

Chapter VI

PROJECTIONS FOR INDIVIDUAL CITIES, GROUPS OF CITIES AND DISTINCT GROUPS OF LOCALITIES

METHODS NOT DEALT WITH IN THIS MANUAL

200. Forecasts of the population for one or several distinct cities are usually made by economic and geographic methods. These methods can comprise much detail, but they must be adapted in each instance to known economic and geographic circumstances, and these can differ remarkably from one city to another. Since a general discussion of such locally specialized adaptations would be difficult, the presentation of such methods is outside the scope of this manual. It is to be doubted whether a set of methods suitable in the forecast for a particular city can be applied without considerable transformations to a city in another country where circumstances and available information are of a different kind.

201. The economic method is probably most suitable in countries with central economic plans where those plans include expectations of labour force in the chief branches of industry to be employed at future dates in each of the various locations. Multipliers can then be applied to represent ratios of total population (including labour force in complementary industrial and service sectors and the dependents of the labour force in every sector) to arrive at corresponding total populations. These forecasts for individual regions and cities may have to be reconciled with the over-all population projections for the whole nation since, logically, the sum of regional forecasts should agree with the national totals. It is then possible to foresee also the migratory movements necessary to reach the planning targets.

202. An alternative method, also making use of multipliers, is pertinent in particular to the foreseeable population of individual city quarters, residential towns or suburbs for which the construction of a given quantity of residential dwelling space can be foreseen. Given the amounts of dwelling space estimated for the future and assuming full or a high degree of occupancy, one can calculate the corresponding estimates of future population. Again, the method is most pertinent where housing construction is centrally planned. And future population estimates according to housing space may have to be reconciled with future population estimates derived from projected employment in basic industries to arrive at consistency in the respective plans.

203. However, elements of judgment concerning comparative rates of city growth will not be lacking in countries whose economy is not centrally planned. City growth has been studied in relationship to numerous other

changes, including the correlated growth of employment in industry and services, available means of transport, taxes and subsidies, rising levels of education, discontent with conditions in rural areas and small towns and so forth. Cities containing certain key industries may grow faster than other cities. Chain effects of migration are also known, such as the attraction to a city of additional migrants once a viable local community has been formed by previous migrants pertaining to a particular ethnic group, caste or region of origin. The subject is ramified and cannot be dealt with at length in this technical manual. As will be seen in this chapter, several alternative methods of projecting city populations in consistency with national total and urban populations are possible, and they can lead to a range of alternative results. The elements of judgement here suggested will have a bearing on the selection of those alternatives which might be of best practical use to the authorities in need of a plausible forecast.

204. In this chapter, methods are proposed which ensure that the population projections for one or several cities will not be inconsistent with those for other cities or the rest of the country's population. Such assurance would be lacking if population projections were decentralized and carried out independently in each city. The procedures suggested here are sensitive to the relative position of each city within the urban system. But they should not be used too mechanically. Where elements of judgement indicate it, a corresponding adjustment should be introduced in an otherwise too systematic procedure.

205. The methods suggested here may also serve in projections for portions of a city, for instance its centre and its periphery, but care should be taken in such a case that well-known circumstances are not being disregarded. In population forecasts with respect to individual city quarters geographical considerations should perhaps be given some weight. Use can be made, for instance, of the empirical observation of gradients of residential housing density as a function of distance from the city's core and progressive changes therein. In virtually all large cities it is observed that in the most central areas the resident population tends to decline. Immediately surrounding the centre are areas of very high residential density, but densities decrease with distance from that area, and rates of population growth reach a maximum further and further away from the city centre. Forecasting methods based on such observations are of special interest where separate population

estimates for the central parts and the peripheries of a city are desired. The geographic method can be made more detailed having regard to the shifting distribution of areas used for business, industry, residence, transport, recreation and so forth. Such forecasts depend, of course, on detailed knowledge of each city's geography.

206. In preceding chapters, urban populations have been projected with reference to the projected total population. The same methods can be employed to project the population of a leading city or of a group of cities with reference to the projected urban population. The point of interest in these methods is that consistency is maintained between the projected population of individual cities and the combined urban population.

RATIO METHOD

207. For the projection of individual city populations in relation to a projection of the combined urban population, the ratio method is sometimes most suitable, at least so long as the unusual growth rate of a particular city does not lead to extremes where the assumption of a constant linear change in a percentage can become unreasonable.

208. A projection of the urban population of Iran has already been presented in chapter IV. Table 14 illustrates how the population of individual cities (the six largest in 1966) may be projected, in relation to the projected urban population, with the use of the ratio method. As a result of these calculations, the population of Tehran may grow almost threefold between 1965 and 1985, the populations of Esfahan, Mashhad and Shiraz may grow more than twofold, the population of Tabriz may grow by two-thirds, but the population of Abadan may decline considerably from 1975 onward. It is to be questioned whether the latter result can be accepted. Since Abadan has grown at a comparatively low rate between the censuses of 1956 and 1966, it is possible that prospects for growth are comparatively limited in that city (a

question which would have to be resolved with more detailed knowledge of relevant local circumstances). But a projection in which growth at first slows down, and thereafter gives way to decline, may have to be questioned seriously. The fault may lie, in part, with the method of calculation, making it desirable to calculate with a different method, and then compare the results.

