In particular, check the year 2050, final year of projection.)

2° Click the button "Animation" in cells F5-G5.

Furthermore, in Worksheet "Comparison6", one can draw the population pyramid for six selected years. Follow the procedure indicated below:

1° In each of the six drag-bars, specify the year.

2° If necessary, adjust the maximum range in cell I4 and press the button for the scale change. (This range is initially set at the same value as thatin Worksheet "Year sp".) A warning will appear if you input the maximum range but do not press the button.

(v) Remark

Worksheets "DB_Estimates", "DB_Medium", "DB_High", "DB_Low" and "DB_Constant" (for each sex) are databases. Writing is not permitted in these sheets.

5. Assumptions on age-specific fertility and mortality

The Excel file UNfert_mort.xls contains the assumptions on age-specific fertility rates and mortality rates of "World Population Prospects (The 2000 Revision)".

(i) Outputs

For each country/region, the following data are presented:

1. Fertility rates for 5 year age groups from 1995-2000 to 2045-2050.

2. Life tables (survival functions, 5-year mortality rates, life expectancies) from 1995-2000 to 2045-2050.

(ii) Structure

UNfert_mort.xls is about 3.9 MB, and has3 worksheets. Appendix 2 illustrates its structure.

(iii) How to get the results

1° Open UNfert_mort.xls, and go to the worksheet "Input".

2° The user has to find the code of the relevant country/region.

- To find the code: (i) Highlight column C, (ii) Click "Edit" then "Find" (then, a dialogbox will appear), (iii) In the dialogbox "Find What", write the name of the country/region, (iv) Click "Find Next", (v) Continue until you arrive at the desired country/region. The code is given in column B against the name of the country/region.

3° Input the code of the relevant country/region in cell B4 of this sheet.

4° Results are then presented in the worksheet "Output".

Furthermore, worksheets "MortM" and MortF" indicate single-year results using appropriate interpolation formulae.

6. AIDS indicators

The Excel file UNAIDS.xls contains key indicators related with AIDS for 45 countries[5] with significant AIDS prevalence based on "World Population Prospects (The 2000 Revision)".

7. Final remarks

(i) Updating

The next revision of the UN projections is expected for 2002. These workbooks will be updated as soon as the data of the new revision are available.

(ii) Data precision

Results of projected population have been given to the third decimal place. Since the unit is thousands, this implies that population numbers are shown to the order of one person.

(iii) Remark on the copyright

The World Population Prospects, as well as their original data diskettes or CD-ROMs, are copyrighted by the United Nations. As it is not allowed to use the data diskettes to prepare derivative work without permission from the United Nations, the use of this Excel version should be restricted to *internal use only.*

[5] These countries are: Angola, Bahamas, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Dominican Republic, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea-Bissau, Haiti, Honduras, India, Kenya, Lesotho, Liberia, Malawi, Mali, Mozambique, Myanmar, Namibia, Nigeria, Rwanda, Sierra Leone, South Africa, Swaziland, Tanzania, Thailand, Togo, Uganda, Zambia, Zimbabwe.

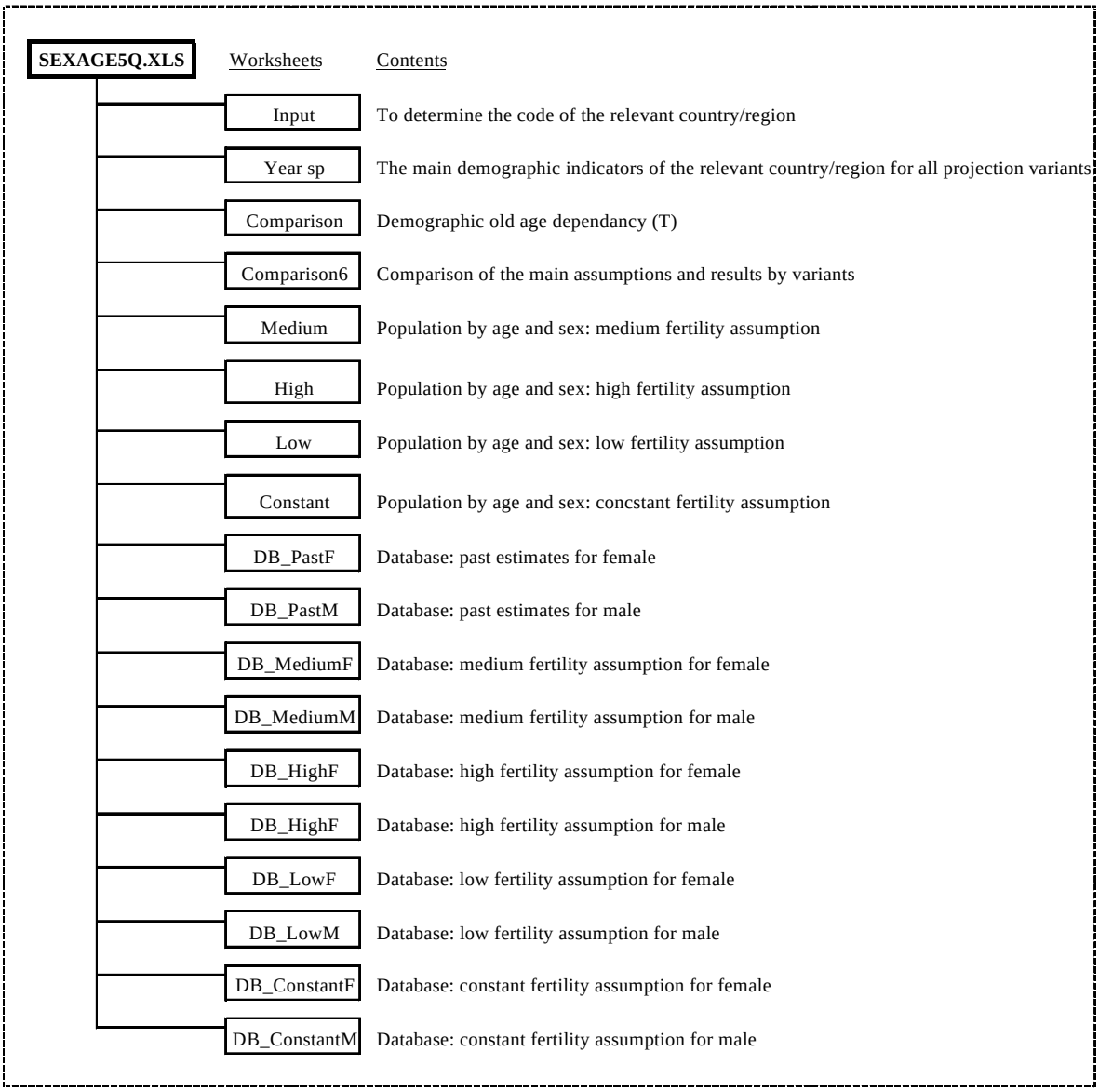
Appendix 1. List of countries and areas (UN World Population Prospects 2000 revision)

