

Chapter IV

PROJECTION OF URBAN AND RURAL POPULATION TOTALS USING THE SIMPLEST METHODS

USE OF URBAN GROWTH RATES

124. The simplest projection is, perhaps, that resulting from an assumption of a constant rate of growth. In the examples which follow it will be assumed that the urban population grows at a constant (annual) rate. It will be assumed, however, that a projection of the corresponding total population already exists, and that in the latter projection the rate of growth in (total) population is not necessarily constant. The urban population, as projected by a constant rate, will then be subtracted from the total population, as projected by other means, to ascertain whether the growth in the residual, i.e. in the hypothetical rural, population remains plausible.

125. Three examples have been selected for an examination of how well the simplest mathematical methods may apply to populations of low, intermediate and high levels of urbanization. The examples concern the populations of the United Republic of Tanzania, Iran and Canada, and use is made of the latest estimates and projections calculated in the United Nations Secretariat.⁵⁴

126. To take first the case of the United Republic of Tanzania, utilizing the United Nations projections of total population and a 1965 estimate of the size of the urban population, it will be assumed that the urban population may grow in the future at rates of 5, 6 or 7 per cent per year, resulting in increases by 27.62, 33.82 or 40.32 per cent, respectively, per five-year period. Estimated as 677,000 in 1965, the urban population would increase as follows (figures in thousands):

Year	Urban rate of increase (assumed)		
	At 5 per cent	At 6 per cent	At 7 per cent
1965	677	677	677
1970	864	906	950
1975	1,103	1,212	1,332
1980	1,408	1,622	1,868
1985	1,797	2,171	2,620

127. The total population of the United Republic of Tanzania has been estimated as 11,674,000 in 1965 and has been projected by the component method to 13,236,000, 15,150,000, 17,475,000 and 20,282,000 for 1970, 1975, 1980 and 1985, respectively, that is at successive annual average rates of 2.54, 2.74, 2.90 and 3.02 per cent. The above projections of the urban population, when subtracted from the projected total populations,

⁵⁴ *World Population Prospects as Assessed in 1968* (United Nations publication, Sales No. 72.XIII.4).

leave the following future estimates of rural population as residuals:

Year	Urban rate of increase (assumed)		
	At 5 per cent	At 6 per cent	At 7 per cent
1965	10,997	10,997	10,997
1970	12,372	12,330	12,286
1975	14,047	13,938	13,818
1980	16,067	15,853	15,607
1985	18,490	18,086	17,667

128. Depending on the urban rate of increase, the rural population would grow at the following average rates:

Years	Urban rate of increase (assumed)		
	At 5 per cent	At 6 per cent	At 7 per cent
1965-1970	2.36	2.29	2.22
1970-1975	2.54	2.45	2.35
1975-1980	2.69	2.57	2.43
1980-1985	2.81	2.64	2.48

There is nothing implausible in the implied future rates of growth of rural population hence, in a country like the United Republic of Tanzania, to assume a constant growth rate in urban population over a stretch of twenty years is not necessarily unrealistic.

129. Using the same methods (assuming somewhat lower rates) in the case of Iran, we obtain the following projections of urban population:

Year	Urban rate of increase (assumed)		
	At 4 per cent	At 5 per cent	At 6 per cent
1965	9,172	9,172	9,172
1970	11,159	11,706	12,274
1975	13,577	14,940	16,425
1980	16,518	19,068	21,980
1985	20,097	24,336	29,414

130. Here, the total population was estimated as 24,549,000 in 1965, and projected to 28,358,000, 33,152,000, 38,769,000 and 45,050,000 for the subsequent dates. By subtraction, we obtain the following implied projections of rural population:

Year	Urban rate of increase (assumed)		
	At 4 per cent	At 5 per cent	At 6 per cent
1965	15,377	15,377	15,377
1970	17,199	16,652	16,084
1975	19,575	18,212	16,727
1980	22,251	19,701	16,789
1985	24,953	20,714	15,636

131. The following rates of increase in the rural population are implied:

Years	Urban rate of increase (assumed)		
	At 4 per cent	At 5 per cent	At 6 per cent
1965-1970.....	2.26	1.60	0.90
1970-1975.....	2.68	1.80	0.79
1975-1980.....	2.60	1.58	0.07
1980-1985.....	2.32	1.01	-1.41

As can be noted, the implied rates of growth in rural population are far apart, hence at this level of urbanization the rural population is quite sensitive to the particular assumption concerning urban growth. It is surprising, furthermore, that the continuance of a high rate of growth in the urban population may soon result in absolute decreases in the rural population. This makes it evident that at an intermediate level of urbanization the assumption of a constant rate of growth in the urban population should not be carried very far. It is more likely then that, with time, urban growth will slow down somewhat.