209. Perhaps an assumption should be made that changes in percentage level, as extrapolated linearly in table 14, will gradually slow down until some future date when all cities grow at the same rate as the combined urban population. The interpolated and extrapolated percentage levels of table 14 will then be modified, changing more and more slowly, eventually becoming constant. The growth of Tehran, Esfahan and Mashhad, which occurred in 1956-1966 at faster rates than the combined urban growth, could be made to slow down somewhat, while, in the same procedure, the slower growth of Tabriz, Abadan and Shiraz would be correspondingly accelerated. Eventually, depending on the date assumed for the convergence of growth rates, all cities would grow at the same rates as the combined urban population. It will have to be recognized, however, that the assumption of a future date of convergence of growth rates is arbitrary and serves only to avoid eventually unreasonable results.

UNITED NATIONS METHOD

210. A more satisfactory alternative method, then, may be the URGD method which has already been illustrated in the projection of urban relative to total population. Proceeding in much the same way, the population of individual cities can be projected in relation to the urban population as already projected. The steps involved in such a calculation are illustrated in table 15, on page 47. Linear changes are now interpolated and extrapolated, not in terms of the percentages themselves, but rather in terms of logistic levels corresponding to those percentages as tabulated in annex I.

TABLE 14. CALCULATION OF POPULATION PROJECTIONS FOR INDIVIDUAL CITIES OF IRAN, 1965-1985, USING THE RATIO METHOD (POPULATION IN THOUSANDS)

Category	Urban population	Tehran	Esfahan	Mashhad	Tabriz	Abadan	Shiraz
Census, November 1956	5,954	1,512	255	242	290	226	171
Census, November 1966	9,794	2,720	424	410	403	273	270
Percentage of urban, 1956	100.0	25.40	4.28	4.06	4.87	3.80	2.87
Percentage of urban, 1966	100.0	27.77	4.33	4.18	4.12	2.79	2.76
Annual change in percentage ...	...	0.237	0.005	0.012	-0.073	-0.101	-0.009
<i>Percentages, interpolated and extrapolated to mid year</i>							
1965	...	27.44	4.320	4.16	4.220	2.930	2.740
1970	...	28.63	4.345	4.22	3.845	2.425	2.685
1975	...	29.82	4.370	4.28	3.470	1.920	2.630
1980	...	31.01	4.395	4.34	3.095	1.415	2.575
1985	...	32.20	4.420	4.40	2.720	0.910	2.520
<i>Population projections, mid year</i>							
1965	9,172	2,517	396	382	387	269	251
1970	11,576	3,314	503	489	445	281	311
1975	14,708	4,386	643	630	510	282	387
1980	18,598	5,767	817	807	576	263	479
1985	23,250	7,486	1,028	1,023	632	212	586

TABLE 15. CALCULATION OF POPULATION PROJECTIONS FOR SIX PRINCIPAL CITIES OF IRAN, 1965-1985, WITH THE URGD METHOD

Category	Tehran	Esfahan	Mashhad	Tabriz	Abadan	Shiraz
<i>Census, November 1956</i>						
Urban population ^a	5,954	4,441	4,187	3,945	3,655	3,429
Population of city	1,512	255	242	290	226	171
Percentage in city	25.40	5.73	5.78	7.35	6.19	4.98
<i>Census, November 1966</i>						
Urban population ^a	9,794	7,075	6,650	6,241	5,837	5,564
Population of city	2,720	424	410	403	273	270
Percentage in city	27.77	5.99	6.16	6.46	4.68	4.85
<i>Logistic level of percentage</i>						
November 1956	-107.2	-280.0	-279.1	-253.4	-271.8	-294.9
November 1966	-95.6	-275.3	-272.4	-267.3	-301.4	297.7
<i>Interpolation and extrapolations to mid year</i>						
1965.....	-97.2	-275.90	-273.30	-265.40	-297.4	-297.3
1970.....	-91.4	-273.55	-269.95	-272.35	-312.2	-298.7
1975.....	-85.6	-271.20	-266.60	-279.30	-327.0	-300.1
1980.....	-79.8	-268.85	-263.25	-286.25	-341.8	-301.5
1985.....	-74.0	-266.50	-259.90	-293.30	-356.6	-302.9
<i>Corresponding percentages, mid year</i>						
1965.....	27.45	5.96	6.11	6.57	4.86	4.87
1970.....	28.62	6.09	6.30	6.16	4.22	4.80
1975.....	29.82	6.23	6.50	5.77	3.66	4.74
1980.....	31.05	6.37	6.71	5.40	3.16	4.68
1985.....	32.30	6.51	6.92	5.05	2.75	4.61
<i>Population projections, mid year</i>						
<i>1965</i>						
Urban population ^a	9,172	6,654	6,257	5,875	5,489	5,222
Population of city	2,518	397	382	386	267	254
<i>1970</i>						
Urban population ^a	11,576	8,263	7,760	7,271	6,823	6,535
Population of city	3,313	503	489	448	288	314
<i>1975</i>						
Urban population ^a	14,708	10,322	9,679	9,050	8,528	8,216
Population of city	4,386	643	629	522	312	389
<i>1980</i>						
Urban population ^a	18,598	12,823	12,008	11,336	10,724	10,385
Population of city	5,775	817	806	612	339	486
<i>1985</i>						
Urban population ^a	23,250	15,740	14,715	13,697	13,005	12,647
Population of city	7,510	1,025	1,018	692	358	583