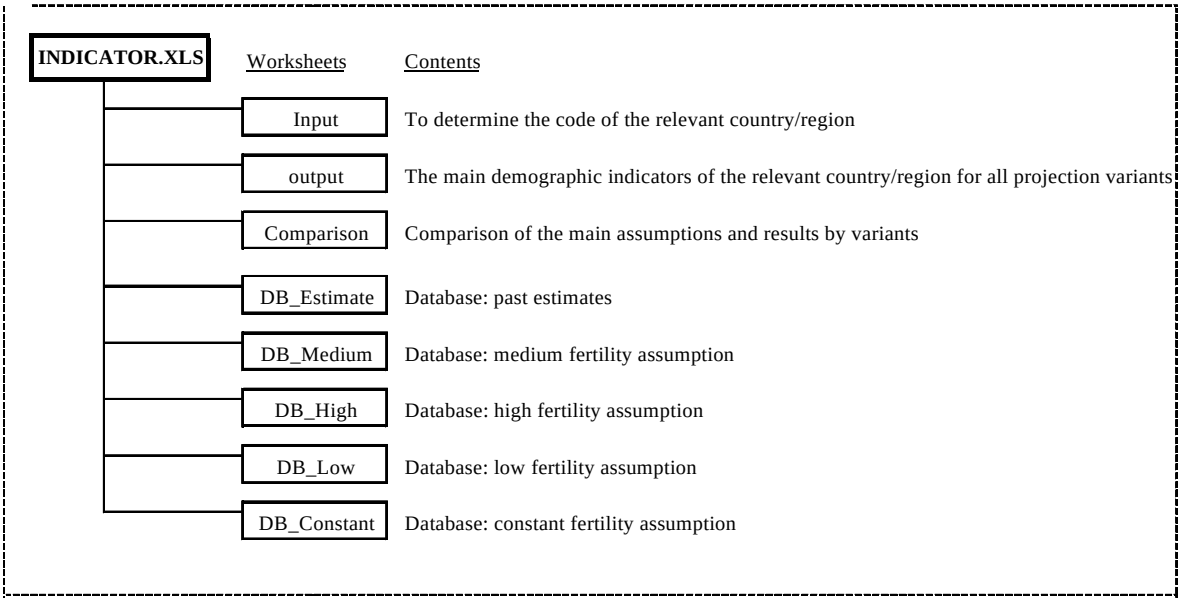
	Code	Country/region
	77	Afghanistan
	5	Africa
	150	Albania
	36	Algeria
*	250	American Samoa
*	151	Andorra
	26	Angola
*	177	Anguilla
*	178	Antigua and Barbuda
	211	Argentina
	104	Armenia
*	179	Aruba
	67	Asia
15	233	Australia
	232	Australia/New Zealand
	166	Austria
	105	Azerbaijan
	180	Bahamas
	106	Bahrain
	78	Bangladesh
	181	Barbados
	125	Belarus
	167	Belgium
	202	Belize
	50	Benin
*	226	Bermuda
	79	Bhutan
	212	Bolivia
	152	Bosnia and Herzegovina
	44	Botswana
	213	Brazil
*	182	British Virgin Islands
	92	Brunei Darussalam
	126	Bulgaria
	51	Burkina Faso
	7	Burundi
	93	Cambodia
	27	Cameroon
	227	Canada
	52	Cape Verde
12	176	Caribbean
*	183	Cayman Islands
	28	Central African Republic
	201	Central America
	29	Chad
	136	Channel Islands
	214	Chile
5	69	China
6	70	China, Hong Kong SAR
7	71	China, Macau SAR
	215	Colombia
	8	Comoros
	30	Congo
*	251	Cook Islands
	203	Costa Rica
	53	Côte d'Ivoire
	153	Croatia
	184	Cuba
	107	Cyprus
	127	Czech Republic
	72	Dem. Peoples's Rep. of Korea
	31	Dem. Rep. of the Congo
	137	Denmark
	9	Djibouti
*	185	Dominica
	186	Dominican Republic
	94	East Timor
1	6	Eastern Africa
	68	Eastern Asia
	124	Eastern Europe
	216	Ecuador
	37	Egypt
	204	El Salvador
	32	Equatorial Guinea
	10	Eritrea
	138	Estonia
	11	Ethiopia
	123	Europe
*	139	Faeroe Islands
*	217	Falkland Islands (Malvinas)
	236	Fiji
	140	Finland
	168	France
	218	French Guiana
	252	French Polynesia
	33	Gabon
	54	Gambia
	109	Georgia
	169	Germany
	55	Ghana
*	154	Gibraltar
	155	Greece
*	228	Greenland
*	187	Grenada
	188	Guadeloupe
	242	Guam
	205	Guatemala
	56	Guinea
	57	Guinea-Bissau
	219	Guyana
	189	Haiti
*	156	Holy See
	206	Honduras
	128	Hungary
	141	Iceland
	80	India
	95	Indonesia
	81	Iran (Islamic Republic of)
	110	Iraq
	142	Ireland
*	143	Isle of Man
	111	Israel
	157	Italy
	190	Jamaica
	73	Japan
	112	Jordan
	82	Kazakhstan
	12	Kenya
*	243	Kiribati
	113	Kuwait
	83	Kyrgyzstan
	96	Lao People's Dem. Republic
	175	Latin America and Caribbean
	144	Latvia
c	4	Least developed countries
	114	Lebanon
	45	Lesotho
b	3	Less developed regions
	300	Less developed regions without China
	301	Less developed regions without the least developed countries
	58	Liberia
	38	Libyan Arab Jamahiriya
*	170	Liechtenstein
	145	Lithuania
	171	Luxembourg
	13	Madagascar
	14	Malawi
	97	Malaysia
	84	Maldives
	59	Mali
	158	Malta
*	244	Marshall Islands
	191	Martinique
	60	Mauritania
2	15	Mauritius
	235	Melanesia
	207	Mexico
16	241	Micronesia
*	245	Micronesia (Fed. States of)
3	25	Middle Africa
*	172	Monaco
	74	Mongolia
*	192	Montserrat
a	2	More developed regions
	39	Morocco
	16	Mozambique

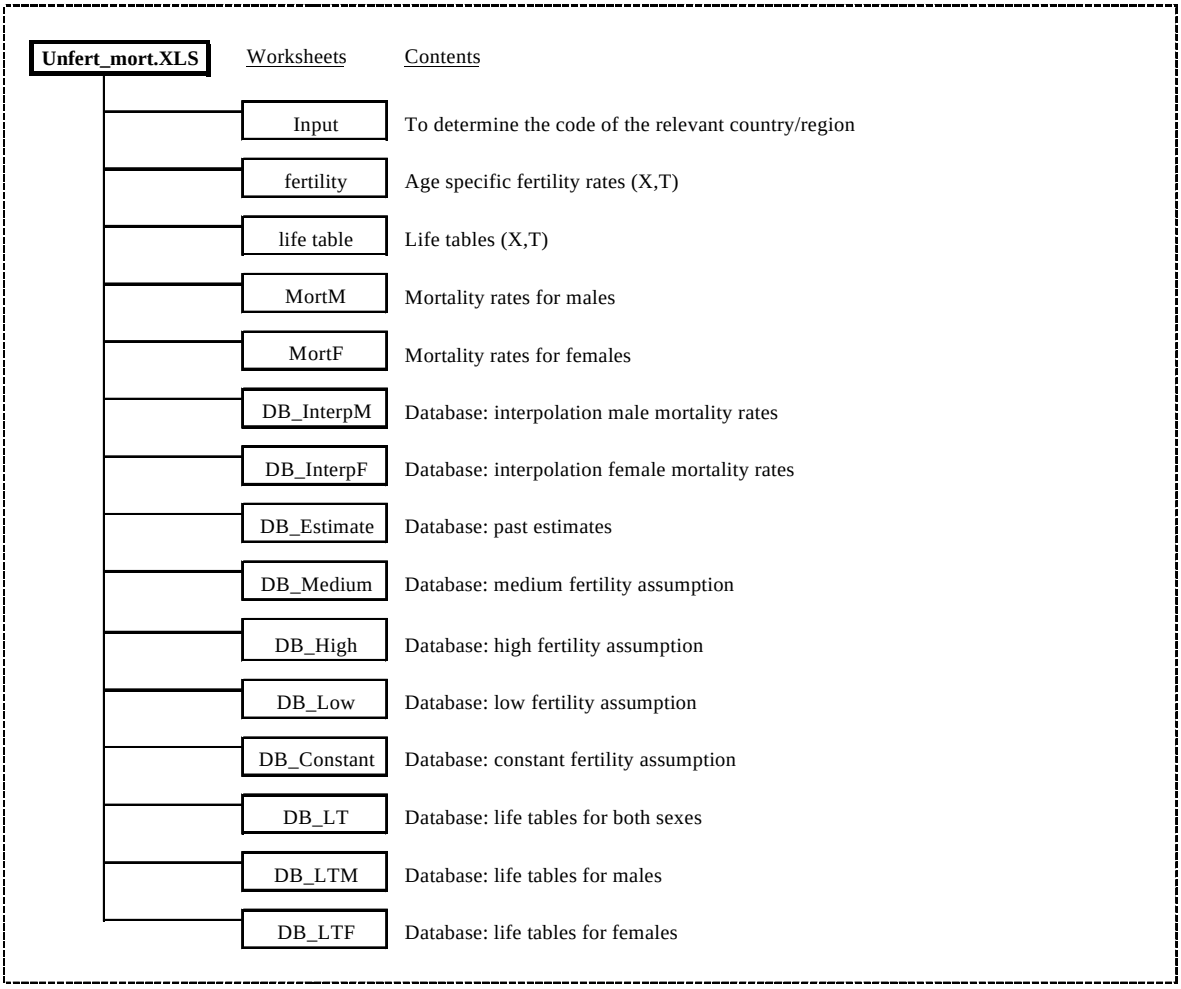
	98	Myanmar		132	Russian Federation		66 Togo
	46	Namibia		18	Rwanda	*	256 Tokelau
*	246	Nauru	*	63	Saint Helena	*	257 Tonga
	85	Nepal	*	195	Saint Kitts and Nevis		198 Trinidad and Tobago
	173	Netherlands		196	Saint Lucia		41 Tunisia
	193	Netherlands Antilles	*	229	Saint Pierre and Miqueleon		120 Turkey
	237	New Caledonia	*	197	Saint Vincent and Grenadines		89 Turkmenistan
	234	New Zealand		255	Samoa	*	199 Turks and Caicos Islands
	208	Nicaragua	*	160	San Marino	*	258 Tuvalu
	61	Niger	*	34	Sao Tome and Principe		21 Uganda
	62	Nigeria		118	Saudi Arabia		134 Ukraine
*	253	Niue		64	Senegal		121 United Arab Emirates
	35	Northern Africa	*	19	Seychelles		148 United Kingdom
14	225	Northern America		65	Sierra Leone		22 United Republic of Tanzania
8	135	Northern Europe		100	Singapore		230 United States of America
*	247	Northern Mariana Islands		133	Slovakia	*	200 United States Virgin Islands
	146	Norway		161	Slovenia		223 Uruguay
	115	Occupied Palestinian Terr.		239	Solomon Islands		90 Uzbekistan
	231	Oceania		20	Somalia		240 Vanuatu
	116	Oman		47	South Africa		224 Venezuela
	86	Pakistan	13	210	South America		102 Viet Nam
*	248	Palau		76	South-central Asia	*	259 Wallis and Futuna Islands
	209	Panama		91	South-eastern Asia	4	49 Western Africa
	238	Papua New Guinea		43	Southern Africa		103 Western Asia
	220	Paraguay	9	149	Southern Europe	11	165 Western Europe
	221	Peru		162	Spain		42 Western Sahara
	99	Philippines		87	Sri Lanka		1 World
*	254	Pitcairn		302	Sub-Saharan Africa		122 Yemen
	129	Poland		40	Sudan		164 Yugoslavia
17	249	Polynesia		222	Suriname		23 Zambia
	159	Portugal		48	Swaziland		24 Zimbabwe
	194	Puerto Rico		147	Sweden		
	117	Qatar		174	Switzerland		
	75	Republic of Korea		119	Syrian Arab Republic		
	130	Republic of Moldova		88	Tajikistan		
	17	Reunion	10	163	TFYR Macedonia		
	131	Romania		101	Thailand		

