V. MAKING LABOUR FORCE PROJECTIONS USING LABOUR FORCE PARTICIPATION RATES

A. Introduction

Labour force projections can be extremely useful in preparing comprehensive plans to accommodate future population change, particularly changes in the working-age population (box 7) and labour force. When used along with employment projections labour force projections can be used to analyse potential future imbalances in the labour market. Specifically, when projected levels of the labour force are compared with the projected levels of employment, it is possible to identify future surpluses or shortages of labour. The analysis can indicate whether projections of population and value added, factors influencing the supply of labour and demand for labour, are realistic and whether the policies underlying those projections will lead to a balance between the supply and demand sides of the labour market.

This chapter describes a method for preparing labour force projections that applies assumed labour force participation rates to the projected population at different dates. This method, which has been used in many planning exercises, yields the labour force, classified by age and sex along with various indicators of labour force size, structure and change. The method is suitable for making national or urban-rural projections.1/

The method would be easy to apply in most developing countries. It does not require extensive data nor does it entail laborious calculations.

When using the method to make an urban-rural projection, however, caution should be exercised if the population projection that underlies the labour force projection is based on a de jure population count. In that case, the urban and rural labour forces would correspond to the labour supplies provided to the urban and rural labour markets only if for the large majority of the labour force, the area of residence was the same as the area of work. Where a sizeable proportion of the urban labour force consisted of commuters or seasonal migrants from rural areas, it would be misleading to treat the urban and rural labour forces as equivalent to the labour supplies provided to these labour markets.

This chapter will first describe the procedure for projecting the labour force. It will then describe inputs required and discuss how assumptions on labour force participation rates can be formulated. Lastly, the chapter will present two illustrative labour force projections, one for the entire country and the other for urban and rural areas.

Box 7

Glossary

Demand for labour
  The quantity of labour that users of labour services desire to purchase at prevailing wages and salaries.

Labour force participation rate
  The number of persons in the labour force of a given age, sex and/or level of education, divided by the corresponding total number of persons with the same characteristics.

Labour market
  The market in which labour services are bought and sold through a process that determines the number of persons employed as well as wages and salaries.

Sex ratio of labour force
  The number of males in the labour force, divided by the corresponding number of females and conventionally multiplied by a hundred.

Supply of labour
  The quantity of labour that owners of labour services desire to sell at prevailing wages and salaries.

Value added
  For a firm or farm, the difference between its total revenue and the cost of raw materials, services and components used in production, over a specified time period; for the economy as a whole or any of its industries, the aggregate of value added of different firms or farms of which the economy or industry is composed.

Working-age population
  The population in the working ages, conventionally defined as 15 to 59 years or 15 to 64 years.

B. The technique

1. Overview

  This overview will first indicate the types of inputs required by the labour force participation rate method and list the types of outputs that it can generate. Also, the overview will outline the computational steps required to prepare a labour force projection using this method.

(a) **Inputs**

The inputs required to project labour forces will include:

(i)   Projected age and sex structure of the population at age 10 and over;
(ii) Assumptions on labour force participation rates.

For a national projection the inputs would be for the entire country. For a urban-rural projection, they would be for urban and rural areas, respectively. The inputs are listed in box 8.

Box 8

**Inputs for making labour force projections using
labour force participation rates**

1.   Age and sex structures of the population at age 10 and over (national or urban
     and rural)

2.   Assumptions on labour force participation rates (national or urban and rural)

     Labour force participation rates, by age and sex

The technique will be described as a procedure for making quinquennial labour force projections, using inputs for dates five years apart, starting with the initial year of the plan.

(b) **Outputs**

The types of output that the labour force participation rate method can generate would partly depend on the type of projection being made. In the case of a national projection, the method would yield:

(i)   Structure of the labour force by age and sex;
(ii)   Various labour force aggregates, such as the total labour force and the growth in total labour force;
(iii) Indicators of the structure of the labour force, such as proportions of labour force in broad age groups (10-24, 25-64 and 65+);
(iv)   Rates of change in the total labour force and its components.

If the technique is used to make an urban-rural projection, the results would include all those listed under (i) through (iv), which would be for

urban and rural areas as well as for the entire country. In addition, the results would include indicators of the urban-rural distribution of the labour force. The types of outputs that the method can generate as part of the national or urban-rural projection are shown in box 9.

Box 9

Types of outputs obtained by projecting labour force
using labour force participation rates

1.   Structure of the labour force by age and sex (national or urban, rural and national)

2.   Labour force aggregates (national or urban, rural and national)

       Total labour force and labour force by broad age group and sex

       Growth in total labour force and in labour force by broad age group and sex

3.   Indicators of structure of the labour force (national or urban, rural and national)

       Proportions of the labour force at different broad age groups, median age of the labour force and sex ratio of the labour force

4.   Indicators of the urban-rural distribution of the labour force (national only; if urban and rural labour force are being projected)

       Proportions of the labour force in different residential locations

5.   Rates of growth of the labour force (national or urban, rural and national)

       Rates of growth of the total labour force and of the labour force disaggregated by broad age and sex groups

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These results would be for dates five years apart or the intervening projection intervals.

(c) Computational steps

The first step of the procedure is to calculate the structure of the labour force disaggregated by age and sex. This structure is obtained from the age and sex structure of the population at age 10 and over and age- and sex-specific labour force participation rates. The procedure also entails

deriving for each projection date the total labour force along with other date-specific indicators. These results can then be used to calculate the absolute growth in the labour force and the rates of growth for the intervening intervals.

2. National level

This section will initially elaborate the steps to compute the structure of the labour force. Then it will explain the steps needed to derive other results for a given projection date or interval at the national level. A summary of those steps is presented in box 10. The steps used to derive urban and rural labour force structures together with the related results will be described in a later section.

Box 10

**Computational steps needed to project the labour force
at the national level**

The steps used to project labour force at the national level over a five-year projection interval are:

(1) Compute the structure of the labour force by age and sex by applying age-specific and sex-specific labour force participation rates to the number of persons in different age and sex groups.

(2) Derive from the structure of the labour force various labour force aggregates, such as the total labour force and the numbers of persons in the labour force in broad age groups. Also, calculate other labour force aggregates, such as the growth in total labour force and the increase in labour force in different broad age groups over the projection interval.

(3) Derive indicators of the structure of the labour force, such as proportions of labour force in broad age groups and the sex ratio of the labour force.

(4) Compute the rates of growth of the total labour force and of the labour force by different broad age group and sex over the projection interval.

(a) Labour force structure

The number of persons in the labour force, classified by age and sex, at a given date, such as the end of a five-year projection interval (t to t+5) can be obtained as follows:

$$LF(a,s,t+5) = POP(a,s,t+5) \cdot LFPR(a,s,t+5); \qquad (1)$$

$$a = 3,\ldots,16;$$

$$s = 1,2,$$

where:

$a = 3,\ldots,16$	are five-year age groups 10-14,...,75+,
$s = 1,2$	are male and female sexes,
t	is the year of the projection period,
$LF(a,s,t+5)$	is the number of persons of age group a and sex s in the labour force at the end of the interval,
$POP(a,s,t+5)$	is the population of age group a and sex s at the end of the interval, and
$LFPR(a,s,t+5)$	is the labour force participation rate among persons of age group a and sex s at the end of the interval.

As indicated by equation (1), the number of persons of a given age group and sex who are in the labour force is obtained as a product of the population of that age group and sex and the relevant labour force participation rate.

(b) <u>Other results</u>

After the structure of the labour force by age and sex is derived, it is possible to make projections for a variety of useful labour force indicators, which include different labour force aggregates, indicators of the structure of the labour force as well as rates of change in the labour force.

(i) <u>Labour force aggregates</u>

A key aggregate that can be projected from the labour force structure is the size of the total labour force. Also, it is possible to obtain from this structure the number of persons in the labour force who belong to different broad age groups along with the number of males and females in the labour force. Once these numbers are obtained for different dates five years apart, it is possible to calculate the increases in those numbers over the intervening five-year projection intervals.

a. Total labour force

The total labour force can be obtained by aggregating the number of persons in the labour force across the range of age groups and sexes. For the end of a projection interval (t to t+5) this number can be calculated as follows:

$$LF(t+5) = \sum_{a=3}^{16} \sum_{s=1}^{2} LF(a,s,t+5), \tag{2}$$

where:

LF(t+5)   is the total labour force at the end of the interval.

b. Labour force in broad age groups

The age span 10 and over may be subdivided into broad age groups, e.g. 10-24, 25-64 and 65 and over. The first group might include younger members of the labour force, persons who are still of school-age, many of whom are just entering the labour force. The second group consists of labour force members who are in their prime working years, 25-64, and the third group, aged 65 and over, would include elderly members of the labour force.

i. Young-age labour force

The number of persons in the youngest component of the labour force can be obtained by aggregating the number of male and female members of the labour force who belong to age groups 10-14 through 20-24:

$$LFY(t+5) = \sum_{a=3}^{5} \sum_{s=1}^{2} LF(a,s,t+5), \tag{3}$$

where:

LFY(t+5)   is the number of persons in the young-age labour force at the end of the interval.

ii. Prime-working-age labour force

The number of persons in the prime-working-age labour force can be derived by summing the number of males and female in the labour force at age groups 25-29 through 60-64:

$$LFP(t+5) = \sum_{a=6}^{13} \sum_{s=1}^{2} LF(a,s,t+5), \qquad (4)$$

where:

LFP(t+5)   is the number of persons in the prime-working-age labour force at the end of the interval.

iii. Old-age labour force

The number of persons in the old-age labour force can be derived by adding up the number of males and females in the labour force who are 65 or older:

$$LFO(t+5) = \sum_{a=14}^{16} \sum_{s=1}^{2} LF(a,s,t+5), \qquad (5)$$

where:

LFO(t+5)   is the number of persons in the old-age labour force at the end of the interval.

c. Labour force disaggregated by sex

In addition to the labour force within different broad age groups, it is also possible to compute the number of males and females in the total labour force and each of its age components. For the sake of brevity, this section will discuss only the disaggregation of the total labour force.

i. Male labour force

The number of males (s=1) in the labour force can be calculated by summing up males of different age groups who are in the labour force:

$$LF(s,t+5) = \sum_{a=3}^{16} LF(a,s,t+5); \qquad (6)$$

$$s = 1,2,$$

where:

LF(s,t+5)   is the number of persons of sex s in the labour force at the end of the interval.

ii. Female labour force

The number of females (s=2) in the labour force can be obtained as the difference between the total labour force and the number of males in the labour force:

$$LF(2,t+5) = LF(t+5) - LF(1,t+5). \tag{7}$$

d. Growth in total labour force

The growth in the total labour force for the projection interval (t to t+5) equals the difference between the total labour force at the end and the beginning of the five-year interval:

$$LFGR = LF(t+5) - LF(t), \tag{8}$$

where:

        LFGR   is the growth in the total labour force over the interval.

e. Growth in young-age, prime-working-age and old-age labour force

Increases in labour force within different broad age groups over the projection interval are respectively obtained by subtracting the size of the labour force component at the beginning of the interval from the size of the corresponding component at the end of the interval.