^a Each time excluding cities listed in preceding columns,

211. To be more specific and to maintain consistency with projections already made, the procedure will have to be applied to one city at a time, preferably beginning with the largest, proceeding to the second largest, and so forth.

212. In table 15, the percentage of Tehran's population in the combined urban population rose from 25.40 in 1956 to 27.77 in 1966, that is from logistic level -107.2 to logistic level -95.6, or by 1.16 steps in logistic level per year. Interpolating and extrapolating, we obtain logistic levels progressing from -97.2 in 1965 to -74.0 in 1985. The percentages corresponding to those levels progress from 27.45 to 32.30. When these percentages are applied to the projected urban population (9,172,000 in 1965, and 23,250,000 in 1985), the

population of Tehran is projected to increase, progressively, from 2,518,000 to 7,510,000.

213. When the projection for the first city is completed, it is possible to proceed to the next city, excluding this time the first city from the combined urban population. In the urban population from which Tehran is excluded, Esfahan occupied 5.73 per cent in 1956, and 5.99 per cent in 1966, and the logistic level rose from -280.0 to -275.3. Again, the logistic levels can be extrapolated linearly, corresponding percentage levels can be established, and future populations of Esfahan can be calculated from the projection of urban population from which the projection for Tehran has already been subtracted. The same procedure can be repeated for each subsequent city, each time relating that city to the urban population from which all the preceding cities have been subtracted.

214. The results obtained in table 15 may now be compared with those in table 14. For the year 1985 they differ by less than one per cent in the cases of Esfahan, Mashdad and Shiraz, and in view of possible errors in any projection such differences are negligible. As compared with table 14, the results in table 15 are slightly larger for Tehran, noticeably larger for Tabriz and considerably larger for Abadan. Even so, Abadan is still projected to grow much more slowly than the other cities, and it may be overtaken to an increasing extent, for instance, by the population of Shiraz. But this is not the only plausible expectation. Special circumstances may have accounted either for the slow growth of Abadan or the rapid growth of Shiraz in the 1956-1966 period. Perhaps the boundaries of one city were widened while those of the other were not. Compensatory future developments may perhaps have to be foreseen as a result of which Abadan may again increase more rapidly or Shiraz more slowly.

215. There is every freedom to modify the implied assumptions to take such specific considerations into account. Knowledge of recent conditions and prospects in individual cities of Iran would be necessary if assumptions were to be modified. In the absence of such detailed knowledge, only the rather mechanical result of the projection in table 15 can be presented here.

FIXED GROUPS OF CITIES

216. While the projections for individual cities may be considerably in error, it is possible that the errors are partly compensated, some cities being over-estimated while some others are underestimated. It may seem safer, therefore, to make a forecast for the combined population of a group of cities. As regards the six largest cities of Iran, this may be done as follows.

217. At the 1956 census, the six cities combined had a population of 2,696,000, which was 45.28 per cent within an urban population of 5,954,000; at the 1966 census, they had 4,500,000 within an urban population of 9,794,000, which is 45.95 per cent. Using the logistic scale in annex I and interpolating and extrapolating, we arrive at the following percentages that may be comprised by those six cities in mid year 1965, 1970, 1975, 1980 and 1985: 45.70, 45.99, 46.26, 46.52 and 46.73 per cent. Applying these percentages to the urban population, we arrive at the totals shown below; in addition, the sums are shown resulting from the individual city projections of table 15.

Year	<i>Population of six principal Iranian cities</i>	
	<i>As projected directly in relation to the urban population</i>	<i>Sum of city populations, as projected individually (see table 14)</i>
1965	4,204	4,204
1970	5,343	5,355
1975	6,844	6,881
1980	8,721	8,835
1985	10,975	11,186

It will be noted that a slightly faster population growth results in the combination of individually projected cities than in the direct projection of the combined cities. This follows from the varying speed with which the percentages advance or fall off on a logistic scale, depending on their levels. The combined population of the six cities is nearly 50 per cent of the combined urban population, and at that level hardly any acceleration occurs in the logistic rise of a percentage. On the other hand, cities smaller than Tehran each time constitute only a small percentage of the urban population (after exclusion of cities of larger size, as in table 15), and at such low levels, according to the logistic, the rise of the percentage accelerates. At any rate, the difference resulting between these two methods of calculation is only rather slight.