132. Taking, finally, the case of Canada, as a country at a very high level of urbanization, we shall assume that the urban population may grow at rates of 2.0, 2.5 or 3.0 per cent, increasing by 10.41, 13.14 or 15.93 per cent in each five-year period. The urban population is estimated at 14,333,000 in 1965, and we obtain these results:

Year	Urban rate of increase (assumed)		
	At 2.0 per cent	At 2.5 per cent	At 3.0 per cent
1965.....	14,333	14,333	14,333
1970.....	15,825	16,216	16,616
1975.....	17,472	18,347	19,263
1980.....	19,291	20,758	22,332
1985.....	21,299	23,486	25,889

133. The total population is estimated at 19,644,000 in 1965 and projected to 21,426,000, 23,284,000, 25,299,000 and 27,348,000 at those future dates. Consequently, the following future rural populations are implied:

Year	Urban rate of increase (assumed)		
	At 2.0 per cent	At 2.5 per cent	At 3.0 per cent
1965.....	5,311	5,311	5,311
1970.....	5,601	5,210	4,810
1975.....	5,812	4,937	4,021
1980.....	6,008	4,541	2,967
1985.....	6,049	3,862	1,459

In the circumstances of Canada it is unlikely that the rural population will increase much, hence the assumption of a constant 2 per cent growth in urban population is not very probable. But it is just as unlikely that the rural population will decrease at a steep and accelerating rate, soon dwindling to quite small numbers. Therefore, to assume a 3 per cent growth in urban population is also unrealistic. It can be seen that, at this high level of urbanization, the constraints for a plausible assumption of a constant rate of increase in the urban population become narrow.

134. In conclusion, the assumption of a constant urban growth rate remains useful only so long as the level of urbanization is rather low. At intermediate or higher levels such an assumption soon tends to become unrealistic.

USE OF RURAL GROWTH RATES

135. The same three examples are now worked through in terms of assumed rates of growth in rural population. First, for the United Republic of Tanzania it will be assumed that the rural population may grow at the constant rates of 2.0, 2.5 or 3.0 per cent. The following future estimates of rural population are obtained:

Year	Urban rate of increase (assumed)		
	At 2.0 per cent	At 2.5 per cent	At 3.0 per cent
1965.....	10,997	10,997	10,997
1970.....	12,142	12,442	12,748
1975.....	13,406	14,077	14,778
1980.....	14,801	15,927	17,132
1985.....	16,341	18,020	19,861

136. Subtracting from the projected total population, we obtain the following implied projections of urban population:

Year	Rural rate of increase (assumed)		
	At 2.0 per cent	At 2.5 per cent	At 3.0 per cent
1965.....	677	677	677
1970.....	1,094	794	488
1975.....	1,744	1,073	372
1980.....	2,674	1,548	343
1985.....	3,941	2,267	426

137. Following are the implied annual rates of urban growth:

Years	Rural rate of increase (assumed)		
	At 2.0 per cent	At 2.5 per cent	At 3.0 per cent
1965-1970.....	9.60	3.19	-6.55
1970-1975.....	9.33	6.02	-5.43
1975-1980.....	8.55	7.33	-1.62
1980-1985.....	7.76	7.63	-4.33

The constraints on the assumed rate of growth in rural population, at this low urbanization level, are noticeable. Urban population in the United Republic of Tanzania can be expected to grow at a fast rate, though perhaps not so fast as 9 per cent per year. This makes the rural rates of 2.0 and 3.0 per cent both rather improbable. Most likely, a rural rate of growth between 2.0 and 2.5 per cent can be sustained. For instance, if the rural rate were a constant 2.25 per cent, urban population would increase in the successive quinquennia at rates of 7.9, 8.5, 8.5 and 8.0 per cent. Provided that the rate of growth in rural population is selected with care, therefore, the assumption of constant growth rates in the rural population need not lead to implausible results for the urban population. Admittedly, this is a trial-and-error procedure, and it would be more logical to base the projection directly on an assumed rate of growth in the urban population, as was done before.