(*) Countries with less 140 000 persons in 2000. Only total population is presented in INDICATOR. In UNfert_mort and in SEXAGE5Q, these countries are not shown separately, but they are included in the regional aggregated figures.
(a) The more developed regions comprise all regions of Europe plus Northern America, Australia/New Zealand and Japan.
(b) The less developed regions comprise all regions of Africa, Asia (excluding Japan), Latin America and the Caribbean plus Melanesia,
(c) The least developed countries, as defined by the United Nations General Assembly in 1998, include 48 countries: Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People's Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Samoa, São Tomé and Príncipe, Sierra Leone, Solomon Islands, Somalia, Sudan, Togo, Tuvalu, Uganda, United Republic of Tanzania, Vanuatu, Yemen and Zambia. These countries are also included in the less developed regions.
(1) Including Seychelles.
(2) Including Agalega, Rodrigues and Saint Brandon.
(3) Including São Tomé and Príncipe.
(4) Including Saint Helena, Ascension and Tristan da Cunha.
(5) For statistical purposes, the data for China do not include Hong Kong and Macao Special Administrative Regions (SAR) of China.
(6) As of 1 July 1997, Hong Kong became a Special Administrative Region (SAR) of China.
(7) As of 20 December 1999, Macao became a Special Administrative Region (SAR) of China.
(8) Including Faeroe Islands and Isle of Man.
(9) Including Andorra, Gibraltar, Holy See and San Marino.
(10) The former Yugoslav Republic of Macedonia.
(11) Including Liechtenstein and Monaco.
(12) Including Anguilla, Antigua, Aruba, British Virgin Islands, Cayman Islands, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Turks and Caicos Islands, and United States Virgin Islands.
(13) Including Falkland Islands (Malvinas).
(14) Including Bermuda, Greenland, and Saint Pierre et Miquelon.
(15) Including Christmas Island, Cocos (Keeling) Islands and Norfolk Island.
(16) Including Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Northern Mariana Islands, and Palau.
(17) Including American Samoa, Cook Islands, Pitcairn, Tokelau, Tonga, Tuvalu, and Wallis and Futuna Islands.

Appendix 2. Contents of the files




INDICATOR.XLS
Worksheets
Contents
Input
To determine the code of the relevant country/region
output
The main demographic indicators of the relevant country/region for all projection variants
Comparison
Comparison of the main assumptions and results by variants
DB_Estimate
Database: past estimates
DB_Medium
Database: medium fertility assumption
DB_High
Database: high fertility assumption
DB_Low
Database: low fertility assumption
DB_Constant
Database: constant fertility assumption


Unfert_mort.XLS
Worksheets
Contents
Input
To determine the code of the relevant country/region
fertility
Age specific fertility rates (X,T)
life table
Life tables (X,T)
MortM
Mortality rates for males
MortF
Mortality rates for females
DB_InterpM
Database: interpolation male mortality rates
DB_InterpF
Database: interpolation female mortality rates
DB_Estimate
Database: past estimates
DB_Medium
Database: medium fertility assumption
DB_High
Database: high fertility assumption
DB_Low
Database: low fertility assumption
DB_Constant
Database: constant fertility assumption
DB_LT
Database: life tables for both sexes
DB_LTM
Database: life tables for males
DB_LTF
Database: life tables for females

Annex B: United Nations Model Life Tables

1. United Nations model life tables

1.1. The United Nations has developed model life tables ([UN3], [UN4]) for the purpose of demographic analysis of a country where no national life tables are available.

1.2. The UN model life tables comprise of the following 5 regional age patterns:

(i) General pattern;
(ii) South Asian pattern;
(iii) Far Eastern pattern;
(iv) Latin American pattern;
(v) Chilean pattern.

1.3. Each pattern contains 41 life tables according to the life expectancy at birth ranging from 35 years of age to 75 years of age.

1.4. In each table, mortality rates are constructed by using of the following 8-parameter formula developed by Heligman and Pollard [HP]:

$$q_x = A^{(x+B)^C} + D \cdot \exp(-E[\ln(x) - \ln(F)]^2) + \frac{GH^x}{1+GH^x},$$

for x = 0,1,2,...,99.

1.5. By specifying the 8 parameters in the above formula, one can obtain the corresponding life table. Due to precision of data in [UN4], some life tables do not reproduce the input life expectancy. In order to correct the discrepancy in these tables, parameter G in the above formula has been adjusted. Tables A.1-A.5 and B.1-B.5 summarises the adjusted determinant parameters for all tables.

2. An Excel workbook for UN model life tables

2.1. An Excel workbook, called UNMORTK.xls, has been developed which produces the main demographic indicators of the UN model life tables.

2.2. UNMORTK.xls is about 400 KB and has 6 worksheets shown as follows:

- UNmort : Input and output sheet;
- General : Database of the determinant parameters of the General pattern;
- South Asia : ditto (South Asian pattern);
- Latin America : ditto (Latin American pattern);
- Far East : ditto (Far Eastern pattern);
- Chile : ditto (Chilean pattern).

All worksheets except “UNmort” are databases. Writing in these sheetsis not permitted.

2.3. UNMORTK.xls produces the following selected life table data for each sex:

- Single-age mortality rates, denoted by q_x ;
- Survival functions, denoted by l_x ;
- Life expectancies, denoted by e_x .

Here, x denotes age and ranges from 0 to 99 and it is assumed that l_x=0 for $x \geq 100$.

2.4. To get results, follow the procedure indicated below:

1° Open UNMORTK.xls and go to the worksheet “UNmort”

2° Choose the regional pattern from the listbox in cells C8-D8.

3° Input the life expectancy at birth for each sex in cells C10 and C11. These figures are rounded to the first decimal place. When the input life expectancy is not an integer, the model calculates the determinant parameters as the linear interpolation of those corresponding to the two nearest integers enclosing the input value, and applies the 8-parameter formula mentioned above.

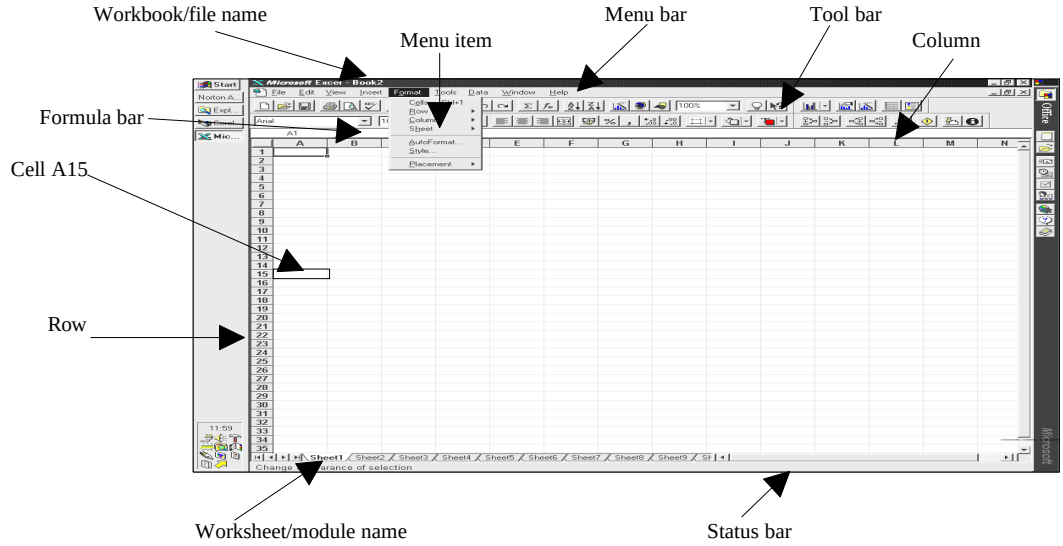
Annex C: Useful Excel tools

1. Introduction

The aim of this annex is to specify some of the basic characteristics of Excel, and to indicate some Excel tools that may come in handy while working with the population projection model. Those users who have a good working knowledge of Excel may omit reading this annex.

The following Figure C.1 indicates the features of the Excel window referred to in the manual.

Figure C.1 : The Excel window



When working with the model, take note of the indications shown in the ***Status bar***

Calculating:	means that Excel is currently calculating cells in the workbook(s).
Calculate:	means that the calculation process in the workbook has not taken place, or is not finished. Therefore, results in the cells may not be correct. In order to recalculate the cells, press the **F9** key.
Circular:	means that somewhere in one of the open workbooks there is a circular reference. If the sheet which contains the circular reference is open, the status bar will indicate **Circular B5** (i.e. the address of the cell).
Ready:	means that all the cells have been calculated and that Excel is ready for other manipulations.

2. Some useful Excel hints

2.1. To open linked files

As already mentioned, all files of the population projection model are interlinked. Therefore, when the files are being opened, Excel displays a window with the message "*The workbook you opened contains automatic links.....*". If you select the "Yes" button, then the cells which are linked are refreshed with the most recent data.

When one saves a linked document, Excel automatically recalculates all the cells and updates them with the latest data. If all the linked documents are open, then all their cells are also automatically updated during this process. However, if some of the linked documents are closed during this process, then the above option to "Update links?" will permit an update of the linked data the next time that they are opened.

2.2. To work more efficiently

Each time a value in a linked cell is modified, Excel automatically updates all the links. For example, when changing a whole row of values, Excel will automatically recalculate the values of cells which are linked to the one/s which have been modified. This can be time consuming, and in this case it is worthwhile to recalculating the various links only when all modifications have been made. To allow this you can switch off the automatic recalculation function and choose the manual recalculation option instead. To do this:

- Go to the **Tools** menu
- Select **Options...**
- Select the **Calculation** tab in the Options window
- Select the **Manual** option

In order to recalculate the sheet after all modifications have been made, press the **F9** key.