Growth in the young-age component of the labour force is:

$$LFYGR = LFY(t+5) - LFY(t), \tag{9}$$

Growth in the prime-working-age component of the labour force is calculated as:

$$LFPGR = LFP(t+5) - LFP(t), \tag{10}$$

Growth in the old-age component of the labour force is:

$$LFOGR = LFO(t+5) - LFO(t), \tag{11}$$

where:

LFYGR   is the growth in the young-age component of the labour force over the interval,

LFPGR   is the growth in the prime-working-age component of the labour force over the interval, and

LFOGR   is the growth in the old-age component of the labour force over the interval.

f. Growth in male and female labour force

The increase in the number of males (or females) in the labour force can be obtained as:

$$LFGR(s) = LF(s,t+5) - LF(s,t); \tag{12}$$

$$s = 1,2,$$

where:

LFGR(s)   is the growth in the component of the labour force consisting of persons of sex s over the interval.

(ii) Indicators of the structure of the labour force

Once the various labour force aggregates are obtained, it is possible to derive proportions of labour force found in different broad age groups. It is also possible to calculate the median age of labour force and the sex ratio of the labour force.

a. Proportions by broad age groups

The proportions of labour force found in the broad age groups identified above can be obtained as follows:

The proportion of young-age persons in the labour force is equal to the young labour force divided by the total labour force:

$$PLFY(t+5) = LFY(t+5) / LF(t+5), \tag{13}$$

The proportion of prime-working-age persons in the labour force is equal to the prime working age labour force divided by the total labour force:

$$PLFP(t+5) = LFP(t+5) / LF(t+5),\qquad(14)$$

The proportion of old-age persons in the labour force is equal to the old age labour force divided by the total labour force:

$$PLFO(t+5) = LFO(t+5) / LF(t+5),\qquad(15)$$

where:

PLFY(t+5)	is the proportion of young persons in the labour force at the end of the interval,
PLFP(t+5)	is the proportion of prime-working-age persons in the labour force at the end of the interval, and
PLFO(t+5)	is the proportion of old-age persons in the labour force at the end of the interval.

b. Median age of labour force

The median age of the labour force can be derived using the standard formula for computing the median age from grouped data.[2] If applied to the age structure of the labour force, this formula is:

$$MALF(t+5) = (a' - 1) \cdot 5 + \left[\left(LF(t+5)/2 - \sum_{a=3}^{a'-1} \sum_{s=1}^{2} LF(a,s,t+5) \right) \Big/ \sum_{s=1}^{2} LF(a',s,t+5) \right] \cdot 5,\qquad(16)$$

where:

MALF(t+5)	is the median age of the labour force at the end of the interval, and
a'	is the number that stands for the five-year age group containing the member of the labour force who is older than one half of the total labour force and younger than the other half.

In equation (16), the first term on the right-hand side, $(a'-1).5$, represents the lower limit of the five-year age group containing the middle member of the population. The term, $\sum_{a=3,a'-1}\sum_{s=1,2}LF(a,s,t+5)$, stands for the number of persons in all five-year age groups preceding the age group containing the middle member, and the term, $\sum_{s=1,2}LF(a',s,t+5)$ is the number of persons in that latter age group.

c. Sex ratio of labour force

The sex ratio of the labour force is equal to the number of males in the labour force, divided by the number of females s and multiplied by a hundred:

$$SRLF(t+5) = [\ (LF(1,t+5) \ ) \ / \ (LF(2,t+5) \ ) \ ] \cdot 100, \tag{17}$$

where:

> $SRLF(t+5)$ is the sex ratio of the labour force at the end of the five-year interval.

(iii) Rates of growth of labour force

As part of a labour force projection, it is possible to compute average annual rates of growth in the total labour force and in the labour force of different broad age groups or sexes.

a. Rate of growth in the total labour force

The average annual growth rate in the total labour force for a given projection interval can be computed from the size of the total labour force at the beginning and at the end of the five-year interval, using the formula for calculating an exponential growth rate:

$$GRLF = [\ (\ \ln \ (\ LF(t+5) \ / \ LF(t) \ ) \ ) \ / \ 5 \ ] \cdot 100, \tag{18}$$

where:

> $GRLF$ is the average annual exponential growth rate of the total labour force for the interval, and

> $\ln$ is the natural logarithm.

b. <u>Rates of growth in young-age, prime-working-age</u>
   <u>and old-age labour force</u>

The average annual rates of growth of the labour force disaggregated into broad age groups can be obtained as follows:

The growth rate of the young-age component of the labour force is calculated as:

$$GRLFY = [(\ln (LFY(t+5) / LFY(t))) / 5] \cdot 100, \tag{19}$$

The growth rate of the prime-working-age component of the labour force is calculated as:

$$GRLFP = [(\ln (LFP(t+5) / LFP(t))) / 5] \cdot 100, \tag{20}$$

The growth rate of the old-age component of the labour force is calculated as:

$$GRLFO = [(\ln (LFO(t+5) / LFO(t))) / 5] \cdot 100, \tag{21}$$

where:

GRLFY	is the average annual exponential growth rate of the young-age component of the labour force for the interval,
GRLFP	is the average annual exponential growth rate of the prime-working-age component of the labour force for the interval, and
GRLFO	is the average annual exponential growth rate of the old-age component of the labour force for the interval.

c. <u>Rates of growth in male and female components</u>
   <u>of the labour force</u>

The growth rates of the labour force of either sex can be obtained as:

$$GRLF(s) = [(\ln (LF(s,t+5) / LF(s,t))) / 5] \cdot 100; \tag{22}$$

$$s = 1,2,$$

where:

GRLF(s)   is the average annual exponential growth rate of the number of persons in the labour force of sex s over the interval.

3. Urban-rural level

This section will discuss a procedure that can be used to make an urban-rural projection of the labour force which is similar to that employed to make a national projection. The procedure consists of steps used to project the structures of labour force by age and sex along with those needed to derive a variety of other results.

(a) Labour force structures

Urban and rural structures of labour force for the end of a given projection interval (t to t+5) can be calculated using an urban-rural equivalent of the step described by equation (1):

$$LF(a,s,k,t+5) = POP(a,s,k,t+5) \cdot LFPR(a,s,k,t+5); \qquad (23)$$

$$a = 3,\ldots,16;$$

$$s = 1,2;$$

$$k = 1,2,$$

where:

k = 1,2   are urban and rural locations,

LF(a,s,k,t+5)   is the number of persons of age group a and sex s in location k in the labour force at the end of the interval,

POP(a,s,k,t+5)   is the population of age group a and sex s in location k at the end of the interval, and

LFPR(a,s,k,t+5)   is the labour force participation rate among persons of age group a and sex s in location k at the end of the interval.

(b) <u>Other results</u>

The indicators discussed in connection with the national projection can also be computed as part of an urban-rural projection. Those indicators are, however, calculated for urban and rural areas and for the entire country, using steps analogous to those indicated by equations (2) through (22). In addition, indicators of the distribution of labour force by residential location--proportions urban and rural--can be calculated.

(i) <u>Proportions urban and rural</u>

The proportion of labour force that is urban (k=1) at the end of a projection interval is computed by dividing the total labour force in urban areas by the total national labour force:

$$PLFURB(t+5) = LF(1,t+5) \;/\; LF(t+5), \qquad (24)$$

where:

> PLFURB(t+5)   is the proportion of the total labour force that is urban at the end of the interval, and

> LF(k,t+5)   is the labour force in location k at the end of the interval.

The proportion of labour force that is rural (k=2) can be found as a complement of the proportion urban:

$$PLFRUR(t+5) = 1 - PLFURB(t+5), \qquad (25)$$

where:

> PLFRUR(t+5)   is the proportion of the total labour force that is rural at the end of the interval.

This completes the description of the technique for making labour force projections.

C. <u>The inputs</u>

This section will discuss the inputs required by the labour force participation rate method. Specifically, it will list those inputs and then describe how they can be prepared.

1. Types of inputs required

The following inputs are required to apply the labour force participation rate method:

(i)   Projected age and sex structure of the population;
(ii)   Assumptions on labour force participation rates, by age and sex.
Depending on whether one wishes to make a national projection or a projection for urban and rural areas, those inputs will be required for the nation as a whole or for urban and rural areas.

2. Preparation of the inputs

The projected population structures can be prepared by making a population projection with the cohort component method (see module one, chapter II). Assumptions on labour force participation rates can be prepared as discussed below, relying among other things, on the observations of those rates.

(a)   Observed labour force participation rates

In order to prepare assumptions on labour force participation rates, observations on these rates for a recent date or a few such dates are needed. These observations are needed in order to formulate assumptions for the initial year of the projection, which would normally be derived by extrapolating recent empirical rates. The extrapolation will reflect the planner's judgement regarding changes in the rates over the time interval prior to the initial year of the projection.

Where observations on labour force participation rates are not available, they can be derived from information on labour force and population, classified by age and sex. The data may come from population censuses, demographic surveys and/or other specialized surveys, such as labour force or employment surveys. Where data from two or more statistical sources are to be used, it is necessary to ensure that labour force information from different sources is based on the same definition of the labour force. Depending on the type of projection sought, the requisite data should be available at the national or urban-rural level.