218. The foregoing is an example in the projection for a fixed group of cities, the cities remaining the same throughout the projection period. The matter is different when it is desired to project, to any future date, the combined population of all cities having at least some minimal size. Since with time additional cities come to surpass that minimal size, the group of cities so defined is an expanding one, comprising more numerous cities as time progresses.

EXPANDING GROUPS OF CITIES

219. In a country like Iran it may be inadvisable to make a projection for the expanding group of cities above a high size limit, such as 100,000. At the 1956 census, apart from Tehran, Iran had eight cities of such size, and at the 1966 census it had thirteen such cities, since five additional cities had meanwhile entered the group. But two of the additional cities had almost 100,000 inhabitants already in 1956, namely Hamedan with 99,909 and Ghom with 96,499. The exact number of additional cities that may enter the group, say, in future five-year periods will depend much on accident; by coincidence, there may be some time periods when many cities happen to enter the group, and others when few or perhaps no additional city happens to reach such size. It is preferable to make calculations for all individual cities of such size that their attainment of 100,000 by the end of the projection period (e.g. by 1985) is possible. In this way one can also estimate how many cities of such size may exist at any future date, and what the combined population of the expanding group might be.

220. When a lower size limit is chosen sufficient to make the cities of the group quite numerous, these reservations regarding the direct projection for the group become unnecessary. In Iran, for instance, there were 49 cities and towns of at least 20,000 inhabitants in 1956, and 73 in 1966. While there may be yearly fluctuations in the number of additional towns which attain

TABLE 16. PROJECTION FOR THE GROUP OF CITIES IN IRAN WHICH HAD AT LEAST 100,000 INHABITANTS IN 1956,
AND FOR THE GROUP OF CITIES WHICH MAY HAVE AT LEAST 100,000 AT ANY SUBSEQUENT DATE, 1965-1985

Date	Population (thousands)			Percentage of urban population (excluding Tehran)		Logistic level		Date	Combined urban population	Tehran	Cities 100,000+ in 1956 ^a	New cities 100,000+ at any date	Urban places smaller than 100,000
	Urban (excluding Tehran)	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date						
A. Projection								B. Composition of urban population (including Tehran)					
Censuses								1. In thousands					
1956	4,441	1,538	1,538	34.63	34.63	-63.5	-63.5	1965	9,172	2,518	2,198	512	3,944
1966	7,075	2,318	2,947	32.76	41.66	-71.9	-33.3	1970	11,576	3,313	2,652	1,019	4,592
								1975	14,708	4,386	3,219	1,753	5,349
								1980	18,598	5,775	3,885	2,776	6,162
								1985	23,250	7,510	4,631	4,136	6,973
Mid-year estimates								2. Percentage					
1965	6,654	2,198	2,710	33.03	40.73	-70.7	-37.5	1965	100.0	27.4	24.0	5.6	43.0
1970	8,263	2,652	3,671	32.10	44.43	-74.9	-22.4	1970	100.0	28.6	22.9	8.8	39.7
1975	10,322	3,219	4,973	31.19	48.18	-79.1	- 7.3	1975	100.0	29.8	21.9	11.9	36.4
1980	12,823	3,885	6,661	30.30	51.95	-83.3	+ 7.8	1980	100.0	31.0	20.9	14.9	33.2
1985	15,740	4,631	8,767	29.42	55.70	-87.5	+22.9	1985	100.0	32.3	19.9	17.8	30.0

^a Including Hamedan (99,909 inhabitants in 1956), excluding Tehran.

TABLE 17. MODIFIED PROJECTION FOR THE GROUP OF CITIES IN IRAN WHICH HAD AT LEAST 100,000 INHABITANTS IN 1956,
AND FOR THE GROUP OF CITIES WHICH MAY HAVE AT LEAST 100,000 AT ANY SUBSEQUENT DATE, 1965-1985

Date	Population (thousands)			Percentage of urban population (excluding Tehran)		Logistic level		Date	Combined urban population	Tehran	Cities 100,000+ in 1956 ^a	New cities 100,000+ at any date	Urban places smaller than 100,000
	Urban (excluding Tehran)	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date	Cities 100,000+ in 1956 ^a	Cities 100,000+ at any date						
A. Projection								B. Composition of urban population (including Tehran)					
Censuses								1. In thousands					
1956	4,441	1,638	1,638	36.88	36.88	-55.9	-55.9	1965	9,172	2,518	2,314	414	3,926
1966	7,075	2,442	2,947	34.52	41.66	-64.0	-33.3	1970	11,576	3,313	2,798	818	4,647
								1975	14,708	4,386	3,402	1,404	5,516
								1980	18,598	5,775	4,112	2,220	6,491
								1985	23,250	7,510	4,911	3,305	7,524
Mid-year estimates								2. Percentage					
1965	6,654	2,314	2,728	34.78	41.00	-62.90	-36.4	1965	100.0	27.4	25.2	4.5	42.9
1970	8,263	2,798	3,616	33.86	43.76	-66.95	-25.1	1970	100.0	28.6	24.2	7.1	40.1
1975	10,322	3,402	4,806	32.96	46.56	-71.00	-13.8	1975	100.0	29.8	23.1	9.5	37.6
1980	12,823	4,112	6,332	32.07	49.38	-75.05	- 2.5	1980	100.0	31.0	22.1	11.9	35.0
1985	15,740	4,911	8,216	31.20	52.20	-79.10	+ 8.8	1985	100.0	32.3	21.1	14.2	32.4