2.3. To identify which files provide information to a workbook

When modifying a workbook, it is sometimes necessary to identify the workbooks which are linked to the one you are working on. In order to identify linked workbooks:

- Go to the **Edit** menu
- Select **Links ...**
- You will now see the workbooks that are linked to the file you are using. For example, the workbook POP.xls is linked to FERT.xls (from where it obtains age-specific fertility rates) and to MORT.xls (from where it obtains sex and age-specific mortality rates) and MIG.xls (from where it obtains net migration figures).

Note that the Links window only shows which files provide information to the current workbook. It does not indicate the files which receive information from the current workbook. Therefore, when modifying a workbook it is not enough to open only those workbooks which are shown in the Links window.

2.4. To identify the links to and from a cell

Data cells hold either input data or the results of calculations, and are generally referred to by other cells. Cells which are a result of calculations can refer to other cells for their values, or can be used to calculate the values of third cells. In order to see these links between cells, Excel offers an auditing tool bar:

- Go to the **Tools** menu
- Select **Auditing**
- Select the **Show Auditing Toolbar** option

The Auditing toolbar has nine buttons:

- **Trace Precedents:** identifies, with arrows, the cells from which the selected cell obtains data
- **Remove Precedent Arrows:** removes the above arrows
- **Trace Dependants:** identifies, with arrows, the cells which receive data from the selected cell
- **Remove Dependent Arrows:** removes the above arrows
- **Remove All Arrows:** removes all the arrows to and from a selected cell
- **Trace Error:** indicates to a certain extent the source of error, if any, in a selected cell
- **New Comment:** permits the user to attach a note to the selected cell. When a note is attached to a cell, a small red dot will appear on the upper right-hand corner of the cell. In Excel 2000, the attached notes will be automatically shown when the cursor arrow is placed on the cell. (In Excel 5, click on the Show Info Window button).
- **Circle Invalid Data**
- **Clear Validation Circles**

2.5. To enable macros

When opening certain files, MS-EXCEL may display a message which indicates: "Macros may contain viruses. It is always safe to disable macros, but if the macros are legitimate, you might lose some functionality." The user is requested to click on one of the following options:

"Disable Macros"
"Enable Macros"
"More Info"

Please click on the option to "**Enable Macros**" otherwise some of the functions within the workbook will not work.

3. Some hints on modifying the population projection model workbooks

Utmost care must be taken when modifying any or all components of the model. If enough care is not taken, the results obtained will no longer be correct.

> It is crucial when opening workbooks, to **"update" the links** between the workbooks. Otherwise results in cells will no longer be correct (see point 2.1).

We will consider two types of modifications, those that do not alter the structure of a worksheet, and those that do.

3.1. Examples of operations which do not alter the structure of a worksheet

- modifications to the contents of a cell, row or column, by updating data;
- revision of formulas within a cell or VBA module.

In these cases, a recalculation of the workbook(s) and the VBA modules will automatically adjust the values in all linked workbooks (see point 2.1).

(Note that this is not an exhaustive list.)

3.2. Examples of operations which alter the structure of a worksheet

- delete or move a linked workbook to another directory;
- modifications to names of linked worksheets;
- deletion of a linked worksheet;
- insertion of rows or columns before cells which have links;
- deletion of rows or columns which have links;
- modifications of the address of output areas within VBA modules.

(Note that this is not an exhaustive list.)

> As a measure of security, open all the files when any files are being modified.

Once any modifications have been made, **save all workbooks**. For modifications that alter the structure of a worksheet, **all linked workbooks must be open** when the changes are made. It is not enough to open only those workbooks which are indicated in the Links window (see point 2.3). All workbooks to which the modified workbook provides data must also be open.

If the above instructions are not followed, then even the "re-establish links" option when a workbook is opened will not reflect the structural modifications of the linked workbooks, and the model will no longer generate correct results.

Where results are calculated by VBA modules, these modules will need to be modified and recalculated.

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Textbooks : Quantitative methods in Social Protection (ILO/ISSA)

Iyer, S. N. : *Actuarial mathematics of social security pensions* (2000)

Plamondon et al. : *Actuarial practice in social security* (2002)

Cichon et al. : *Modelling in health care finance* (1999)

Scholz et al. : *Social budgeting* (2000)

Table A.1: General Pattern (Males)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.08995	0.33925	0.36920	0.00603	3.51502	26.66315	0.00112000	1.06559
36	0.08510	0.33005	0.36342	0.00573	3.51550	26.60995	0.00105499	1.06622
37	0.08044	0.32096	0.35770	0.00544	3.51640	26.54962	0.00099800	1.06685
38	0.07596	0.31196	0.35202	0.00516	3.51697	26.49468	0.00094100	1.06750
39	0.07167	0.30299	0.34639	0.00490	3.51773	26.43624	0.00088700	1.06815
40	0.06757	0.29427	0.34085	0.00465	3.51863	26.37524	0.00083490	1.06881
41	0.06363	0.28561	0.33534	0.00441	3.51940	26.31627	0.00078499	1.06948
42	0.05987	0.27711	0.32992	0.00417	3.52067	26.24833	0.00073900	1.07016
43	0.05625	0.26862	0.32448	0.00395	3.52181	26.18268	0.00069400	1.07086
44	0.05279	0.26018	0.31905	0.00374	3.52258	26.12238	0.00065050	1.07157
45	0.04947	0.25186	0.31369	0.00353	3.52386	26.05300	0.00061000	1.07229
46	0.04631	0.24369	0.30838	0.00334	3.52539	25.97960	0.00057050	1.07302
47	0.04328	0.23557	0.30306	0.00315	3.52656	25.91112	0.00053270	1.07378
48	0.04039	0.22751	0.29777	0.00297	3.52799	25.83796	0.00049700	1.07455
49	0.03762	0.21957	0.29250	0.00280	3.52916	25.76796	0.00046300	1.07534
50	0.03501	0.21191	0.28735	0.00263	3.53085	25.68947	0.00043050	1.07615
51	0.03249	0.20398	0.28205	0.00247	3.53214	25.61600	0.00039950	1.07698
52	0.03010	0.19635	0.27687	0.00232	3.53432	25.52757	0.00037000	1.07783
53	0.02784	0.18889	0.27172	0.00217	3.53583	25.44980	0.00034200	1.07871
54	0.02568	0.18132	0.26648	0.00203	3.53711	25.37329	0.00031540	1.07962
55	0.02362	0.17381	0.26125	0.00190	3.53935	25.28199	0.00029000	1.08055
56	0.02167	0.16632	0.25599	0.00177	3.54127	25.19268	0.00026600	1.08151
57	0.01983	0.15895	0.25072	0.00164	3.54299	25.10643	0.00024350	1.08251
58	0.01811	0.15189	0.24558	0.00153	3.54445	25.02275	0.00022170	1.08355
59	0.01648	0.14493	0.24043	0.00141	3.54667	24.92599	0.00020150	1.08463
60	0.01493	0.13774	0.23512	0.00131	3.54865	24.83053	0.00018220	1.08575
61	0.01349	0.13073	0.22983	0.00120	3.55073	24.73206	0.00016430	1.08691
62	0.01212	0.12363	0.22444	0.00111	3.55174	24.64793	0.00014740	1.08813
63	0.01086	0.11701	0.21926	0.00101	3.55442	24.53710	0.00013180	1.08938
64	0.00969	0.11037	0.21396	0.00093	3.55630	24.43511	0.00011700	1.09071
65	0.00858	0.10349	0.20848	0.00084	3.55924	24.31507	0.00010360	1.09207
66	0.00757	0.09694	0.20308	0.00076	3.56000	24.22547	0.00009085	1.09355
67	0.00664	0.09051	0.19764	0.00069	3.56027	24.13814	0.00007925	1.09507
68	0.00578	0.08435	0.19230	0.00062	3.56184	24.02911	0.00006870	1.09668
69	0.00500	0.07804	0.18670	0.00055	3.56431	23.90414	0.00005906	1.09837
70	0.00429	0.07190	0.18111	0.00049	3.56621	23.78305	0.00005024	1.10018
71	0.00365	0.06600	0.17554	0.00043	3.56549	23.69347	0.00004237	1.10209
72	0.00308	0.05997	0.16974	0.00038	3.56826	23.55080	0.00003536	1.10409
73	0.00256	0.05413	0.16389	0.00033	3.56550	23.48016	0.00002916	1.10625
74	0.00211	0.04876	0.15827	0.00029	3.56995	23.30211	0.00002380	1.10850
75	0.00172	0.04352	0.15251	0.00024	3.56694	23.22067	0.00001910	1.11096