(b)   Assumptions on future labour force participation rates

To formulate assumptions on labour force participation rates for dates beyond the initial year of the projection, it is normally necessary to consider socio-economic and demographic changes expected to occur during the plan horizon and to estimate their effects on the participation rates. In

particular, as part of formulating assumptions on labour force participation rates for young-age persons of either sex, special attention needs to be paid to future trends in schooling. As school attendance is generally incompatible with participation in the labour force, future trends in proportions of children and adolescents enrolled in schools are likely to have a strong effect on the incidence of labour force participation among these groups. Assumptions on labour force participation rates at the upper end of the working-age span must reflect likely future changes in old-age security arrangements, both at the family and societal levels, since those arrangements are likely to have an important influence on withdrawal from the labour force at advanced years of age.

Assumptions concerning male and female labour force participation rates in the prime working ages are, typically, formulated differently from each other. In many countries male rates are assumed to remain fixed over time or are expected to change only slightly, since those rates are generally close to unity and show only minor variations over time. On the other hand, rates for females in the prime working ages are changing rapidly in many societies and so the assumptions must be based on a consideration of likely developments in areas such as childbearing and childrearing practices, female education, employment opportunities, household income and urbanization.

Developments in some areas will tend to raise and in others to reduce female participation rates. For example, if fertility is expected to decline over the plan horizon, female labour force participation may well increase. Similarly, where female schooling is expanding assumptions on the prime working-age female participation rates are likely to increase over time.

These rates may also be assumed to increase if employment is expanding rapidly, since improved employment opportunities are likely to draw an increasing number of women into the work force. On the other hand, an increase in household income can have a depressing effect on female participation rates, especially if the major source of the increase is the rising earnings of males. Under these conditions, the incentives for women to enter and/or remain in the labour market and contribute to household income may decline.

These developments and their effects on female labour force participation may not be the same at the national and at the urban-rural levels. Therefore, where the assumptions on female participation rates are formulated for a national projection, the effects of the expected trends in urbanization should also be taken into account. This is necessary wherever there are sizeable urban-rural differentials in female labour force participation rates. Thus, if participation in the labour force is more prevalent among rural women than urban women, and if rapid urbanization is likely to occur over the plan horizon as a result of the rapid employment expansion in the urban-based sectors of the economy, urbanization will tend to reduce the national female participation rates.

D. Illustrative examples of projections

This section will present examples to illustrate the use of the labour force participation rates to prepare a national and an urban-rural labour force projection. These examples will indicate how the relevant calculations are made by focusing on the projection interval 0-5. In addition, they will provide complete projection results for the 20-year period.

1. National projection

The calculations presented in this example will be based on the inputs contained in tables 33 and 34, which respectively show population structures and assumptions on future labour force participation rates. The inputs are specified for dates five years apart, starting with the initial year of the plan, which is denoted as year 0. The age and sex structures are those at age 10 and over, and the labour force participation rates are for various age and sex groups over the same age range.

(a) Labour force structure

For any given date, the number of persons in the civilian labour force in various age and sex groups are calculated as the products of the number of persons in those groups and the corresponding labour force participation rates. These calculations are illustrated in table 35 for the end of the projection interval 0-5. The number of persons of either sex in the civilian labour force, classified by age (column 4), are obtained as the number of persons of that sex classified by age (column 2), multiplied by the corresponding labour force participation rates (column 3).3/

For example, the number of males aged 10-14 in the civilian labour force at the end of the interval 0-5, 136.5, is obtained as:

$$136.5 = (729.9)(0.187), \tag{1}$$

where 729.9 is the number of males aged 10-14 and 0.187 is the male labour force participation rate for age group 10-14 at that date.

Performing the calculations illustrated for the end of the interval 0-5 for each five-year interval of the entire projection period produces the labour force structures for the entire period. The labour force structures for the 20-year projection interval are shown in table 36.

(b) Other results

Other results that can be obtained as part of a labour force projection at the national level include various labour force aggregates, indicators of the structure of the labour force and rates of change of the labour force.

Table 33. Population structures at age 10 and over: entire country

(Thousands)

Age group	Year				
	0	5	10	15	20
	Male				
10-14	624.0	729.9	729.3	815.6	917.5
15-19	486.6	618.5	724.9	725.4	812.0
20-24	402.2	481.5	613.4	720.1	721.5
25-29	361.5	397.1	476.7	608.5	715.5
30-34	358.7	355.9	392.2	472.0	603.6
35-39	312.4	351.5	350.2	387.1	466.9
40-44	223.6	303.6	343.4	343.5	381.0
45-49	152.1	214.5	293.2	333.5	335.1
50-54	192.5	142.8	203.2	279.9	320.3
55-59	157.0	175.3	131.5	189.0	262.4
60-64	128.1	136.3	154.4	117.4	170.5
65-69	90.1	103.6	112.4	129.5	99.9
70-74	44.2	65.9	77.7	86.2	101.4
75+	38.6	45.6	63.0	81.4	99.1
	Female				
10-14	580.5	685.2	697.4	783.3	877.0
15-19	448.3	574.9	680.2	693.5	779.9
20-24	359.8	442.5	569.3	675.3	689.6
25-29	348.3	354.5	437.5	564.5	670.7
30-34	352.2	342.4	349.9	433.2	560.0
35-39	300.9	345.1	337.0	345.5	428.7
40-44	206.7	293.5	338.2	331.6	340.8
45-49	158.5	200.2	285.7	330.7	325.2
50-54	174.6	151.2	192.3	276.1	320.9
55-59	164.0	162.2	141.9	181.9	262.8
60-64	126.1	145.9	146.3	129.5	167.6
65-69	105.6	105.1	124.0	126.4	113.4
70-74	63.5	80.0	81.7	98.5	102.3
75+	69.4	72.9	86.4	97.5	116.1

Table 34. Labour force particapation rates: entire country

Age group	Year				
	0	5	10	15	20
			Male		
10–14	0.239	0.186	0.160	0.129	0.099
15–19	0.492	0.447	0.386	0.344	0.295
20–24	0.807	0.819	0.825	0.823	0.827
25–29	0.929	0.923	0.928	0.930	0.935
30–34	0.941	0.939	0.939	0.942	0.947
35–39	0.933	0.933	0.935	0.937	0.944
40–44	0.926	0.926	0.929	0.934	0.940
45–49	0.912	0.915	0.919	0.922	0.928
50–54	0.887	0.889	0.894	0.899	0.905
55–59	0.837	0.834	0.835	0.835	0.838
60–64	0.738	0.729	0.722	0.723	0.731
65–69	0.395	0.385	0.382	0.381	0.383
70–74	0.099	0.102	0.098	0.103	0.103
75+	0.049	0.049	0.043	0.043	0.037
			Female		
10–14	0.153	0.132	0.117	0.098	0.078
15–19	0.344	0.334	0.319	0.313	0.298
20–24	0.348	0.357	0.367	0.378	0.391
25–29	0.357	0.375	0.392	0.409	0.427
30–34	0.303	0.316	0.334	0.352	0.369
35–39	0.247	0.257	0.267	0.283	0.294
40–44	0.196	0.200	0.204	0.211	0.220
45–49	0.145	0.149	0.154	0.158	0.166
50–54	0.097	0.101	0.105	0.110	0.116
55–59	0.077	0.080	0.081	0.082	0.083
60–64	0.068	0.071	0.071	0.072	0.072
65–69	0.065	0.067	0.062	0.062	0.063
70–74	0.062	0.058	0.058	0.052	0.052
75+	0.052	0.054	0.047	0.047	0.042

Table 35. Calculating labour force structure, by age and sex:
entire country, year 5

Age group	Population at age 10 and over a/ (thousands)	Labour force participation rates b/	Labour force c/ (thousands)
(1)	(2)	(3)	(4)

Male

10-14	729.9	0.187	136.5
15-19	618.5	0.448	277.1
20-24	481.5	0.820	394.8
25-29	397.1	0.924	366.9
30-34	355.9	0.940	334.5
35-39	351.5	0.934	328.3
40-44	303.6	0.927	281.4
45-49	214.5	0.915	196.3
50-54	142.8	0.890	127.1
55-59	175.3	0.834	146.2
60-64	136.3	0.729	99.4
65-69	103.6	0.386	40.0
70-74	65.9	0.102	6.7
75+	45.6	0.049	2.2

Female

10-14	685.2	0.132	90.4
15-19	574.9	0.335	192.6
20-24	442.5	0.358	158.4
25-29	354.5	0.375	132.9
30-34	342.4	0.317	108.5
35-39	345.1	0.257	88.7
40-44	293.5	0.200	58.7
45-49	200.2	0.149	29.8
50-54	151.2	0.101	15.3
55-59	162.2	0.080	13.0
60-64	145.9	0.072	10.5
65-69	105.1	0.068	7.1
70-74	80.0	0.058	4.6
75+	72.9	0.055	4.0

a/ From table 33.
b/ From table 34.
c/ (Col. 2) . (Col. 3).

Table 36. Projected labour force, by age and sex: entire country

(Thousands)

Age group	Year				
	0	5	10	15	20

Male

Age group	0	5	10	15	20
10-14	149.1	136.5	116.7	106.0	90.8
15-19	239.4	277.1	280.5	249.5	240.4
20-24	324.6	394.8	506.7	593.4	597.4
25-29	335.8	366.9	442.9	566.5	669.7
30-34	337.5	334.5	368.7	445.1	572.2
35-39	291.5	328.3	327.8	363.1	441.2
40-44	207.1	281.4	319.4	321.2	358.5
45-49	138.7	196.3	269.5	307.5	311.3
50-54	170.7	127.1	181.7	251.6	289.9
55-59	131.4	146.2	109.8	158.0	219.9
60-64	94.5	99.4	111.5	84.9	124.6
65-69	35.6	40.0	43.0	49.3	38.3
70-74	4.4	6.7	7.6	8.9	10.4
75+	1.9	2.2	2.7	3.5	3.7

Female

Age group	0	5	10	15	20
10-14	88.8	90.4	82.3	76.8	68.4
15-19	154.2	192.6	217.7	217.8	232.4
20-24	125.2	158.4	208.9	255.9	270.3
25-29	124.3	132.9	171.5	230.9	286.4
30-34	106.7	108.5	117.2	152.9	206.6
35-39	74.3	88.7	90.0	98.1	126.0
40-44	40.5	58.7	69.3	70.0	75.3
45-49	23.0	29.8	44.0	52.6	54.0
50-54	16.9	15.3	20.2	30.6	37.5
55-59	12.6	13.0	11.5	14.9	21.8
60-64	8.6	10.5	10.5	9.5	12.2
65-69	6.9	7.1	7.7	7.8	7.1
70-74	3.9	4.6	4.7	5.2	5.4
75+	3.6	4.0	4.1	4.7	4.9