NOTE : This is a modification of the projection in table 16. The modification consists in including the city of Hamedan among those with at least 100,000 inhabitants already in 1956.

^a Including Hamedan (99,909 inhabitants in 1956), excluding Tehran.

20,000 inhabitants, the fluctuations in added population are probably quite small in relation to the increase in size of the combined population of all localities of at least 20,000. No appreciable error is introduced, in such a case, if the addition of new localities is regarded as a fairly continuous process.

221. The foregoing considerations will now be illustrated with the results of actual calculations. First, two calculations are made for Iran's cities other than Tehran with 100,000 or more inhabitants, distinguishing cities which already had at least 100,000 inhabitants at the 1956 census from those additional cities which may attain such size at any subsequent date. The first calculation (table 16) shows the results strictly according to the census data. But the same type of calculation is repeated (see table 17) to show the difference in results when one additional city (Hamedan) is also included among those with 100,000 inhabitants already in 1956: according to the census, it then had 99,909 inhabitants, i.e. virtually 100,000.

222. Let us consider first the calculations in table 16. Cities other than Tehran with 100,000 inhabitants already in 1956 had a population of 1,538,000 in 1956 and 2,318,000 in 1966; thus their proportion in the combined urban population (without Tehran) fell from 34.63 per cent to 32.76 per cent. After interpolation and extrapolation on the logistic scale, conversion into percentages and application of the percentages to the projected urban population (without Tehran), we find that the combined population of this fixed group of cities may grow from 2,198,000 in 1965 to 4,631,000 in 1985. The same type of calculation was made for the population of all cities other than Tehran having at least 100,000 inhabitants at any time. This is an expanding group, and its combined population rose from 1,538,000 in 1956 to 2,947,000 in 1966; the projection indicates a rise in population from 2,710,000 in 1965 to 8,767,000 in 1985.

223. Subtracting the projection for the fixed group from that of the expanding group of cities we find, as shown in part B1 of table 16, that new cities of 100,000 and more inhabitants which had not yet had such a size in 1956 may rise from a combined population of 512,000 in 1965 to 4,136,000 in 1985. Such rapid growth in the population of new cities reaching 100,000 at any time, while not impossible, appears rather surprising, for it is calculated that by 1985 these new cities will combine almost as much population as the eight cities which had such size already in 1956. It can be roughly estimated that the number of new cities of such size would rise to about twenty-three by 1985.⁶¹ It is a matter of speculation whether such a development appears plausible, and one may have to examine whether there is a sufficient

supply of cities with hitherto less than 100,000 inhabitants, which can reasonably be expected to surpass that limit by 1985.

224. Still considering table 16, we note that from 1965 to 1985 Tehran may increase 3.0-fold; the fixed group of cities, 2.1-fold; the expanding group of cities, 3.2-fold (not much more rapidly than Tehran, despite increase in the number of cities); and the population of towns smaller than 100,000, 1.8-fold, which is not much slower than the growth of the fixed group of cities, despite the fact that cities attaining 100,000 inhabitants are continuously being lost to that last-named group. The several projections are not necessarily inconsistent with each other.

225. The fact that five new cities attained 100,000 each between the censuses of 1956 and 1966, however, may have to be regarded as rather accidental, especially in view of the fact that at the 1956 census two of these cities already had very nearly 100,000 inhabitants (Hamedan with 99,909, and Ghom with 96,499). A more plausible trend of developments may be suggested by counting at least the city of Hamedan among cities with 100,000 inhabitants already in 1960, so that only four additional cities join the group between 1956 and 1966. The calculations in table 17 are the same as those in table 16, with this modification. The resulting projection is perhaps somewhat more realistic than the one previously shown.

226. As compared with table 16, we now find (in table 17) that the 1965-1985 growth in Tehran may be 3.0-fold (as before); the growth in the fixed group of cities (including Hamedan), 2.1-fold (approximately as before); the growth in the expanding group of cities, 3.0-fold (slightly less than before); and the growth in towns smaller than 100,000, 1.9-fold (slightly more than before). For reasons stated, the projection in table 17 should perhaps be preferred. It may be noted that the modification is not very substantial. It can be roughly estimated⁶² that the calculation implies eighteen new cities reaching 100,000 between 1956 and 1985.