Table B.1: General Pattern (Females)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.10798	0.56777	0.36903	0.01196	3.55409	26.63512	0.00057100	1.07440
36	0.10254	0.54966	0.36364	0.01131	3.54833	26.67861	0.00054290	1.07488
37	0.09728	0.53164	0.35826	0.01070	3.54271	26.71959	0.00051499	1.07534
38	0.09226	0.51429	0.35301	0.01011	3.53688	26.76386	0.00049200	1.07583
39	0.08742	0.49719	0.34778	0.00955	3.53109	26.80700	0.00046800	1.07631
40	0.08280	0.48074	0.34270	0.00901	3.52539	26.84835	0.00044499	1.07679
41	0.07835	0.46455	0.33765	0.00849	3.51968	26.88926	0.00042350	1.07728
42	0.07412	0.44910	0.33274	0.00800	3.51381	26.93253	0.00040200	1.07779
43	0.07005	0.43394	0.32791	0.00754	3.50806	26.97312	0.00038150	1.07829
44	0.06613	0.41894	0.32306	0.00709	3.50224	27.01415	0.00036190	1.07880
45	0.06238	0.40445	0.31831	0.00666	3.49635	27.05551	0.00034300	1.07932
46	0.05880	0.39055	0.31369	0.00625	3.49070	27.09203	0.00032480	1.07984
47	0.05535	0.37670	0.30905	0.00585	3.48470	27.13362	0.00030750	1.08039
48	0.05205	0.36326	0.30447	0.00548	3.47882	27.17197	0.00029050	1.08093
49	0.04887	0.34994	0.29987	0.00512	3.47275	27.21232	0.00027420	1.08149
50	0.04584	0.33711	0.29538	0.00478	3.46682	27.24908	0.00025850	1.08206
51	0.04295	0.32478	0.29101	0.00445	3.46083	27.28552	0.00024360	1.08263
52	0.04017	0.31245	0.28655	0.00413	3.45480	27.32080	0.00022920	1.08323
53	0.03750	0.30031	0.28211	0.00383	3.44876	27.35489	0.00021499	1.08384
54	0.03496	0.28858	0.27775	0.00355	3.44264	27.38832	0.00020170	1.08446
55	0.03253	0.27716	0.27343	0.00328	3.43646	27.42093	0.00018870	1.08511
56	0.03020	0.26588	0.26910	0.00302	3.43036	27.45014	0.00017640	1.08577
57	0.02800	0.25506	0.26489	0.00277	3.42408	27.47937	0.00016450	1.08645
58	0.02588	0.24407	0.26052	0.00254	3.41767	27.50908	0.00015290	1.08716
59	0.02387	0.23371	0.25632	0.00232	3.41183	27.52497	0.00014200	1.08788
60	0.02196	0.22326	0.25199	0.00211	3.40556	27.54551	0.00013130	1.08864
61	0.02015	0.21333	0.24783	0.00191	3.39914	27.56564	0.00012130	1.08942
62	0.01844	0.20358	0.24363	0.00173	3.39360	27.56636	0.00011160	1.09022
63	0.01680	0.19360	0.23925	0.00155	3.38764	27.56902	0.00010240	1.09106
64	0.01528	0.18483	0.23531	0.00138	3.38234	27.55668	0.00009370	1.09193
65	0.01382	0.17515	0.23089	0.00123	3.37669	27.54447	0.00008525	1.09285
66	0.01247	0.16654	0.22683	0.00109	3.37136	27.52233	0.00007720	1.09382
67	0.01120	0.15787	0.22264	0.00096	3.36657	27.48325	0.00006966	1.09482
68	0.00999	0.14880	0.21819	0.00083	3.36183	27.43481	0.00006260	1.09587
69	0.00887	0.14020	0.21383	0.00072	3.35733	27.37589	0.00005590	1.09697
70	0.00785	0.13262	0.20986	0.00062	3.35445	27.28120	0.00004955	1.09816
71	0.00688	0.12434	0.20547	0.00052	3.35351	27.14022	0.00004375	1.09938
72	0.00601	0.11670	0.20122	0.00044	3.35122	27.01704	0.00003820	1.10073
73	0.00519	0.10860	0.19665	0.00036	3.34988	26.86199	0.00003315	1.10213
74	0.00446	0.10178	0.19262	0.00030	3.35247	26.62859	0.00002849	1.10364
75	0.00380	0.09451	0.18811	0.00024	3.35521	26.38146	0.00002417	1.10528

Table A.2: South Asian Pattern (Males)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.19382	0.83517	0.53415	0.00182	3.80342	21.74407	0.00072000	1.07068
36	0.18412	0.81386	0.52480	0.00175	3.80341	21.71499	0.00067200	1.07140
37	0.17465	0.79231	0.51542	0.00168	3.80306	21.68993	0.00063100	1.07213
38	0.16564	0.77185	0.50644	0.00161	3.80315	21.65965	0.00059250	1.07287
39	0.15678	0.75070	0.49728	0.00154	3.80229	21.63949	0.00055590	1.07361
40	0.14831	0.73032	0.48839	0.00148	3.80153	21.61832	0.00052050	1.07436
41	0.14008	0.70976	0.47951	0.00141	3.80061	21.59832	0.00048800	1.07511
42	0.13215	0.68958	0.47075	0.00135	3.80050	21.56891	0.00045700	1.07587
43	0.12452	0.66960	0.46209	0.00129	3.79976	21.54587	0.00042750	1.07665
44	0.11719	0.64999	0.45358	0.00123	3.79866	21.52662	0.00039950	1.07743
45	0.11010	0.63023	0.44502	0.00118	3.79780	21.50472	0.00037300	1.07822
46	0.10325	0.61049	0.43650	0.00112	3.79638	21.48783	0.00034800	1.07903
47	0.09678	0.59180	0.42828	0.00107	3.79521	21.46801	0.00032390	1.07986
48	0.09050	0.57269	0.41994	0.00102	3.79417	21.44648	0.00030100	1.08070
49	0.08442	0.55334	0.41155	0.00097	3.79191	21.43742	0.00027990	1.08155
50	0.07872	0.53521	0.40353	0.00092	3.79168	21.40402	0.00025980	1.08241
51	0.07324	0.51692	0.39546	0.00087	3.79030	21.38353	0.00024050	1.08330
52	0.06798	0.49862	0.38737	0.00083	3.78821	21.37051	0.00022230	1.08420
53	0.06294	0.48033	0.37925	0.00079	3.78740	21.34196	0.00020500	1.08514
54	0.05818	0.46273	0.37134	0.00074	3.78626	21.31606	0.00018870	1.08609
55	0.05370	0.44576	0.36359	0.00070	3.78413	21.30057	0.00017320	1.08708
56	0.04939	0.42853	0.35574	0.00066	3.78183	21.28573	0.00015870	1.08808
57	0.04530	0.41124	0.34785	0.00062	3.78027	21.26082	0.00014510	1.08911
58	0.04146	0.39465	0.34013	0.00058	3.77953	21.22613	0.00013220	1.09017
59	0.03777	0.37741	0.33219	0.00055	3.77779	21.20055	0.00012000	1.09127
60	0.03433	0.36097	0.32445	0.00051	3.77604	21.17303	0.00010870	1.09241
61	0.03111	0.34491	0.31676	0.00048	3.77326	21.15669	0.00009810	1.09358
62	0.02805	0.32844	0.30892	0.00044	3.77121	21.12848	0.00008820	1.09480
63	0.02522	0.31293	0.30133	0.00041	3.76922	21.10119	0.00007885	1.09607
64	0.02254	0.29670	0.29342	0.00038	3.76782	21.06078	0.00007020	1.09738
65	0.02012	0.28230	0.28613	0.00035	3.76623	21.02498	0.00006220	1.09876
66	0.01779	0.26631	0.27817	0.00032	3.76504	20.97904	0.00005500	1.10019
67	0.01569	0.25156	0.27058	0.00029	3.76049	20.96876	0.00004800	1.10169
68	0.01373	0.23656	0.26276	0.00027	3.75720	20.94055	0.00004173	1.10326
69	0.01197	0.22273	0.25535	0.00024	3.75719	20.87493	0.00003602	1.10492
70	0.01032	0.20770	0.24735	0.00022	3.75393	20.84106	0.00003085	1.10665
71	0.00885	0.19366	0.23965	0.00020	3.74998	20.81069	0.00002620	1.10847
72	0.00750	0.17900	0.23153	0.00018	3.74853	20.74648	0.00002206	1.11038
73	0.00633	0.16657	0.22426	0.00016	3.74137	20.74305	0.00001833	1.11244
74	0.00527	0.15268	0.21618	0.00014	3.74562	20.61419	0.00001508	1.11460
75	0.00434	0.13966	0.20830	0.00012	3.73554	20.62455	0.00001225	1.11690