(i)   Labour force aggregates

Labour force aggregates include the total labour force, the number of persons in the labour force who belong to broad age groups and the number of males and females in the labour force. Other labour force aggregates include increases in the total labour force, in the number of persons in the labour force in broad age groups and increases in the number of males and females in the labour force.

a.   The total labour force

The total labour force at the end of a given projection interval is obtained as the sum of the number of persons in the labour force in different age and sex groups. At the end of the interval 0-5, the total labour force, 3,652.2, is computed by adding the number of male and female members of the labour force in various age groups. This number (3,652.2) is shown in table 37 (in the column corresponding to year 5) along with other results derived for the entire 20-year projection period. The total labour force and its male and female components over this period is illustrated in figure X.

b.   Labour force in broad age groups

The number of persons in the young-age, prime-working-age, and old-age labour force can be derived by aggregating the number of persons in the labour force within broad age groups 10-24, 25-64 and 65+, respectively.

i.   Young-age labour force

The number of persons in the young-age component of the labour force at the end of the projection interval 0-5, 1,249.9, is obtained by aggregating the number of males and females in the labour force in age groups 10-14 through 20-24. The number is shown in table 37 (column corresponding to year 5).

ii.   Prime-working-age labour force

The number of persons in prime-working-age component of the labour force, 2,337.6, is found by summing the number of persons of both sexes in labour force in age groups 25-29 through 60-64.
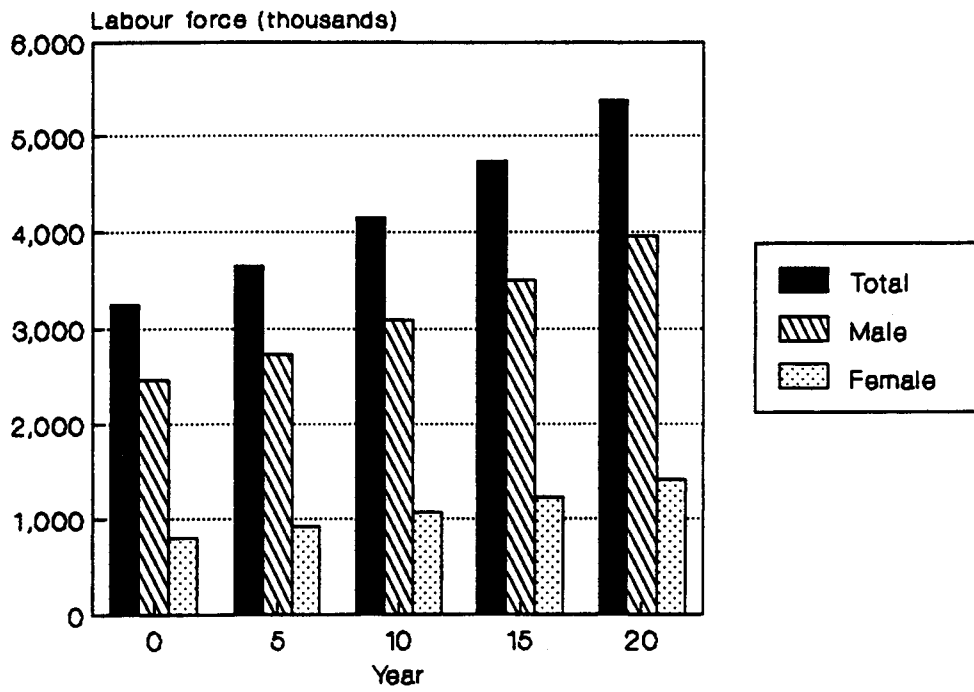

iii.   Old-age labour force

The number of persons in old-age component of the labour force, 64.7, equals the sum of males and females in the labour force at age 65 and over.

Table 37. Labour force aggregates, structure and rates of growth: entire country

Indicators	Year				
	0	5	10	15	20

Labour force aggregates (thousands)

Labour force

Total	3251.9	3652.2	4148.0	4736.2	5376.9
Young-age	1081.4	1249.9	1412.8	1499.4	1499.7
Prime-working-age	2114.3	2337.6	2665.3	3157.4	3807.3
Old-age	56.3	64.7	69.9	79.5	69.8
Male	2462.3	2737.5	3088.3	3508.5	3968.3
Female	789.7	914.7	1059.7	1227.7	1408.5

Growth in labour force

Total		400.2	495.9	588.2	640.7	
Young-age		168.5	162.9	86.6	0.3	
Prime-working-age		223.3	327.7	492.1	650.0	
Old-age		8.5	5.2	9.5	-9.6	
Male		275.2	350.8	420.2	459.8	
Female		125.0	145.0	168.0	180.9	

Indicators of labour force structure

Proportions by broad age groups

Young	0.33	0.34	0.34	0.32	0.28
Prime-working-age	0.65	0.64	0.64	0.67	0.71
Old-age	0.02	0.02	0.02	0.02	0.01
Median age of labour force	31.0	30.9	30.5	30.6	31.5
Sex ratio of labour force	312	299	291	286	282

Rates of growth in labour force (percentage)

Total		2.32	2.55	2.65	2.54	
Young-age		2.90	2.45	1.19	0.00	
Prime-working-age		2.01	2.62	3.39	3.74	
Old-age		2.81	1.55	2.55	-2.59	
Male		2.12	2.41	2.55	2.46	
Female		2.94	2.94	2.94	2.75	

Figure X.   Total labour force and numbers of males and
            females in labour force

The projected levels of young-age, prime-working-age and old-age components of the labour force for the entire projection period are shown in figure XI.

c. Labour force disaggregated by sex

In addition to labour force within broad age groups, this method can be used to derive the number of males and females in the labour force.

i. Male labour force

The number of males in the labour force at the end of the interval 0-5, 2,737.5, is obtained as the sum of males in the labour force of different age groups from 10-14 onward. The number is shown in table 37.

ii. Female labour force

The number of females in the labour force, 914.7, can be calculated by subtracting the number of males in the labour force, 2,737.5, from the total labour force, 3,652.2:

$$914.7 = 3,652.2 - 2,737.5. \tag{7}$$

The numbers of males and females in the labour force at different dates during the projection period are illustrated in figure X.

d. Growth in the total labour force

The increase in the total labour force over a given projection interval equals the difference between the total labour force at the end and the beginning of the interval. For the interval 0-5, the growth in the total labour force, 400.2, is obtained as:

$$400.2 = 3,652.2 - 3,251.9, \tag{8}$$

where 3,251.9 and 3,652.2 are, respectively, the total labour force at the beginning and the end of the interval (shown in columns corresponding to years 0 and 5, respectively).

e. Growth in young-age, prime-working-age and old-age components of the labour force

The increase in labour force components corresponding to the different broad age groups over the interval 0-5 is obtained as follows:

Figure XI. Young-age, prime-working-age and old-age labour force

Growth in the young-age component of the labour force, 168.5, is calculated as:

$$168.5 = 1,249.9 - 1,081.4, \tag{9}$$

where 1,081.4 and 1,249.9 are the numbers of persons in the young-age labour force in years 0 and 5, respectively;

Growth in the prime-working-age component of the labour force, 223.3, is calculated as:

$$223.3 = 2,337.6 - 2,114.3, \tag{10}$$

where 2,114.3 and 2,337.6 are the numbers of persons in the prime-working-age labour force in years 0 and 5;

Growth in the old-age component of the labour force, 8.5, is calculated as:

$$8.5 = 64.7 - 56.3, \tag{11}$$

where 56.3 and 64.7 are the numbers of persons in the old-age component of the labour force in years 0 and 5.

f. Growth in male and female labour force

The increase in the number of males in the labour force over the interval 0-5, 275.2, is calculated as:

$$275.2 = 2,737.5 - 2,462.3, \tag{12}$$

where 2,462.3 and 2,737.5 are the numbers of males in the labour force in years 0 and 5, respectively.

Growth in the number of females in the labour force, 125.0, can be calculated in an anologous way:

$$125.0 = 914.7 - 789.7, \tag{12}$$

where 789.7 and 914.7 are the numbers of females in the labour force in years 0 and 5, respectively.

(ii)   Indicators of the structure of the labour force

Indicators of the structure of the labour force that can be calculated as part of a labour force projection include the proportions of labour force found in broad age groups, the median age of labour force and the sex ratio of the labour force.

a.   Proportions by broad age groups

The proportions of the labour force in each broad age group in year 5 can be calculated as follows:

The proportion of the total labour force in the young-age labour force, 0.34, is:

$$0.34 = 1,249.9 / 3,652.2, \tag{13}$$

where 1,249.9 and 3,652.2 are, respectively, the number of persons in the young-age component of the labour force and the total labour force;

The proportion of the total labour force in the prime-working-age labour force, 0.64, is:

$$0.64 = 2,337.6 / 3,652.2, \tag{14}$$

where 2,337.6 is the number of persons in the prime-working-age component of the labour force;

The proportion of the total labour force in the old-age labour force, 0.02, is:

$$0.02 = 64.7 / 3,652.2, \tag{15}$$

where 64.7 is the number of persons in the old-age component of the labour force.

b.   Median age of labour force

The median age of the labour force, which is the age that divides the labour force into two groups of equal size, is computed using the formula for calculating the median age from the grouped data. For the end of the 0-5 interval, the median age of the labour force, 30.9, is computed as follows:

$$30.9 = (7 - 1) (5) + [(3,652.2 / 2 - 1,749.6) / 443.0] (5). \tag{16}$$

For the end of the interval 0-5, the median-age divides the total labour force, 3,652.2, into one half, 1,826.1 (3,652.2 / 2), that is older than the median, and one half, 1826.1, that is younger. By cumulating the number of persons of both sexes in the labour force in the various five-year age groups starting with group 10-14, it can be verified that one half the total labour force, 1,826.1, falls in the seventh five-year age group. This can be seen by comparing the cumulative sum of the number of persons in the four age groups 10-14 through 25-29, 1,749.6, with one half the labour force, 1,826.1. Therefore, among the numbers used, the 7 in the first parenthesis stands for the seventh five-year age group, 30-34, which contains the middle member of the labour force; the term in the parenthesis is multiplied by 5, the length of the five-year age group. The result, 30, is the lower limit of the five-year age group containing the middle member.