PROJECTION OF POPULATION BY SIZE GROUP OF LOCALITY

227. Before proceeding to the projection of Iranian towns and cities greater than 20,000 inhabitants, the general line of approach should first be discussed. As has been shown, the consistency with other projections, notably projections for cities of other size groups, remains a consideration of interest, especially as a test of the plausibility of the results. Separate projections have already been made for the population of Tehran (much larger than any other city, hence a category apart), of the urban population without Tehran, and of the population of cities either larger or smaller than 100,000. A projection of the rural population is also shown in chapter V. With the further introduction of a lower size-limit, we can obtain, relative to the projection of Iran's total population, the following component categories: Tehran; other cities of at least 100,000; towns and

⁶¹ Allowing for growth of already existing new cities in any five-year period at rates similar to the growth of old cities, we obtain balances for additional new cities of any five-year period. For instance, the population of 512,000 (new cities of 1965) may represent four cities having each recently surpassed 100,000; these may increase to about 650,000 by 1970, leaving a further increase by about 369,000 (1,019,000 minus 650,000), the equivalent perhaps of another three new cities; and so forth. The calculation is hypothetical and very rough.

⁶² See foot-note 61 for the method of estimation.

cities with 20,000-99,999 inhabitants; towns smaller than 20,000; and rural areas; altogether five categories, which comprise between them the total population of Iran.

228. When dealing with such successive categories, it becomes desirable to apply a systematic procedure. This can be done in two alternative ways. In one procedure, which we may call the downward procedure, we begin with the total population and make the appropriate calculations in respect to Tehran; then we take up the total population without Tehran and carry out the same type of exercise with regard to other cities of at least 100,000 inhabitants; and so forth with the remaining categories, until we arrive at the rural population. The opposite, or upward procedure, would be as follows: again we begin with the total population and make a calculation concerning the rural population; then we take up the urban population and do the respective calculation for towns smaller than 20,000 inhabitants; and so forth with other categories, until finally we arrive at Tehran.

229. All the foregoing experiments in projecting Iran's urban population and that of cities or groups of cities have been based on the arbitrary assumption (see chapter V) that the urban-rural growth difference, or URGD, is at the level of 3.0 per cent. Actually, between the censuses of November 1956 and November 1966, the

urban population grew from 5,954,000 to 9,794,000, that is at an instantaneous rate of 4.98 per cent; and the rural population increased from 14,362,000 to 16,950,000, i.e. at an instantaneous rate of 1.62 per cent; the difference between these two rates, or URGD, is 3.36 per cent. All the calculations which follow will be derived strictly from the census data, hence the results will differ from those in the foregoing calculations.

230. The data which will be used are the available projection of the total population for 1965-1985, the 1956 and 1966 populations in each of the five categories, and the cumulative populations of successive categories including either all preceding categories or all subsequent categories.

231. To recapitulate, the total population of Iran has been projected as follows (in thousands):

Year	Population (in thousands)
1965	24,549
1970	28,358
1975	33,152
1980	38,769
1985	45,050

The populations enumerated in 1956 and 1966 in each category, and in cumulated categories, were as follows (in thousands):⁶³

Census date	Tehran	Other cities 100,000+	Towns with 20,000- 99,999	Towns smaller than 20,000	Rural population
<i>Population in each category</i>					
1956.....	1,512	1,538 ^a	1,543	1,361	13,001
1966.....	2,720	2,947	2,462	1,665	15,285
<i>Cumulative population, including all subsequent categories</i>					
1956.....	18,955 ^b	17,443	15,905	14,362	13,001
1966.....	25,079 ^b	22,359	19,412	16,950	15,285
<i>Cumulative population, including all preceding categories</i>					
1956.....	1,512	3,050	4,593	5,954 ^c	18,955 ^b
1966.....	2,720	5,667	8,129	9,794 ^c	25,079 ^b

^a Includes Hamedan. ^b i.e. the total population. ^c i.e. the urban population.

232. To illustrate the first two steps in the downward procedure, the figures on the next page show how the population of Tehran can be projected in relation to the country's total population and how the population of other cities can be calculated with reference to the country's total population without Tehran.

233. Continuing these operations for the remaining categories, we obtain the results shown in table 18 in the order in which they were calculated.

234. In the inverted, or "upward" procedure, first a projection of the rural population is obtained in relation to the projection of the total population; then a population for towns smaller than 20,000 is derived in relation to the projection for the urban population; and so forth. The manner of calculation is the same and need not be illustrated. The results are as shown in table 19, in the order of the successive calculations.

235. A comparison of the results of the two procedures (tables 18 and 19) shows that in the "downward" procedure (calculations beginning with Tehran and ending with the rural population), the city of Tehran is projected to grow with appreciably greater speed than in the "upward" procedure (calculations beginning with the rural population and ending with Tehran). On the other hand, in the "downward" procedure the rural population is projected to grow somewhat less than in the "upward" procedure. The projections for cities of at least 100,000 inhabitants (without Tehran) and for towns smaller than 20,000 inhabitants do not differ much in the two procedures; for towns with 20,000-99,999 inhabitants, the two procedures produce virtually identical results.