Table B.2: South Asian Pattern (Females)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.20166	0.99254	0.51819	0.00658	3.69730	24.02693	0.00034000	1.08191
36	0.19211	0.96452	0.51003	0.00621	3.69328	24.03694	0.00032250	1.08245
37	0.18267	0.93577	0.50169	0.00586	3.68913	24.04810	0.00030499	1.08300
38	0.17378	0.90914	0.49383	0.00553	3.68511	24.05716	0.00028900	1.08355
39	0.16503	0.88204	0.48587	0.00521	3.68102	24.06666	0.00027350	1.08411
40	0.15661	0.85565	0.47804	0.00491	3.67693	24.07587	0.00025880	1.08468
41	0.14850	0.82995	0.47039	0.00462	3.67255	24.08857	0.00024450	1.08525
42	0.14057	0.80397	0.46266	0.00435	3.66870	24.09327	0.00023100	1.08583
43	0.13309	0.77986	0.45534	0.00408	3.66486	24.09701	0.00021830	1.08641
44	0.12572	0.75495	0.44780	0.00383	3.66054	24.10670	0.00020590	1.08701
45	0.11870	0.73116	0.44051	0.00360	3.65674	24.10840	0.00019400	1.08761
46	0.11185	0.70710	0.43315	0.00337	3.65221	24.11948	0.00018260	1.08823
47	0.10529	0.68373	0.42592	0.00315	3.64834	24.12011	0.00017200	1.08885
48	0.09897	0.66067	0.41874	0.00294	3.64472	24.11637	0.00016150	1.08949
49	0.09292	0.63834	0.41166	0.00275	3.64032	24.12243	0.00015150	1.09015
50	0.08708	0.61601	0.40459	0.00256	3.63632	24.12135	0.00014200	1.09081
51	0.08153	0.59461	0.39771	0.00238	3.63258	24.11576	0.00013280	1.09149
52	0.07613	0.57292	0.39071	0.00221	3.62884	24.10843	0.00012410	1.09218
53	0.07105	0.55249	0.38400	0.00205	3.62436	24.11018	0.00011570	1.09291
54	0.06614	0.53199	0.37722	0.00189	3.62067	24.09892	0.00010780	1.09364
55	0.06138	0.51099	0.37023	0.00174	3.61676	24.08854	0.00010030	1.09438
56	0.05694	0.49155	0.36364	0.00160	3.61332	24.07041	0.00009300	1.09515
57	0.05270	0.47250	0.35710	0.00147	3.61000	24.04839	0.00008600	1.09595
58	0.04857	0.45258	0.35020	0.00135	3.60610	24.03162	0.00007930	1.09678
59	0.04472	0.43406	0.34369	0.00123	3.60288	24.00313	0.00007310	1.09762
60	0.04104	0.41566	0.33712	0.00112	3.59953	23.97413	0.00006705	1.09851
61	0.03758	0.39781	0.33065	0.00101	3.59691	23.93253	0.00006140	1.09942
62	0.03426	0.37979	0.32402	0.00091	3.59370	23.89491	0.00005605	1.10036
63	0.03112	0.36175	0.31730	0.00082	3.59020	23.85829	0.00005085	1.10135
64	0.02822	0.34518	0.31095	0.00073	3.58753	23.80674	0.00004605	1.10238
65	0.02548	0.32879	0.30462	0.00065	3.58688	23.72340	0.00004150	1.10345
66	0.02288	0.31197	0.29798	0.00058	3.58367	23.67072	0.00003720	1.10457
67	0.02045	0.29523	0.29129	0.00051	3.58224	23.58914	0.00003319	1.10574
68	0.01823	0.28036	0.28518	0.00045	3.58419	23.45800	0.00002945	1.10696
69	0.01614	0.26483	0.27867	0.00039	3.58309	23.36572	0.00002596	1.10826
70	0.01418	0.24860	0.27177	0.00033	3.58261	23.25274	0.00002278	1.10961
71	0.01242	0.23429	0.26544	0.00029	3.58354	23.12081	0.00001975	1.11108
72	0.01079	0.21983	0.25895	0.00024	3.58548	22.96879	0.00001704	1.11261
73	0.00932	0.20626	0.25262	0.00020	3.59019	22.77125	0.00001456	1.11424
74	0.00796	0.19182	0.24581	0.00017	3.58802	22.65637	0.00001228	1.11600
75	0.00675	0.17802	0.23910	0.00014	3.59877	22.36656	0.00001029	1.11782

Table A.3: Far Eastern Pattern (Males)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.06764	0.32645	0.35131	0.00492	3.59931	25.18239	0.00196499	1.06187
36	0.06332	0.31519	0.34475	0.00465	3.60283	25.08519	0.00183499	1.06264
37	0.05923	0.30411	0.33828	0.00440	3.60636	24.98832	0.00171499	1.06343
38	0.05536	0.29343	0.33196	0.00417	3.61037	24.88419	0.00160250	1.06422
39	0.05167	0.28271	0.32562	0.00394	3.61390	24.78785	0.00149350	1.06503
40	0.04819	0.27243	0.31944	0.00373	3.61756	24.68961	0.00139000	1.06585
41	0.04489	0.26223	0.31329	0.00352	3.62142	24.58855	0.00129350	1.06668
42	0.04176	0.25231	0.30725	0.00332	3.62524	24.48817	0.00120200	1.06753
43	0.03879	0.24238	0.30118	0.00314	3.62899	24.38893	0.00111400	1.06840
44	0.03599	0.23294	0.29531	0.00296	3.63304	24.28513	0.00103150	1.06928
45	0.03333	0.22332	0.28930	0.00279	3.63661	24.18858	0.00095350	1.07019
46	0.03083	0.21413	0.28347	0.00263	3.64042	24.08828	0.00088000	1.07112
47	0.02846	0.20503	0.27767	0.00247	3.64442	23.98502	0.00081120	1.07206
48	0.02621	0.19589	0.27178	0.00232	3.64792	23.88814	0.00074499	1.07303
49	0.02410	0.18710	0.26603	0.00218	3.65157	23.78956	0.00068350	1.07404
50	0.02212	0.17856	0.26035	0.00205	3.65557	23.68517	0.00062499	1.07506
51	0.02026	0.17014	0.25468	0.00192	3.65898	23.58865	0.00057100	1.07612
52	0.01850	0.16180	0.24901	0.00179	3.66269	23.48783	0.00052000	1.07721
53	0.01685	0.15357	0.24332	0.00168	3.66575	23.39433	0.00047150	1.07833
54	0.01530	0.14548	0.23766	0.00156	3.66935	23.29286	0.00042499	1.07949
55	0.01386	0.13772	0.23212	0.00145	3.67261	23.19539	0.00038499	1.08068
56	0.01253	0.13032	0.22669	0.00135	3.67606	23.09473	0.00034499	1.08192
57	0.01127	0.12277	0.22111	0.00125	3.67829	23.00845	0.00030970	1.08321
58	0.01009	0.11505	0.21536	0.00116	3.68109	22.91287	0.00027499	1.08454
59	0.00902	0.10800	0.20988	0.00107	3.68317	22.82536	0.00024490	1.08593
60	0.00802	0.10108	0.20441	0.00098	3.68631	22.72246	0.00021499	1.08736
61	0.00709	0.09408	0.19883	0.00090	3.68923	22.62030	0.00019015	1.08885
62	0.00624	0.08727	0.19321	0.00082	3.69001	22.54325	0.00016499	1.09042
63	0.00548	0.08110	0.18791	0.00075	3.69157	22.45510	0.00014410	1.09205
64	0.00477	0.07480	0.18242	0.00068	3.69524	22.33623	0.00012440	1.09374
65	0.00413	0.06852	0.17673	0.00061	3.69528	22.26103	0.00010650	1.09554
66	0.00355	0.06261	0.17123	0.00055	3.69334	22.20538	0.00009040	1.09742
67	0.00302	0.05699	0.16581	0.00049	3.69662	22.08268	0.00007630	1.09937
68	0.00256	0.05138	0.16021	0.00044	3.69483	22.01886	0.00006360	1.10145
69	0.00214	0.04580	0.15440	0.00038	3.69516	21.92314	0.00005265	1.10361
70	0.00179	0.04176	0.14970	0.00034	3.69471	21.83517	0.00004300	1.10591
71	0.00147	0.03648	0.14377	0.00029	3.69050	21.78401	0.00003477	1.10832
72	0.00119	0.03212	0.13839	0.00025	3.68744	21.71586	0.00002773	1.11089
73	0.00096	0.02782	0.13275	0.00022	3.68409	21.64440	0.00002177	1.11362
74	0.00077	0.02455	0.12801	0.00018	3.68122	21.55925	0.00001691	1.11645
75	0.00060	0.02093	0.12261	0.00016	3.67392	21.52177	0.00001288	1.11949

Table B.3: Far Eastern Pattern (Females)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.08292	0.50996	0.37387	0.01421	3.58998	26.21727	0.00120110	1.06563
36	0.07824	0.49320	0.36835	0.01337	3.58421	26.25535	0.00114000	1.06615
37	0.07379	0.47695	0.36295	0.01258	3.57858	26.29081	0.00108000	1.06668
38	0.06953	0.46102	0.35760	0.01182	3.57298	26.32544	0.00102400	1.06721
39	0.06552	0.44585	0.35245	0.01110	3.56734	26.36010	0.00097000	1.06775
40	0.06168	0.43109	0.34735	0.01042	3.56175	26.39348	0.00091800	1.06829
41	0.05804	0.41676	0.34236	0.00977	3.55627	26.42437	0.00086800	1.06884
42	0.05458	0.40304	0.33749	0.00915	3.55071	26.45578	0.00082100	1.06939
43	0.05127	0.38947	0.33261	0.00856	3.54503	26.48820	0.00077499	1.06996
44	0.04812	0.37633	0.32785	0.00800	3.53975	26.51311	0.00073200	1.07052
45	0.04515	0.36393	0.32329	0.00746	3.53422	26.54127	0.00069080	1.07111
46	0.04230	0.35149	0.31863	0.00695	3.52860	26.56975	0.00065010	1.07170
47	0.03960	0.33964	0.31414	0.00647	3.52321	26.59318	0.00061150	1.07231
48	0.03701	0.32794	0.30967	0.00601	3.51799	26.61201	0.00057499	1.07291
49	0.03455	0.31650	0.30520	0.00557	3.51241	26.63581	0.00054000	1.07354
50	0.03222	0.30541	0.30083	0.00516	3.50692	26.65651	0.00050499	1.07419
51	0.02999	0.29442	0.29641	0.00476	3.50166	26.67103	0.00047320	1.07484
52	0.02788	0.28404	0.29218	0.00438	3.49614	26.68842	0.00044200	1.07552
53	0.02587	0.27366	0.28789	0.00403	3.49089	26.69912	0.00041200	1.07622
54	0.02397	0.26370	0.28369	0.00369	3.48567	26.70708	0.00038360	1.07693
55	0.02217	0.25407	0.27958	0.00338	3.48059	26.71014	0.00035620	1.07766
56	0.02043	0.24396	0.27519	0.00308	3.47564	26.70806	0.00033000	1.07841
57	0.01881	0.23469	0.27110	0.00279	3.47077	26.70185	0.00030499	1.07919
58	0.01729	0.22572	0.26707	0.00253	3.46558	26.69871	0.00028100	1.08002
59	0.01583	0.21654	0.26287	0.00228	3.46104	26.67993	0.00025850	1.08085
60	0.01446	0.20768	0.25870	0.00205	3.45626	26.66202	0.00023660	1.08173
61	0.01317	0.19904	0.25460	0.00183	3.45172	26.63580	0.00021600	1.08264
62	0.01194	0.19018	0.25030	0.00163	3.44768	26.59631	0.00019670	1.08357
63	0.01080	0.18178	0.24614	0.00144	3.44449	26.53823	0.00017820	1.08455
64	0.00973	0.17367	0.24205	0.00127	3.44051	26.48865	0.00016070	1.08559
65	0.00872	0.16516	0.23765	0.00111	3.43750	26.41612	0.00014450	1.08666
66	0.00780	0.15770	0.23373	0.00096	3.43625	26.30912	0.00012920	1.08778
67	0.00694	0.14995	0.22949	0.00083	3.43337	26.22300	0.00011449	1.08900
68	0.00613	0.14180	0.22500	0.00071	3.43253	26.09498	0.00010120	1.09024
69	0.00539	0.13452	0.22092	0.00060	3.43478	25.90939	0.00008890	1.09155
70	0.00472	0.12698	0.21646	0.00050	3.43658	25.72361	0.00007745	1.09295
71	0.00410	0.11973	0.21217	0.00041	3.44046	25.49764	0.00006690	1.09444
72	0.00353	0.11238	0.20768	0.00034	3.44446	25.25895	0.00005730	1.09601
73	0.00302	0.10517	0.20303	0.00027	3.45118	24.97516	0.00004855	1.09772
74	0.00256	0.09763	0.19819	0.00022	3.45827	24.67385	0.00004070	1.09953
75	0.00215	0.09003	0.19298	0.00017	3.46997	24.29511	0.00003370	1.10149