The number 1,749.6, in the second parenthesis, stands for the number of persons in the labour force below age 30 (prior to the seventh age group). The number 443.0, which divides that parenthesis, is the sum of the numbers of males and females in the labour force in the age group 30-34. The 5 which multiplies the brackets stands for the length of the five-year age group. The result of this multiplication, 0.9, is the number which is added to the value indicating the lower limit of the five-year age group containing the middle member of the labour force, 30, in order to obtain the value of the median age sought, 30.9.

c. Sex ratio of labour force

The sex ratio of the labour force is the number of males in the labour force to the number of females, multiplied by a hundred. The sex ratio at the end of the 0-5 interval, 299, is obtained as follows:

$$299 = (2,737.5 / 914.7) \cdot 100 \qquad\qquad (17)$$

where 2,737.5 and 914.7 are, respectively, the numbers of males and females in the labour force at that date.

(iii) Rates of growth of the labour force

The rates of growth of the labour force that can be calculated include those of the total labour force, the labour force disaggregated into broad age groups and labour force disaggregated according to sex.

a. Rate of growth in the total labour force

The average annual growth rate of the total labour force for a given interval can be obtained by the exponential growth rate formula. For the projection interval 0-5, this growth rate, which equals 2.32 per cent (table 37), is obtained as follows:

$$2.32 = [(\ln (3{,}652.2 \, / \, 3{,}251.9)) \, / \, 5] \cdot 100, \qquad (18)$$

where 3,251.9 and 3,652.2 are the total labour force in years 0 and 5, respectively, and 5 is the length of the interval.

Rates of growth in the total labour force over the 20-year projection period are shown in figure XII.

b. <u>Rates of growth in the young-age, prime-working-age and old-age labour force</u>

The average annual rates of increase in the number of persons in labour force disaggregated by broad age groups for the interval 0-5 are calculated as follows:

The rate of growth in the number of persons in the young-age component of the labour force, 2.90 per cent, is:

$$2.90 = [(\ln (1{,}249.9 \, / \, 1{,}081.4)) \, / \, 5] \cdot 100, \qquad (19)$$

where 1,081.4 and 1,249.9 are the numbers of persons in the young-age component of the labour force in years 0 and 5, respectively;

The rate of growth in the number of persons in the prime-working-age component of the labour force, 2.01 per cent, is:

$$2.01 = [(\ln (2{,}337.6 \, / \, 2{,}114.3)) \, / \, 5] \cdot 100, \qquad (20)$$

where 2,114.3 and 2,337.6 are the numbers of persons in the prime-working-age component of the labour force in years 0 and 5;

The rate of growth in the number of persons in the old-age component of the labour force, 2.81 per cent, is:

$$2.81 = [(\ln (64.7 \, / \, 56.3)) \, / \, 5] \cdot 100, \qquad (21)$$

where 56.3 and 64.7 are the numbers of persons in the old-age component of the labour force in years 0 and 5.

The rates of growth in the numbers of persons in the young-age, prime-working-age and old-age components of the labour force are shown in figure XIII.

Figure XII.   Rates of growth of total labour force and numbers
of males and females in labour force
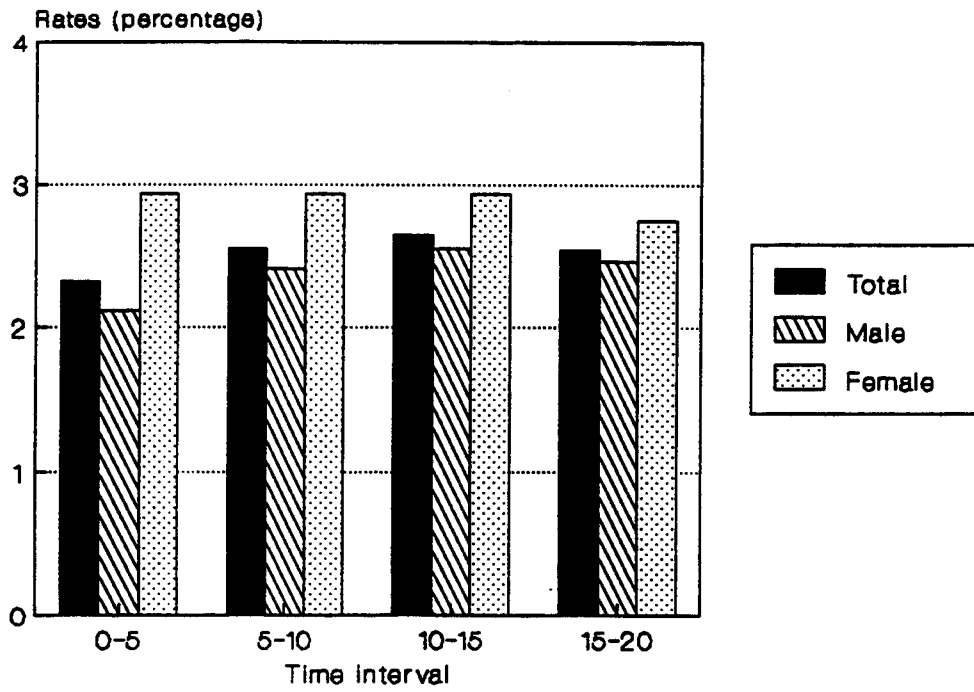
Figure XIII.   Rates of growth of young-age, prime-working-age
              and old-age labour force
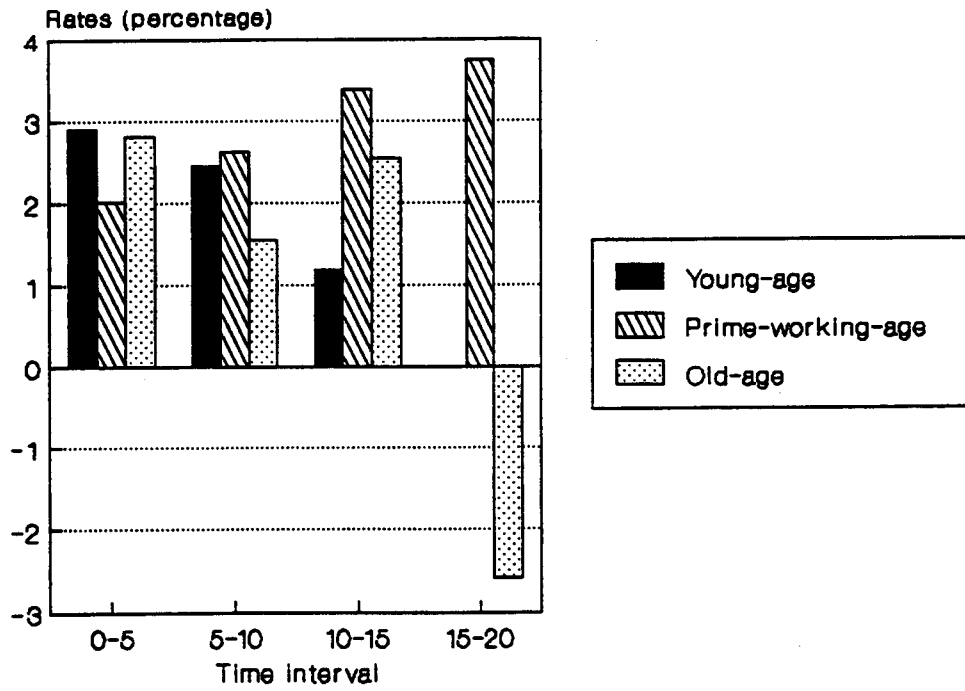
c. Rates of growth in male and female components
    of the labour force

The average annual percentage rate of growth in the number of males in the labour force for the interval 0.5, 2.12 per cent, can be calculated as follows:

$$2.12 = [(\ln (2{,}737.5 / 2{,}462.3)) / 5] \cdot 100, \tag{22}$$

where 2,462.3 and 2,737.5 are the numbers of males in the labour force in years 0 and 5;

The average annual rate of growth in the number of females in the labour force, 2.94 per cent, can be computed in an analogous way:

$$2.94 = [(\ln (914.7 / 789.7)) / 5] \cdot 100, \tag{22}$$

where 789.7 and 914.7 are the numbers of females in the labour force in years 0 and 5.

The rates of growth in the male and female components of the labour force are indicated in figure XII.

2. Projection for urban and rural areas

The technique for projecting labour force for urban and rural areas is similar to that for the country as a whole. This example will show how such a projection can be prepared by utilizing the inputs shown in tables 38 through 41. Table 38 shows the structure of the urban population at age 10 and over. Table 39 presents assumptions on the future labour force participation rates for urban areas. Table 40 shows the structure of the rural population at age 10 and over. Table 41 presents assumptions on the future labour force participation for rural areas.

The example will emphasize calculations that are unique to an urban-rural projection of the labour force.

(a) Labour force structures

For any given date, such as the end of the projection interval, the structures of the labour force for urban and rural areas are obtained by calculations identical to those used to make a national projection. In the urban-rural projection, however, those calculations are performed for either area.