138. Next, we take again the example of Iran. Here it will be assumed that the rural population may grow at constant rates of 1.5, 2.0 or 2.5 per cent. The following future rural populations are obtained:

Years	Rural rate of increase (assumed)		
	At 1.5 per cent	At 2.0 per cent	At 2.5 per cent
1965	15,377	15,377	15,377
1970	16,566	16,978	17,398
1975	17,847	18,745	19,684
1980	19,227	20,696	22,270
1985	20,713	22,850	25,196

139. By subtraction from projected total populations, the implied urban populations are the following:

Year	Rural rate of increase (assumed)		
	At 1.5 per cent	At 2.0 per cent	At 2.5 per cent
1965	9,172	9,172	9,172
1970	11,792	11,380	10,960
1975	15,305	14,407	13,408
1980	19,542	18,073	16,499
1985	24,337	22,200	19,854

140. The implied rates of growth in urban population are as below:

Years	Rural rate of increase (assumed)		
	At 1.5 per cent	At 2.0 per cent	At 2.5 per cent
1965-1970	5.02	4.41	3.63
1970-1975	5.21	4.83	4.21
1975-1980	5.00	4.64	4.14
1980-1985	4.48	4.20	3.77

As can be seen, none of these results are necessarily implausible. Under any of the three assumptions regarding rural growth, a fairly steady rate of growth in urban population is obtained, first accelerating and then slowing down.

141. Coming finally to the example of Canada, we shall assume that the rural population remains constant, that it decreases annually by 0.5 per cent or that it decreases by 1.0 per cent. The following rural populations are thereby projected:

Year	Assumed rural rate of increase (or decrease)		
	At 0.0 per cent	At -0.5 per cent	At -1.0 per cent
1965	5,311	5,311	5,311
1970	5,311	5,179	5,051
1975	5,311	5,051	4,804
1980	5,311	4,926	4,569
1985	5,311	4,804	4,345

It is not necessary to adduce the implied urban populations and their rates of growth, as it can be readily seen that at this high level of urbanization no implausible result will be implied.

142. It can be concluded that constant rates of change in the rural population have a somewhat wider applicability than constant rates of change of urban population.

There may be many situations in which such an assumption produces satisfactory results. It is understood, of course, that the rural population increases more slowly than the urban.

RATIO METHOD

143. The ratio method rests on the assumption that an observed trend in the percentage of a subnational population to a country's total population will continue. It is a highly practical method in the estimation and projection of regional or provincial populations in relation to estimated and projected national totals. The method is also useful in the projection of urban and rural populations, subject to certain constraints, as will be shown.

144. The case of Iran is taken first. Here, according to United Nations estimates, 27.13 per cent of the total population was urban in 1950, and 33.18 per cent in 1960. Thus, the percentage had risen by 6.05 points in ten years, and it may go on rising by 3.025 points every five years. Projecting these percentages linearly and using the United Nations projection of the total population, we obtain the following projections of urban and rural population (in thousands):

Year	Total	Per cent urban	Urban	Rural
1965	24,549	36.205	8,888	15,661
1970	28,358	39.230	11,125	17,233
1975	33,152	42.255	14,008	19,144
1980	38,769	45.280	17,555	21,214
1985	45,050	48.305	21,761	23,289

145. The implied annual rates of increase in urban and rural population are the following:

Years	Urban	Rural
1965-1970	4.60	1.93
1970-1975	4.71	2.12
1975-1980	4.62	2.08
1980-1985	4.39	1.88

There is nothing implausible in such rates of growth of the urban and rural population, and the projection may be acceptable.