Table A.4: Latin American Pattern (Males)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.11392	0.45861	0.39976	0.00768	3.44728	28.03060	0.00076499	1.06814
36	0.10833	0.44819	0.39398	0.00732	3.44602	28.00764	0.00073150	1.06866
37	0.10293	0.43779	0.38827	0.00698	3.44513	27.97747	0.00069490	1.06918
38	0.09773	0.42747	0.38260	0.00665	3.44413	27.94920	0.00066000	1.06972
39	0.09269	0.41703	0.37692	0.00633	3.44307	27.92160	0.00062499	1.07026
40	0.08784	0.40678	0.37132	0.00602	3.44213	27.89117	0.00059499	1.07080
41	0.08316	0.39652	0.36575	0.00573	3.44113	27.86182	0.00056470	1.07136
42	0.07864	0.38623	0.36017	0.00544	3.44031	27.82861	0.00053499	1.07192
43	0.07429	0.37606	0.35465	0.00517	3.43933	27.79778	0.00050700	1.07250
44	0.07011	0.36607	0.34920	0.00491	3.43866	27.76044	0.00048000	1.07308
45	0.06607	0.35594	0.34371	0.00465	3.43802	27.72224	0.00045410	1.07367
46	0.06219	0.34589	0.33826	0.00441	3.43734	27.68391	0.00042850	1.07428
47	0.05847	0.33603	0.33287	0.00418	3.43659	27.64617	0.00040420	1.07490
48	0.05490	0.32630	0.32752	0.00395	3.43609	27.60310	0.00038100	1.07554
49	0.05145	0.31633	0.32209	0.00373	3.43546	27.56135	0.00035850	1.07619
50	0.04815	0.30662	0.31674	0.00352	3.43540	27.50849	0.00033700	1.07685
51	0.04497	0.29671	0.31132	0.00332	3.43502	27.46008	0.00031630	1.07752
52	0.04194	0.28708	0.30598	0.00313	3.43439	27.41503	0.00029610	1.07823
53	0.03905	0.27755	0.30066	0.00294	3.43457	27.35493	0.00027700	1.07894
54	0.03627	0.26799	0.29531	0.00276	3.43447	27.29780	0.00025850	1.07968
55	0.03361	0.25836	0.28988	0.00259	3.43396	27.24728	0.00024080	1.08045
56	0.03108	0.24900	0.28456	0.00242	3.43421	27.18127	0.00022390	1.08123
57	0.02867	0.23950	0.27915	0.00226	3.43393	27.12364	0.00020750	1.08205
58	0.02639	0.23034	0.27384	0.00210	3.43462	27.04700	0.00019220	1.08288
59	0.02423	0.22142	0.26859	0.00196	3.43496	26.97514	0.00017710	1.08376
60	0.02216	0.21204	0.26313	0.00182	3.43530	26.90067	0.00016290	1.08466
61	0.02020	0.20297	0.25773	0.00168	3.43516	26.83255	0.00014940	1.08560
62	0.01836	0.19406	0.25234	0.00155	3.43582	26.74860	0.00013641	1.08659
63	0.01662	0.18501	0.24685	0.00143	3.43643	26.66300	0.00012400	1.08761
64	0.01498	0.17593	0.24131	0.00131	3.43720	26.57223	0.00011240	1.08868
65	0.01344	0.16675	0.23563	0.00120	3.43790	26.47932	0.00010140	1.08980
66	0.01200	0.15795	0.23005	0.00109	3.43869	26.38304	0.00009102	1.09098
67	0.01066	0.14900	0.22435	0.00099	3.43901	26.29082	0.00008120	1.09222
68	0.00942	0.14057	0.21877	0.00089	3.43946	26.19241	0.00007201	1.09354
69	0.00827	0.13170	0.21293	0.00080	3.44078	26.07529	0.00006354	1.09489
70	0.00721	0.12327	0.20717	0.00072	3.44249	25.95029	0.00005550	1.09637
71	0.00624	0.11461	0.20122	0.00064	3.44295	25.83755	0.00004815	1.09791
72	0.00535	0.10641	0.19536	0.00057	3.44243	25.73841	0.00004135	1.09958
73	0.00456	0.09854	0.18957	0.00050	3.44519	25.58028	0.00003520	1.10134
74	0.00383	0.09001	0.18325	0.00043	3.44692	25.43055	0.00002975	1.10318
75	0.00320	0.08259	0.17742	0.00037	3.44626	25.31575	0.00002465	1.10524

Table B.4: Latin American Pattern (Females)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.14603	0.83152	0.41970	0.01131	3.47194	27.95896	0.00041499	1.07704
36	0.13907	0.80735	0.41354	0.01073	3.46559	28.02052	0.00039499	1.07746
37	0.13231	0.78317	0.40737	0.01018	3.45913	28.08407	0.00037499	1.07790
38	0.12583	0.75980	0.40135	0.00965	3.45270	28.14687	0.00036499	1.07833
39	0.11960	0.73713	0.39545	0.00914	3.44613	28.21218	0.00034499	1.07877
40	0.11360	0.71490	0.38964	0.00866	3.43964	28.27583	0.00033250	1.07920
41	0.10773	0.69229	0.38372	0.00820	3.43294	28.34314	0.00031499	1.07965
42	0.10218	0.67107	0.37808	0.00775	3.42630	28.40911	0.00030180	1.08010
43	0.09678	0.64979	0.37241	0.00732	3.41956	28.47647	0.00028490	1.08056
44	0.09158	0.62890	0.36678	0.00692	3.41268	28.54611	0.00027310	1.08102
45	0.08665	0.60913	0.36138	0.00652	3.40596	28.61244	0.00026000	1.08149
46	0.08185	0.58924	0.35595	0.00615	3.39902	28.68200	0.00024499	1.08196
47	0.07724	0.56980	0.35056	0.00579	3.39205	28.75180	0.00023450	1.08244
48	0.07282	0.55083	0.34527	0.00544	3.38498	28.82236	0.00022260	1.08293
49	0.06853	0.53166	0.33986	0.00511	3.37774	28.89560	0.00021080	1.08344
50	0.06447	0.51374	0.33474	0.00479	3.37062	28.96560	0.00019970	1.08394
51	0.06052	0.49547	0.32946	0.00449	3.36332	29.03783	0.00018900	1.08445
52	0.05676	0.47801	0.32436	0.00420	3.35577	29.11412	0.00017850	1.08499
53	0.05312	0.46023	0.31912	0.00392	3.34799	29.19356	0.00016840	1.08554
54	0.04965	0.44317	0.31405	0.00365	3.34041	29.26732	0.00015890	1.08608
55	0.04635	0.42683	0.30907	0.00339	3.33270	29.34268	0.00014950	1.08666
56	0.04319	0.41064	0.30410	0.00315	3.32485	29.41830	0.00014050	1.08723
57	0.04012	0.39406	0.29895	0.00291	3.31617	29.50921	0.00013170	1.08785
58	0.03722	0.37839	0.29401	0.00269	3.30825	29.58266	0.00012340	1.08846
59	0.03446	0.36308	0.28913	0.00247	3.29985	29.66298	0.00011499	1.08909
60	0.03182	0.34793	0.28417	0.00227	3.29162	29.73782	0.00010760	1.08974
61	0.02930	0.33299	0.27926	0.00208	3.28256	29.82637	0.00010010	1.09043
62	0.02693	0.31861	0.27444	0.00189	3.27413	29.89893	0.00009300	1.09111
63	0.02464	0.30388	0.26940	0.00172	3.26460	29.99106	0.00008600	1.09185
64	0.02249	0.28956	0.26443	0.00155	3.25565	30.06592	0.00007950	1.09259
65	0.02049	0.27655	0.25980	0.00140	3.24690	30.13389	0.00007310	1.09337
66	0.01857	0.26305	0.25494	0.00125	3.23828	30.19342	0.00006710	1.09418
67	0.01676	0.24984	0.25002	0.00111	3.22815	30.27924	0.00006130	1.09504
68	0.01506	0.23677	0.24509	0.00099	3.21854	30.34748	0.00005570	1.09594
69	0.01348	0.22433	0.24032	0.00087	3.20930	30.40075	0.00005050	1.09685
70	0.01199	0.21179	0.23537	0.00075	3.19950	30.45734	0.00004555	1.09784
71	0.01063	0.20018	0.23070	0.00065	3.19221	30.45103	0.00004090	1.09884
72	0.00935	0.18820	0.22570	0.00056	3.17976	30.54761	0.00003630	1.09998
73	0.00817	0.17698	0.22086	0.00047	3.17288	30.51001	0.00003220	1.10112
74	0.00709	0.16569	0.21593	0.00039	3.16296	30.52491	0.00002825	1.10236
75	0.00611	0.15486	0.21104	0.00032	3.15681	30.44349	0.00002462	1.10367