Table 38. Population structures at age 10 and over: urban areas

(Thousands)

Age group	Year				
	0	5	10	15	20
			Male		
10-14	170.0	272.6	285.2	343.5	432.8
15-19	181.7	279.7	378.8	384.6	447.3
20-24	201.3	246.1	348.4	446.3	450.7
25-29	134.5	228.4	277.0	381.7	480.5
30-34	126.2	162.5	247.3	298.9	406.5
35-39	109.9	149.9	180.9	259.4	313.8
40-44	77.7	124.7	163.5	191.3	265.8
45-49	51.6	85.1	132.9	170.9	196.7
50-54	59.6	54.7	88.3	136.1	173.3
55-59	47.1	61.6	55.0	87.9	134.8
60-64	31.6	47.2	60.5	53.1	84.7
65-69	26.1	29.8	42.8	54.7	47.9
70-74	12.8	21.7	25.2	35.5	45.6
75+	11.2	14.7	22.3	29.4	40.5
			Female		
10-14	154.8	215.6	226.8	276.4	359.1
15-19	137.4	207.7	280.3	284.6	337.4
20-24	110.9	185.2	270.3	341.3	346.4
25-29	103.2	145.2	224.4	310.7	386.0
30-34	102.4	130.8	171.1	247.6	338.0
35-39	96.7	124.8	151.7	186.3	262.8
40-44	63.0	111.3	142.4	164.4	196.7
45-49	50.0	71.5	123.2	153.3	173.2
50-54	49.2	54.4	77.4	128.8	159.3
55-59	52.4	52.7	56.9	79.5	130.6
60-64	33.3	53.4	54.7	56.9	79.1
65-69	32.6	32.2	50.3	51.5	53.2
70-74	19.6	27.9	28.4	43.1	44.7
75+	21.4	24.9	32.7	37.9	50.7

Table 39. Labour force participation rates: urban areas

Age group	Year				
	0	5	10	15	20
	Male				
10–14	0.017	0.019	0.013	0.009	0.006
15–19	0.250	0.245	0.207	0.159	0.118
20–24	0.737	0.749	0.768	0.772	0.776
25–29	0.901	0.908	0.915	0.922	0.931
30–34	0.914	0.921	0.929	0.936	0.944
35–39	0.908	0.916	0.926	0.934	0.943
40–44	0.905	0.914	0.922	0.934	0.942
45–49	0.904	0.911	0.920	0.929	0.937
50–54	0.885	0.894	0.904	0.912	0.921
55–59	0.838	0.847	0.857	0.866	0.876
60–64	0.736	0.746	0.755	0.764	0.773
65–69	0.393	0.410	0.427	0.442	0.455
70–74	0.099	0.108	0.116	0.123	0.130
75+	0.049	0.049	0.049	0.049	0.049
	Female				
10–14	0.022	0.018	0.012	0.008	0.008
15–19	0.190	0.186	0.174	0.158	0.141
20–24	0.313	0.332	0.348	0.365	0.384
25–29	0.362	0.388	0.408	0.428	0.453
30–34	0.306	0.326	0.349	0.369	0.387
35–39	0.248	0.257	0.268	0.282	0.293
40–44	0.195	0.205	0.215	0.225	0.239
45–49	0.144	0.154	0.165	0.175	0.185
50–54	0.096	0.106	0.117	0.126	0.136
55–59	0.077	0.086	0.086	0.087	0.089
60–64	0.067	0.077	0.077	0.078	0.078
65–69	0.058	0.067	0.067	0.067	0.068
70–74	0.048	0.058	0.058	0.058	0.058
75+	0.038	0.047	0.047	0.048	0.048

Table 40. Population structures at age 10 and over: rural areas

(Thousands)

Age group	Year				
	0	5	10	15	20
			Male		
10-14	454.0	457.1	442.4	464.4	477.1
15-19	304.9	338.8	345.8	339.1	357.0
20-24	200.9	235.5	265.0	273.6	269.1
25-29	227.0	169.1	200.0	226.9	234.8
30-34	232.5	193.5	145.5	173.5	197.3
35-39	202.5	201.7	169.5	128.5	153.7
40-44	145.9	179.1	180.1	152.6	116.1
45-49	100.5	129.5	160.5	162.8	138.8
50-54	132.9	88.3	115.1	144.1	147.4
55-59	109.9	113.8	76.7	101.2	127.8
60-64	96.5	89.2	93.9	64.3	85.9
65-69	64.0	73.7	69.6	74.7	52.0
70-74	31.4	44.2	52.3	50.7	55.6
75+	27.4	31.0	40.7	51.7	58.3
			Female		
10-14	425.7	469.5	469.4	500.9	512.0
15-19	310.9	367.1	399.7	407.6	436.5
20-24	248.9	257.3	299.0	333.7	341.7
25-29	245.1	209.3	213.3	253.7	284.4
30-34	249.8	211.6	178.9	185.8	222.0
35-39	204.2	220.3	185.4	159.3	166.2
40-44	143.7	182.2	195.8	167.2	144.3
45-49	108.5	128.7	162.6	177.4	152.0
50-54	125.4	96.9	115.0	147.4	161.6
55-59	111.6	109.5	85.0	102.5	132.3
60-64	92.8	92.6	91.6	72.6	88.5
65-69	73.0	72.9	73.8	74.8	60.2
70-74	43.9	52.2	53.3	55.6	57.5
75+	48.0	48.1	53.9	59.6	65.5

Table 41. Labour force participation rates: rural areas

Age group	Year				
	0	5	10	15	20
			Male		
10-14	0.322	0.288	0.257	0.222	0.186
15-19	0.636	0.615	0.586	0.557	0.523
20-24	0.878	0.893	0.902	0.908	0.917
25-29	0.946	0.945	0.947	0.946	0.947
30-34	0.956	0.955	0.954	0.955	0.955
35-39	0.947	0.946	0.946	0.944	0.945
40-44	0.937	0.937	0.937	0.935	0.935
45-49	0.917	0.917	0.917	0.916	0.916
50-54	0.887	0.887	0.887	0.887	0.887
55-59	0.838	0.828	0.819	0.809	0.799
60-64	0.740	0.721	0.701	0.690	0.690
65-69	0.395	0.376	0.356	0.337	0.317
70-74	0.100	0.100	0.090	0.090	0.080
75+	0.049	0.049	0.039	0.039	0.030
			Female		
10-14	0.200	0.185	0.169	0.150	0.130
15-19	0.412	0.421	0.423	0.425	0.423
20-24	0.362	0.375	0.385	0.393	0.401
25-29	0.354	0.364	0.374	0.383	0.392
30-34	0.301	0.311	0.321	0.330	0.339
35-39	0.246	0.257	0.266	0.284	0.294
40-44	0.195	0.196	0.196	0.196	0.197
45-49	0.146	0.146	0.146	0.146	0.146
50-54	0.098	0.098	0.098	0.098	0.098
55-59	0.078	0.078	0.078	0.078	0.078
60-64	0.068	0.068	0.068	0.068	0.068
65-69	0.068	0.068	0.059	0.059	0.059
70-74	0.068	0.059	0.059	0.049	0.049
75+	0.057	0.058	0.048	0.048	0.038

The calculation of the structure of the labour force in the urban areas for year 5 is shown in table 42.

The structure of the urban labour force at dates five years apart can be found by performing those calculations for all relevant dates over a period starting with the initial date of the projection. Table 43 displays the urban structures.

The structure of the rural labour force at dates five years apart can be projected in the same way for all relevant dates over a period starting with the initial date of the projection. Table 44 shows such rural structures.

The rural and urban labour force structures of the labour force at dates five years apart can be aggregated across the two locations to obtain the structures of the national labour force, which are shown in table 45.

(b) **Other results**

Projections of the labour force structures for urban (or rural) areas can be used to calculate all those additional results that can be obtained as part of the national projection. Those results referring to urban (or rural) areas as well as to the entire country can be calculated by means of the steps illustrated above. In addition, in the course of the projection, it is possible to calculate proportions of the total labour force in urban and rural areas, respectively. This section will illustrate how those proportions can be obtained.

(i) **Proportions of the labour force that are urban and rural**

The proportion of the labour force that is urban is calculated for the end of a given projection interval as a ratio of the total labour force in the urban areas to the total labour force for the entire country. The proportion of the labour force that is urban in year 5, 0.38, is obtained as:

$$0.38 = 1,383.7 \ / \ 3,652.7, \tag{24}$$

where 1,383.7 is the total labour force in the urban areas and 3,652.7 is the total labour force for the entire country.

The proportion of the labour force that is rural, 0.62, is calculated as a complement of the proportion that is urban:

$$0.62 = 1 - 0.38, \tag{25}$$

where 0.38 is the proportion of the labour force that is urban.

Table 42. Calculating labour force structure, by age and sex:
urban areas, year 5

Age group	Population at age 10 and over a/ (thousands)	Labour force participation rates b/	Labour force c/ (thousands)
(1)	(2)	(3)	(4)
		Male	
10-14	272.6	0.019	5.2
15-19	279.7	0.245	68.5
20-24	246.1	0.749	184.3
25-29	228.4	0.908	207.4
30-34	162.5	0.921	149.7
35-39	149.9	0.916	137.3
40-44	124.7	0.914	114.0
45-49	85.1	0.911	77.5
50-54	54.7	0.894	48.9
55-59	61.6	0.847	52.2
60-64	47.2	0.746	35.2
65-69	29.8	0.410	12.2
70-74	21.7	0.108	2.3
75+	14.7	0.049	0.7
		Female	
10-14	215.6	0.018	3.9
15-19	207.7	0.186	38.6
20-24	185.2	0.332	61.5
25-29	145.2	0.388	56.3
30-34	130.8	0.326	42.6
35-39	124.8	0.257	32.1
40-44	111.3	0.205	22.8
45-49	71.5	0.154	11.0
50-54	54.4	0.106	5.8
55-59	52.7	0.086	4.5
60-64	53.4	0.077	4.1
65-69	32.2	0.067	2.2
70-74	27.9	0.058	1.6
75+	24.9	0.047	1.2

a/ From table 38.
b/ From table 39.
c/ (Col. 2) . (Col. 3).