⁶³ For reasons already discussed, the city of Hamedan is included among those with 100,000 or more inhabitants in 1956.

	Total population	Population of Tehran	Percentage Tehran in total	Logistic level	Total without Tehran
<i>Censuses</i>					
1956.....	18,955	1,512	7.98	-244.5	17,433
1966.....	25,079	2,720	10.85	-210.5	22,359
<i>Mid-year estimates</i>					
1965.....	24,549	2,556	10.41	-215.2	21,993
1970.....	28,538	3,434	12.11	-198.2	24,924
1975.....	33,152	4,655	14.04	-181.2	28,497
1980.....	38,769	6,288	16.22	-164.2	32,481
1985.....	45,050	8,406	18.66	-147.2	36,644
	Total population without Tehran	Other cities 100,000+	Percentage 100,000+ in total without Tehran	Logistic Level	Total without Tehran and cities 100,000+
<i>Censuses</i>					
1956.....	17,443	1,538	8.82	-233.6	15,905
1966.....	22,359	2,947	13.18	-188.5	19,412
<i>Mid-year estimates</i>					
1965.....	21,993	2,747	12.49	-194.70	19,246
1970.....	24,924	3,781	15.17	-172.15	21,143
1975.....	28,497	5,215	18.30	-149.60	23,282
1980.....	32,481	7,120	21.92	-127.05	25,361
1985.....	36,644	9,535	26.02	-104.50	27,109

236. Whether the results are internally consistent may be tested by comparing the calculated 1965-1985 increases in each category. In the "downward" procedure, Tehran increases 3.3-fold; other cities of 100,000 inhabitants or more increase 3.5-fold; towns with 20,000-99,999 inhabitants increase 2.3-fold; small towns increase 1.4-fold; and the rural population grows 1.3-fold. In the "upward" procedure the growth of Tehran is 3.0-fold; that in other cities of 100,000 or more inhabitants, 3.4-fold; that in towns of 20,000-99,999 inhabitants, 2.3-fold; that in small towns, 1.4-fold; and that in the rural population, 1.3-fold.

237. It is reasonable to expect that the group of cities of 100,000 or more inhabitants—which is an "expanding" group, growing more numerous with time—may grow faster than Tehran, though not all individual cities will grow so fast. It is also reasonable to expect that with dwindling size classes rates of growth become progressively lower. It appears somewhat peculiar, nevertheless, that the population of towns smaller than 20,000 is projected to increase hardly any faster than the rural population. With time, new small towns may come into existence or villages may acquire the size or characteristics which make them classifiable as towns. It appears that, with unchanging census definitions of "urban" localities, little expansion of the small-town category is provided for. Perhaps the census definition has identified in 1956 and 1966 the same identical towns, making no allowance for additional towns that might have come into existence during the census interval, with the consequence that the projection likewise fails to provide for the possible emergence of more numerous small towns. On the other hand, it is possible that small towns are in fact economically stagnant, and grow with hardly any greater speed than the strictly rural localities.

238. At first it may seem difficult to decide which of the two sets of projections should be preferred, that obtained by the "downward" procedure, or that resulting from the "upward" procedure. But note should be taken of the percentage which each category represents in relation to the combined category from which it was projected.

239. As for the downward procedure, the following percentages are taken from the 1966 census data: Tehran (2,720,000) then contained 10.85 per cent of the country's total population (25,079,000); other cities of 100,000 or more inhabitants (2,947,000) then contained 13.18 per cent of the total population after exclusion of Tehran (22,359,000); towns with 20,000-99,999 inhabitants (2,462,000) contained 12.68 per cent of the total population after exclusion of Tehran and other cities of at least 100,000 (19,412,000); and towns smaller than 20,000 inhabitants (1,665,000) contained 9.82 per cent of the total population after exclusion of Tehran, cities of at least 100,000, and towns of 20,000-99,999 inhabitants (16,950,000); the rural population (15,285,000) constituted the residual.

240. As for the upward procedure, the following percentages are taken from the 1966 census data: The rural population (15,285,000) comprised 60.95 per cent of the country's total population (25,079,000); towns smaller than 20,000 (1,665,000) comprised 17.00 per cent of the country's urban population (9,794,000); towns with 20,000-99,999 inhabitants (2,462,000) comprised 30.29 per cent of the urban population excluding small towns (8,129,000); and cities other than Tehran with 100,000 or more inhabitants (2,947,000) comprised 52.00 per cent of the population of all cities including Tehran (5,667,000); the population of Tehran (2,720,000) constituted the residual.