146. Now, let us use the same method with respect to the United Republic of Tanzania. Here, according to the estimates, the population was 3.50 per cent urban in 1950 and 4.98 per cent in 1960. The level had risen by 1.48 in ten years and it may rise by 0.74 every five years. In conjunction with the projected total population, we obtain the following urban and rural projections:

Year	Total	Per cent urban	Urban	Rural
1965	11,674	5.72	668	11,006
1970	13,236	6.46	855	12,381
1975	15,150	7.20	1,091	14,059
1980	17,475	7.94	1,388	16,087
1985	20,287	8.68	1,761	18,526

147. In these projections the annual rates of growth in urban and rural population would be the following:

<i>Years</i>	<i>Urban</i>	<i>Rural</i>
1965-1970.....	4.94	2.35
1970-1975.....	4.88	2.54
1975-1980.....	4.82	2.69
1980-1985.....	4.76	2.82

Again, the results may be acceptable. One is led to wonder, however, whether the rise in the percentage of urban population, at this low level of urbanization, would not have a tendency to accelerate, as higher and higher levels of urbanization are being reached. It should be recalled that in Iran the percentage level was estimated to rise 3.025 points every five years, whereas in the United Republic of Tanzania it rises only 0.740 points.

148. Moving now to the example of Canada, we note that 60.66 per cent of the population was estimated urban in 1950, and 68.45 per cent in 1960, a rise of 7.79 points in ten years, or 3.895 points in five years. Using the projection of total population, we obtain these results:

<i>Year</i>	<i>Total</i>	<i>Per cent urban</i>	<i>Urban</i>	<i>Rural</i>
1965	19,644	72.345	14,211	5,433
1970	21,426	76.240	16,335	5,091
1975	23,284	80.135	18,659	4,625
1980	25,299	84.030	21,259	4,040
1985	27,348	87.925	24,046	3,302

It can be noted that in this projection the rural population decreases at a rapidly accelerating tempo. Furthermore, the constant rise in the percentage cannot continue very long because then 100 per cent would be reached and surpassed already in the year 2001, which is absurd. At such a high level of urbanization, therefore, the use of the ratio method encounters a more severe limitation. It is evident that the rise in the ratio must eventually slow down.

149. In conclusion, the ratio method yields acceptable results at intermediate levels of urbanization, but it should not be used where the urbanization level is very low or very high.

SUMMARY

150. Three methods have been examined, namely the method employing constant rates of growth in the urban population, that using constant growth (or decline) in the rural population, and the ratio method. From the observations made with estimates for a country of low

urbanization level, one of intermediate level and one of advanced level, some general conclusions emerge.

151. At the low level of urbanization, the most adequate of the three methods appeared to be the one employing constant rates of growth in the urban population. At the intermediate level, the ratio method seemed to be most satisfactory; and at the advanced level it appeared best to make plausible assumptions concerning the growth (or decline) in the rural population. Not all three methods can fit any given situation equally well.

152. One is led to think that some modification of the ratio method may have the widest applicability if it makes provision for an acceleration in the rise of the urbanization level while it is low, a peak rate while it is intermediate, and a slow-down when it is high. These conditions can be met in a logistic curve, or some other curve having both an upper and a lower asymptote. As was shown in chapter III, the assumption of a constant difference between urban and rural rates of growth coincides with a logistic curve in the level of urbanization within the outer limits of zero and 100 per cent.

153. It would be difficult, however, and often impossible, to calculate the several parameters of a complex curve on the basis of limited past observations; and it would be inadvisable to make a forecast depend on parameters easily affected by temporary fluctuations or accidents. True, urbanization throughout the world progresses in the same direction, but the phenomenon is subject to variations in time and place which often elude measurement or prediction. To arrive at judgment it is important to bear in mind pertinent observations made in numerous countries.

154. It should also be recalled that the use of a mathematical curve courts the risk of misinterpretation on the part of the users of a forecast. It may seem to them that a forecast pretends to be exact because a precise formula was used. It will have to be stated clearly that the use of a formula does not imply accuracy in the results. Future developments will never conform to a mathematical artefact. To guard against misinterpretation, the assumptions should be presented flexibly and with an allowance for an error range. This is probably best done by calculating "high" and "low" alternatives in addition to a "medium" forecast.

155. A curve lending itself readily to comparison of observations throughout the world and to flexible application in alternative forecasts is therefore useful. The following chapter will show the ease with which a logistic curve can be applied.