Table A.5: Chilean Pattern (Males)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.05604	0.13426	0.34619	0.00717	3.33944	29.97419	0.00128499	1.06305
36	0.05290	0.13129	0.34159	0.00678	3.33832	29.93948	0.00121499	1.06365
37	0.04989	0.12825	0.33693	0.00641	3.33724	29.90389	0.00114499	1.06427
38	0.04703	0.12536	0.33240	0.00606	3.33646	29.86140	0.00108499	1.06488
39	0.04430	0.12250	0.32795	0.00572	3.33580	29.81601	0.00102400	1.06550
40	0.04170	0.11970	0.32352	0.00540	3.33529	29.76690	0.00096499	1.06613
41	0.03921	0.11688	0.31910	0.00509	3.33477	29.71800	0.00090900	1.06678
42	0.03683	0.11396	0.31461	0.00480	3.33440	29.66531	0.00085499	1.06743
43	0.03456	0.11130	0.31035	0.00452	3.33459	29.59960	0.00080490	1.06808
44	0.03241	0.10864	0.30607	0.00425	3.33486	29.53262	0.00075499	1.06875
45	0.03034	0.10584	0.30169	0.00399	3.33502	29.46645	0.00071050	1.06943
46	0.02838	0.10318	0.29745	0.00375	3.33543	29.39506	0.00066499	1.07013
47	0.02650	0.10048	0.29314	0.00351	3.33636	29.31168	0.00062390	1.07083
48	0.02472	0.09782	0.28888	0.00329	3.33748	29.22427	0.00058300	1.07156
49	0.02302	0.09519	0.28462	0.00308	3.33839	29.14033	0.00054400	1.07231
50	0.02140	0.09251	0.28032	0.00287	3.33960	29.04910	0.00050730	1.07307
51	0.01986	0.08999	0.27618	0.00268	3.34154	28.94280	0.00047200	1.07384
52	0.01840	0.08738	0.27191	0.00249	3.34324	28.83998	0.00043850	1.07464
53	0.01701	0.08468	0.26755	0.00232	3.34524	28.73001	0.00040650	1.07546
54	0.01570	0.08223	0.26343	0.00215	3.34792	28.60624	0.00037620	1.07630
55	0.01445	0.07962	0.25914	0.00199	3.35038	28.48567	0.00034700	1.07718
56	0.01327	0.07703	0.25483	0.00184	3.35315	28.35762	0.00031950	1.07807
57	0.01216	0.07440	0.25048	0.00170	3.35619	28.22412	0.00029300	1.07901
58	0.01110	0.07179	0.24611	0.00156	3.35986	28.07591	0.00026850	1.07996
59	0.01011	0.06908	0.24161	0.00144	3.36284	27.94286	0.00024430	1.08099
60	0.00917	0.06647	0.23722	0.00131	3.36706	27.78137	0.00022250	1.08201
61	0.00829	0.06386	0.23277	0.00120	3.37115	27.62323	0.00020140	1.08310
62	0.00747	0.06106	0.22807	0.00110	3.37414	27.48431	0.00018130	1.08424
63	0.00670	0.05847	0.22356	0.00099	3.38033	27.28371	0.00016310	1.08540
64	0.00599	0.05572	0.21880	0.00090	3.38248	27.15673	0.00014550	1.08666
65	0.00532	0.05291	0.21402	0.00081	3.38846	26.95799	0.00012930	1.08795
66	0.00471	0.05030	0.20933	0.00073	3.39281	26.78681	0.00011430	1.08930
67	0.00415	0.04752	0.20438	0.00066	3.39801	26.59875	0.00010010	1.09074
68	0.00362	0.04492	0.19968	0.00058	3.40381	26.39633	0.00008755	1.09222
69	0.00315	0.04221	0.19470	0.00052	3.41158	26.16126	0.00007590	1.09377
70	0.00272	0.03956	0.18973	0.00046	3.41293	26.03047	0.00006500	1.09549
71	0.00233	0.03697	0.18472	0.00040	3.42013	25.79979	0.00005544	1.09723
72	0.00197	0.03356	0.17860	0.00035	3.42503	25.60061	0.00004669	1.09912
73	0.00165	0.03087	0.17326	0.00031	3.42793	25.43577	0.00003882	1.10116
74	0.00138	0.02818	0.16775	0.00027	3.43216	25.24009	0.00003200	1.10326
75	0.00113	0.02593	0.16292	0.00023	3.43910	24.99944	0.00002605	1.10552

Table B.5: Chilean Pattern (Females)

Life expectancy at birth	A	B	C	D	E	F	G	H
35	0.06954	0.19379	0.34119	0.01135	3.56451	26.42328	0.00073499	1.06978
36	0.06614	0.18894	0.33732	0.01070	3.55923	26.45539	0.00070200	1.07024
37	0.06288	0.18433	0.33359	0.01008	3.55426	26.48225	0.00066499	1.07071
38	0.05972	0.17951	0.32973	0.00949	3.54903	26.51266	0.00063500	1.07118
39	0.05671	0.17506	0.32606	0.00893	3.54394	26.54069	0.00060400	1.07166
40	0.05380	0.17053	0.32234	0.00839	3.53874	26.56987	0.00057400	1.07214
41	0.05102	0.16624	0.31875	0.00788	3.53388	26.59259	0.00054490	1.07262
42	0.04834	0.16193	0.31512	0.00740	3.52868	26.62056	0.00051490	1.07312
43	0.04576	0.15764	0.31148	0.00694	3.52355	26.64639	0.00049030	1.07363
44	0.04328	0.15351	0.30794	0.00650	3.51859	26.66876	0.00046450	1.07414
45	0.04092	0.14962	0.30452	0.00608	3.51362	26.69022	0.00044000	1.07465
46	0.03862	0.14552	0.30095	0.00568	3.50859	26.71175	0.00041499	1.07518
47	0.03643	0.14164	0.29748	0.00530	3.50334	26.73596	0.00039300	1.07573
48	0.03432	0.13776	0.29400	0.00494	3.49841	26.75319	0.00037100	1.07627
49	0.03229	0.13395	0.29053	0.00459	3.49345	26.77016	0.00034970	1.07684
50	0.03034	0.13016	0.28707	0.00426	3.48866	26.78207	0.00032950	1.07740
51	0.02848	0.12665	0.28375	0.00395	3.48385	26.79351	0.00031000	1.07798
52	0.02669	0.12300	0.28034	0.00366	3.47931	26.79837	0.00029100	1.07858
53	0.02497	0.11946	0.27696	0.00337	3.47450	26.80570	0.00027330	1.07919
54	0.02332	0.11589	0.27351	0.00311	3.46940	26.81640	0.00025560	1.07983
55	0.02176	0.11261	0.27026	0.00285	3.46474	26.81680	0.00023900	1.08048
56	0.02025	0.10916	0.26683	0.00262	3.46045	26.80917	0.00022280	1.08114
57	0.01881	0.10584	0.26349	0.00239	3.45647	26.79381	0.00020750	1.08183
58	0.01743	0.10243	0.26002	0.00218	3.45188	26.78545	0.00019270	1.08254
59	0.01613	0.09944	0.25685	0.00198	3.44751	26.77074	0.00017860	1.08327
60	0.01488	0.09616	0.25343	0.00179	3.44385	26.74079	0.00016499	1.08403
61	0.01369	0.09277	0.24986	0.00161	3.43994	26.71150	0.00015210	1.08482
62	0.01257	0.08990	0.24669	0.00144	3.43735	26.65547	0.00014000	1.08562
63	0.01150	0.08674	0.24320	0.00129	3.43306	26.62487	0.00012790	1.08650
64	0.01048	0.08370	0.23981	0.00115	3.43055	26.55996	0.00011680	1.08738
65	0.00953	0.08067	0.23637	0.00101	3.42907	26.47225	0.00010640	1.08829
66	0.00862	0.07761	0.23285	0.00089	3.42676	26.39466	0.00009610	1.08929
67	0.00778	0.07482	0.22951	0.00078	3.42697	26.26710	0.00008680	1.09027
68	0.00699	0.07193	0.22603	0.00067	3.42567	26.16192	0.00007770	1.09137
69	0.00624	0.06858	0.22207	0.00058	3.42665	26.01022	0.00006935	1.09248
70	0.00555	0.06599	0.21881	0.00049	3.42981	25.81795	0.00006160	1.09365
71	0.00492	0.06328	0.21532	0.00042	3.43307	25.61667	0.00005425	1.09489
72	0.00432	0.06007	0.21130	0.00035	3.44036	25.34614	0.00004745	1.09622
73	0.00378	0.05778	0.20809	0.00029	3.44767	25.06878	0.00004120	1.09763
74	0.00327	0.05455	0.20393	0.00023	3.46375	24.64900	0.00003560	1.09909
75	0.00282	0.05170	0.20005	0.00019	3.47337	24.32849	0.00003019	1.10075