Table 43. Projected labour force, by age and sex: urban areas

(Thousands)

Age group	Year				
	0	5	10	15	20
Male					
10-14	2.9	5.2	3.7	3.1	2.6
15-19	45.4	68.5	78.4	61.2	52.8
20-24	148.4	184.3	267.6	344.5	349.7
25-29	121.2	207.4	253.5	351.9	447.3
30-34	115.3	149.7	229.7	279.8	383.7
35-39	99.8	137.3	167.5	242.3	295.9
40-44	70.3	114.0	150.7	178.7	250.4
45-49	46.6	77.5	122.3	158.8	184.3
50-54	52.7	48.9	79.8	124.1	159.6
55-59	39.5	52.2	47.1	76.1	118.1
60-64	23.3	35.2	45.7	40.6	65.5
65-69	10.3	12.2	18.3	24.2	21.8
70-74	1.3	2.3	2.9	4.4	5.9
75+	0.5	0.7	1.1	1.4	2.0
Female					
10-14	3.4	3.9	2.7	2.2	2.9
15-19	26.1	38.6	48.8	45.0	47.6
20-24	34.7	61.5	94.1	124.6	133.0
25-29	37.4	56.3	91.6	133.0	174.9
30-34	31.3	42.6	59.7	91.4	130.8
35-39	24.0	32.1	40.7	52.5	77.0
40-44	12.3	22.8	30.6	37.0	47.0
45-49	7.2	11.0	20.3	26.8	32.0
50-54	4.7	5.8	9.1	16.2	21.7
55-59	4.0	4.5	4.9	6.9	11.6
60-64	2.2	4.1	4.2	4.4	6.2
65-69	1.9	2.2	3.4	3.5	3.6
70-74	0.9	1.6	1.6	2.5	2.6
75+	0.8	1.2	1.5	1.8	2.4

Table 44. Projected labour force, by age and sex: rural areas

(Thousands)

Age group	Year				
	0	5	10	15	20
Male					
10-14	146.2	131.6	113.7	103.1	88.7
15-19	193.9	208.4	202.6	188.9	186.7
20-24	176.4	210.3	239.0	248.4	246.8
25-29	214.7	159.8	189.4	214.6	222.4
30-34	222.3	184.8	138.8	165.7	188.4
35-39	191.8	190.8	160.3	121.3	145.2
40-44	136.7	167.8	168.8	142.7	108.6
45-49	92.2	118.8	147.2	149.1	127.1
50-54	117.9	78.3	102.1	127.8	130.7
55-59	92.1	94.2	62.8	81.9	102.1
60-64	71.4	64.3	65.8	44.4	59.3
65-69	25.3	27.7	24.8	25.2	16.5
70-74	3.1	4.4	4.7	4.6	4.4
75+	1.3	1.5	1.6	2.0	1.7
Female					
10-14	85.1	86.9	79.3	75.1	66.6
15-19	128.1	154.5	169.1	173.2	184.6
20-24	90.1	96.5	115.1	131.1	137.0
25-29	86.8	76.2	79.8	97.2	111.5
30-34	75.2	65.8	57.4	61.3	75.3
35-39	50.2	56.6	49.3	45.2	48.9
40-44	28.0	35.7	38.4	32.8	28.4
45-49	15.8	18.8	23.7	25.9	22.2
50-54	12.3	9.5	11.3	14.4	15.8
55-59	8.7	8.5	6.6	8.0	10.3
60-64	6.3	6.3	6.2	4.9	6.0
65-69	5.0	5.0	4.4	4.4	3.6
70-74	3.0	3.1	3.1	2.7	2.8
75+	2.7	2.8	2.6	2.9	2.5

Table 45. Projected labour force, by age and sex: entire country

(Thousands)

Age group	Year				
	0	5	10	15	20
			Male		
10-14	149.1	136.8	117.4	106.2	91.3
15-19	239.3	276.9	281.1	250.0	239.5
20-24	324.7	394.6	506.6	593.0	596.5
25-29	335.9	367.2	442.9	566.6	669.7
30-34	337.6	334.5	368.5	445.5	572.2
35-39	291.6	328.1	327.9	363.6	441.2
40-44	207.0	281.8	319.5	321.4	358.9
45-49	138.8	196.3	269.4	307.9	311.4
50-54	170.6	127.2	181.9	251.9	290.4
55-59	131.6	146.4	110.0	158.0	220.2
60-64	94.7	99.5	111.5	84.9	124.7
65-69	35.5	39.9	43.1	49.4	38.3
70-74	4.4	6.8	7.6	8.9	10.4
75+	1.9	2.2	2.7	3.5	3.7
			Female		
10-14	88.5	90.7	82.1	77.3	69.4
15-19	154.2	193.2	217.8	218.2	232.2
20-24	124.8	158.0	209.2	255.7	270.0
25-29	124.1	132.5	171.3	230.1	286.3
30-34	106.5	108.4	117.1	152.7	206.1
35-39	74.2	88.7	90.0	97.8	125.9
40-44	40.3	58.5	69.0	69.8	75.4
45-49	23.0	29.8	44.1	52.7	54.2
50-54	17.0	15.3	20.3	30.7	37.5
55-59	12.7	13.1	11.5	14.9	21.9
60-64	8.5	10.4	10.4	9.4	12.2
65-69	6.9	7.1	7.7	7.9	7.2
70-74	3.9	4.7	4.8	5.2	5.4
75+	3.5	4.0	4.1	4.7	4.9

These proportions along with all other results for the entire projection interval are shown in tables 46 through 48, which respectively refer to the urban and rural areas and the entire country. The proportions are also depicted in figure XIV.

E. Summary

The foregoing chapter has discussed the uses of projections of the labour force in development planning and has described the labour force participation rate method for preparing such projections at the national or urban-rural level. As part of the description of the method, the procedures used in making national and urban-rural projections were presented. In addition, the types of inputs required by the method were described along with a discussion relating to the preparation of the inputs. Lastly, two examples of projections--national and urban-rural--were discussed. A complete listing of the outputs that can be generated by the method is shown in box 11.

Box 11

Outputs of a method for projecting labour force
with labour force participation rates

1. <u>Structure of the labour force by age and sex</u> (national or urban, rural and national)

2. <u>Labour force aggregates</u> (national or urban, rural and national)

   Labour force size

      Total labour force

      Young-age labour force
      Prime-working-age labour force
      Old-age labour force

      Male labour force
      Female labour force

   Growth in the labour force

      Total labour force

      Young-age labour force
      Prime-working-age labour force
      Old-age labour force

Box 11   (continued)

Male labour force
Female labour force

3.   Indicators of structure of the labour force (national or urban, rural and national)

Proportions of persons in:

Young-age labour force
Prime-working-age labour force
Old-age labour force

Median age of the labour force

Sex ratio of the labour force

4.   Indicators of the urban-rural distribution of the labour force (national only; if urban and rural labour force are being projected)

Proportions of the national labour force:

Urban
Rural

5.   Rates of growth in the labour force (national or urban, rural and national)

Rate of growth in the labour force:

Total labour force:

Young-age labour force
Prime-working-age labour force
Old-age labour force

Male labour force
Female labour force

Table 46. Labour force aggregates, structure and rates of growth: urban areas

Indicators	Year				
	0	5	10	15	20
Labour force aggregates (thousands)					
Labour force					
Total	968.5	1383.7	1881.5	2438.8	3033.0
Young-age	260.9	362.0	495.2	580.5	588.6
Prime-working-age	691.9	1001.4	1357.4	1820.5	2406.0
Old-age	15.7	20.2	28.8	37.8	38.4
Male	777.5	1095.5	1468.3	1891.0	2339.7
Female	191.0	288.2	413.1	547.8	693.3
Growth in labour force					
Total		415.2	497.8	557.3	594.2
Young-age		101.1	133.2	85.3	8.0
Prime-working-age		309.5	356.0	463.1	585.5
Old-age		4.5	8.6	8.9	0.6
Male		318.0	372.9	422.7	448.7
Female		97.2	124.9	134.7	145.5
Indicators of labour force structure					
Proportions by broad age group					
Young-age	0.27	0.26	0.26	0.24	0.19
Prime-working-age	0.71	0.72	0.72	0.75	0.79
Old-age	0.02	0.01	0.02	0.02	0.01
Median age of labour force	32.2	31.7	31.7	32.1	33.0
Sex ratio of labour force	407	380	355	345	337
Rates of growth in labour force (percentage)					
Total		7.13	6.15	5.19	4.36
Young-age		6.55	6.27	3.18	0.28
Prime-working-age		7.39	6.08	5.87	5.58
Old-age		5.04	7.10	5.38	0.31
Male		6.86	5.86	5.06	4.26
Female		8.23	7.20	5.64	4.71

Table 47. Labour force aggregates, structure and rates of growth: rural areas

Indicators	Year				
	0	5	10	15	20
Labour force aggregates (thousands)					
Labour force					
Total	2282.7	2269.0	2268.0	2298.9	2344.2
Young-age	819.8	888.2	918.9	919.9	910.4
Prime-working-age	1422.4	1336.3	1308.0	1337.3	1402.2
Old-age	40.4	44.5	41.2	41.8	31.5
Male	1685.3	1642.8	1621.7	1619.7	1628.7
Female	597.4	626.2	646.4	679.3	715.5
Growth in labour force					
Total		-13.7	-0.9	30.9	45.3
Young-age		68.4	30.7	1.0	-9.5
Prime-working-age		-86.1	-28.3	29.3	65.0
Old-age		4.0	-3.3	0.6	-10.2
Male		-42.5	-21.1	-2.0	9.1
Female		28.8	20.2	32.9	36.2
Indicators of labour force structure					
Proportions by broad age groups					
Young-age	0.36	0.39	0.41	0.40	0.39
Prime-working-age	0.62	0.59	0.58	0.58	0.60
Old-age	0.02	0.02	0.02	0.02	0.01
Median age of labour force	30.3	30.2	29.0	28.7	28.9
Sex ratio of labour force	282	262	251	238	228
Rates of growth in labour force (percentage)					
Total		-0.12	-0.01	0.27	0.39
Young-age		1.60	0.68	0.02	-0.21
Prime-working-age		-1.25	-0.43	0.44	0.95
Old-age		1.90	-1.55	0.29	-5.61
Male		-0.51	-0.26	-0.02	0.11
Female		0.94	0.63	0.99	1.04

Table 48. Labour force aggregates, structure, distribution and rates of growth: entire country

Indicators	Year				
	0	5	10	15	20

Labour force aggregates (thousands)

Labour force

Total	3251.2	3652.7	4149.5	4737.7	5377.2
Young-age	1080.7	1250.2	1414.1	1500.5	1499.0
Prime-working-age	2114.3	2337.7	2665.4	3157.8	3808.3
Old-age	56.2	64.7	70.0	79.5	69.9
Male	2462.8	2738.3	3090.0	3510.7	3968.4
Female	788.4	914.4	1059.5	1227.1	1408.8

Growth in labour force

Total		401.5	496.9	588.2	639.4
Young-age		169.5	163.9	86.3	-1.4
Prime-working-age		223.4	327.7	492.4	650.5
Old-age		8.5	5.3	9.5	-9.6
Male		275.5	351.7	420.7	457.8
Female		126.0	145.1	167.6	181.7

Indicators of labour force structure

Proportions by broad age groups

Young-age	0.33	0.34	0.34	0.32	0.28
Prime-working-age	0.65	0.64	0.64	0.67	0.71
Old-age	0.02	0.02	0.02	0.02	0.01
Median age of labour force	31.0	30.9	30.5	30.6	31.5
Sex ratio of labour force	312	299	292	286	282

Indicators of labour force distribution

Proportions of labour force

Urban	0.30	0.38	0.45	0.51	0.56
Rural	0.70	0.62	0.55	0.49	0.44

Rates of growth in labour force (percentage)

Total		2.33	2.55	2.65	2.53
Young-age		2.91	2.46	1.19	-0.02
Prime-working-age		2.01	2.62	3.39	3.75
Old-age		2.83	1.57	2.55	-2.58
Male		2.12	2.42	2.55	2.45
Female		2.97	2.95	2.94	2.76

Figure XIV. Proportions of total labour force: urban and rural
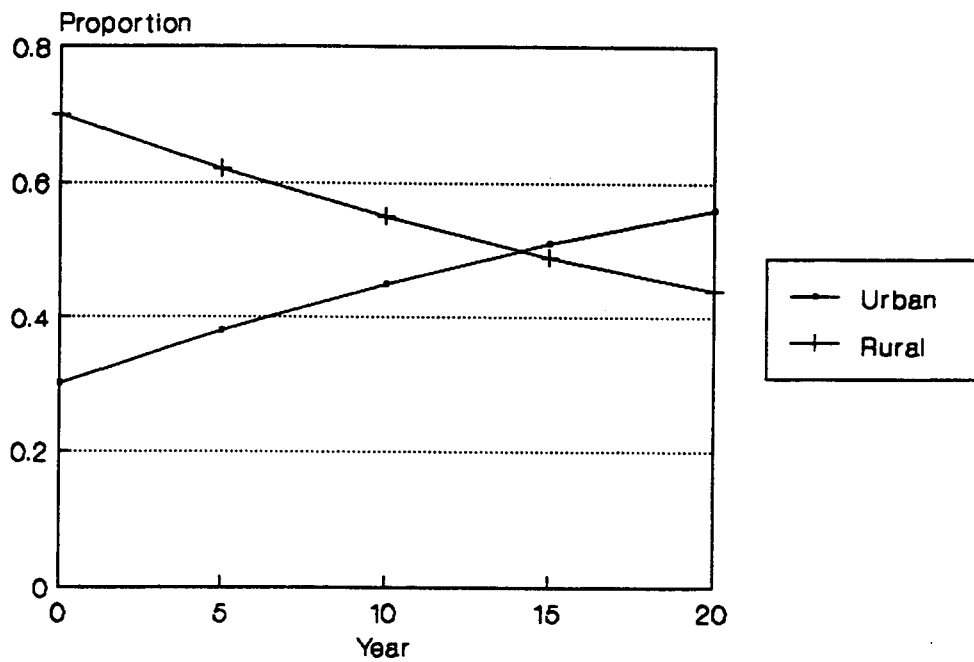
F. Notation and equations

1. Indices, variables and special symbols

(a) **List of indices**

$a = 3,\ldots,16$ are five-year age groups 10-14,...,75+

a' is the number that stands for the five-year age group containing the member of the labour force who is older than one half of the total labour force and younger than the other half

$k = 1,2$ are urban and rural locations

$s = 1,2$ are male and female sexes

t is the year of the projection period

(b) **List of variables**

GRLF   is the average annual exponential growth rate of the total labour force for the interval

GRLF(s)   is the average annual exponential growth rate of the number of persons in the labour force of sex s over the interval

GRLFO   is the average annual exponential growth rate of the old-age component of the labour force for the interval

GRLFP   is the average annual exponential growth rate of the prime-working-age component of the labour force for the interval

GRLFY   is the average annual exponential growth rate of the young-age component of the labour force for the interval

LF(a,s,k,t+5)   is the number of persons of age group a and sex s in location k in the labour force at the end of the interval

LF(a,s,t+5)   is the number of persons of age group a and sex s in the labour force at the end of the interval

LF(k,t+5)	is the total labour force in location k at the end of the interval
LF(s,t+5)	is the number of persons of sex s in the labour force at the end of the interval
LF(t+5)	is the total labour force at the end of the interval
LFGR	is the growth in the total labour force over the interval
LFGR(s)	is the growth in the labour force consisting of persons of sex s over the interval
LFO(t+5)	is the number of persons in the old-age labour force at the end of the interval
LFOGR	is the growth in the old-age component of the labour force over the interval
LFP(t+5)	is the number of persons in the prime-working-age labour force at the end of the interval
LFPGR	is the growth in the prime-working-age component of the labour force over the interval
LFPR(a,s,k,t+5)	is the labour force participation rate among persons of age group a and sex s in location k at the end of the interval
LFPR(a,s,t+5)	is the labour force participation rate among persons of age group a and sex s at the end of the interval
LFY(t+5)	is the number of persons in the young-age labour force at the end of the interval
LFYGR	is the growth in the young-age component of the labour force over the interval
MALF(t+5)	is the median age of the labour force at the end of the interval
PLFO(t+5)	is the proportion of the old-age persons in the labour force at the end of the interval
PLFP(t+5)	is the proportion of the prime-working-age persons in the labour force at the end of the interval
PLFRUR(t+5)	is the proportion of the total labour force which is rural at the end of the interval

PLFURB(t+5)   is the proportion of the total labour force which is urban at the end of the interval

PLFY(t+5)   is the proportion of the young-age persons in the labour force at the end of the interval

POP(a,s,k,t+5)   is the population of age group a and sex s in location k at the end of the interval

POP(a,s,t+5)   is the population of age group a and sex s at the end of the interval

SRLF(t+5)   is the sex ratio of the labour force at the end of the interval

(c) Special symbols

ln   is the natural logarithm

2. Equations

1. National level

(a) Labour force structure

$$LF(a,s,t+5) = POP(a,s,t+5) \cdot LFPR(a,s,t+5); \tag{1}$$

$$a = 3,\ldots,16;$$

$$s = 1,2$$

(b) Other results

(i) Labour force aggregates

a. Total labour force

$$LF(t+5) = \sum_{a=3}^{16} \sum_{s=1}^{2} LF(a,s,t+5) \tag{2}$$

b. **Labour force in broad age groups**

    i. **Young-age labour force**

$$LFY(t+5) = \sum_{a=3}^{5} \sum_{s=1}^{2} LF(a,s,t+5) \qquad (3)$$

    ii. **Prime-working-age labour force**

$$LFP(t+5) = \sum_{a=6}^{13} \sum_{s=1}^{2} LF(a,s,t+5) \qquad (4)$$

    iii. **Old-age labour force**

$$LFO(t+5) = \sum_{a=14}^{16} \sum_{s=1}^{2} LF(a,s,t+5) \qquad (5)$$

c. **Labour force disaggregated by sex**

    i. **Male labour force**

$$LF(s,t+5) = \sum_{a=3}^{16} LF(a,s,t+5); \qquad (6)$$

$$s = 1,2$$

    ii. **Female labour force**

$$LF(2,t+5) = LF(t+5) - LF(1,t+5) \qquad (7)$$

d. **Growth in total labour force**

$$LFGR = LF(t+5) - LF(t) \qquad (8)$$

e. **Growth in young-age, prime-working-age and old-age labour force**

$$LFYGR = LFY(t+5) - LFY(t) \tag{9}$$

$$LFPGR = LFP(t+5) - LFP(t) \tag{10}$$

$$LFOGR = LFO(t+5) - LFO(t) \tag{11}$$

f. **Growth in male and female labour force**

$$LFGR(s) = LF(s,t+5) - LF(s,t); \tag{12}$$

$$s = 1,2$$

(ii) **Indicators of the structure of labour force**

a. **Proportions by broad age groups**

$$PLFY(t+5) = LFY(t+5) / LF(t+5) \tag{13}$$

$$PLFP(t+5) = LFP(t+5) / LF(t+5) \tag{14}$$

$$PLFO(t+5) = LFO(t+5) / LF(t+5) \tag{15}$$

b. **Median age of labour force**

$$MALF(t+5) = (a' - 1) \cdot 5 + [(LF(t+5)/2 - \sum_{a=3}^{a'-1} \sum_{s=1}^{2} LF(a,s,t+5)) / \tag{16}$$

$$\sum_{s=1}^{2} LF(a',s,t+5)] \cdot 5$$

c. <u>Sex ratio of labour force</u>

$$SRLF(t+5) = [(LF(1,t+5)) / (LF(2,t+5))] \cdot 100 \tag{17}$$

(iii) <u>Rates of growth of the labour force</u>

   a. <u>Rate of growth in the total labour force</u>

$$GRLF = [(\ln (LF(t+5) / LF(t)))] \cdot 100 \tag{18}$$

   b. <u>Rates of growth in young-age, prime-working-age and old-age labour force</u>

$$GRLFY = [(\ln (LFY(t+5) / LFY(t))) / 5] \cdot 100 \tag{19}$$

$$GRLFP = [(\ln (LFP(t+5) / LFP(t))) / 5] \cdot 100 \tag{20}$$

$$GRLFO = [(\ln (LFO(t+5) / LFO(t))) / 5] \cdot 100 \tag{21}$$

   c. <u>Rates of growth of male and female components of the labour force</u>

$$GRLF(s) = [(\ln (LF(s,t+5) / LF(s,t))) / 5] \cdot 100; \tag{22}$$

$$s = 1,2$$

2. <u>Urban-rural level</u>

(a) <u>Labour force structures</u>

$$LF(a,s,k,t+5) = POP(a,s,k,t+5) \cdot LFPR(a,s,k,t+5); \tag{23}$$

$$a = 3,\ldots,16;$$

$$s = 1,2;$$

$$k = 1,2$$

(b) **Other results**

    (i)   **Proportions of the labour force that are urban and rural**

$$PLFURB(t+5) = LF(t+5) \; / \; LF(t+5) \tag{24}$$

$$PLFRUR(t+5) = 1 - PLFURB(t+5) \tag{25}$$

Notes

1/   The elements of the method described in this chapter were originally discussed in United Nations, (1971).

2/   For a discussion of the calculation of the median age from grouped data, see Shryock and others (1973).

3/   The age and sex structures of the population used in this example are expressed in units of one thousand. Therefore, the projected numbers of labour force are also given in thousands.

References

Shryock, Henry S., Jacob S. Siegel and Associates (1973). The Methods and Materials of Demography, Washington D.C.: U.S. Department of Commerce.

United Nations (1971). Manual V: Methods of Projecting the Economically Active Population. Population Studies, No. 46. Sales No. E.70.XIII.2.