TABLE 18. COMPOSITION OF THE TOTAL POPULATION OF IRAN BY FIVE CLASSES OF SETTLEMENTS, 1965-1985, AS PROJECTED IN THE "DOWNWARD" PROCEDURE

<i>Mid-year date</i>	<i>Total population</i>	<i>Tehran</i>	<i>Other cities 100,000 +</i>	<i>Towns with 20,000-99,999</i>	<i>Towns smaller than 20,000</i>	<i>Rural population</i>
<i>1. In thousands</i>						
1965.....	24,549	2,556	2,747	2,352	1,652	15,242
1970.....	28,358	3,434	3,781	2,945	1,811	16,387
1975.....	33,152	4,655	5,215	3,686	1,985	17,611
1980.....	38,769	6,288	7,120	4,550	2,146	18,665
1985.....	45,050	8,406	9,535	5,492	2,268	19,349
<i>2. Percentage</i>						
1965.....	100.0	10.4	11.2	9.6	6.7	62.1
1970.....	100.0	12.1	13.3	10.4	6.4	57.8
1975.....	100.0	14.0	15.7	11.1	6.0	53.1
1980.....	100.0	16.2	18.4	11.7	5.5	48.1
1985.....	100.0	18.7	21.2	12.2	5.0	43.0

TABLE 19. COMPOSITION OF THE TOTAL POPULATION OF IRAN BY FIVE CLASSES OF SETTLEMENTS, 1965-1985, AS PROJECTED IN THE "UPWARD" PROCEDURE

<i>Mid-year date</i>	<i>Total population</i>	<i>Rural population</i>	<i>Towns smaller than 20,000</i>	<i>Towns with 20,000-99,999</i>	<i>Cities 100,000 + without Tehran</i>	<i>Tehran</i>
<i>1. In thousands</i>						
1965.....	24,549	15,228	1,653	2,356	2,750	2,562
1970.....	28,358	16,459	1,807	2,940	3,759	3,393
1975.....	33,152	17,859	1,980	3,673	5,142	4,498
1980.....	38,769	19,222	2,152	4,540	6,958	5,897
1985.....	45,050	20,493	2,289	5,491	9,212	7,565
<i>2. Percentage</i>						
1965.....	100.0	62.0	6.7	9.6	11.2	10.4
1970.....	100.0	58.0	6.4	10.4	13.3	12.0
1975.....	100.0	53.9	6.0	11.1	15.5	13.6
1980.....	100.0	49.6	5.6	11.7	17.9	15.2
1985.....	100.0	45.5	5.1	12.2	20.4	16.8

241. It will be noted that all the percentages used in the "downward" procedure are rather small, while in the "upward" procedure most of the percentages are rather substantial. On the logistic scale, small percentages rise at accelerating rates, but much less acceleration occurs in percentages at more substantial levels. It is possible, therefore, that more reliance should be placed on the projections arrived at with the "upward" procedure and presented in table 19.

242. As a further check one may compare the present results with those which would have been obtained with the use of simpler methods. The drawbacks of simple methods have been discussed in chapter IV. Nevertheless, within certain limits their use is quite expedient where a population is subdivided into several categories. For instance, the sum of extrapolated percentages for every category will always remain 100 per cent. If constant rates of growth are calculated for each category, on the other hand, the sum of results will exceed the projection of the total population, but an adjustment can be made through prorating, maintaining the projected proportions, but reducing numbers in each category by a constant.

The results of the two procedures illustrated in the foregoing and those of the two simple methods obtained for the year 1985 are compared on the next page.

243. The ratio method and constant rates (prorated) produce larger results for small and medium-sized towns than the foregoing procedures. Otherwise, results of the ratio method are generally closer to those of the "upward" procedure, while those of constant rates (prorated) are intermediate between those of the "downward" and "upward" procedures. Each method may be affected by a bias of its own, and no definite conclusion can be reached as to which method produces the "best" results. If no other source of judgement is available, perhaps one might suggest to use an average of the results obtained by the "downward" and "upward" procedures, respectively.

244. This tentative suggestion might be modified in the light of more knowledge of the circumstances prevailing in the urbanization process in Iran. For instance, it might be argued that urbanization occurs either more in response to a "pull" (i.e. the attraction exerted by big

<i>Procedure</i>	<i>Total population</i>	<i>Tehran</i>	<i>Other cities 100,000 +</i>	<i>Towns with 20,000 – – 99,999</i>	<i>Towns smaller than 20,000</i>	<i>Rural population</i>
<i>1. In thousands</i>						
"Downward" procedure	45,050	8,406	9,535	5,492	2,268	19,349
"Upward" procedure	45,050	7,565	9,212	5,491	2,289	20,493
Ratio method	45,050	7,294	8,348	5,834	2,536	21,048
Constant rates:						
(Unprorated)	(47,075)	(8,117)	(9,891)	(5,877)	(2,530)	(20,660)
Prorated	45,050	7,768	9,466	5,624	2,421	19,771
<i>2. Percentage</i>						
"Downward" procedure	100.0	18.7	21.2	12.2	5.0	43.0
"Upward" procedure	100.0	16.8	20.4	12.2	5.1	45.5
Ratio method	100.0	16.2	18.5	13.0	5.6	46.7
Constant rates	100.0	17.2	21.0	12.5	5.4	43.9

cities) or more in response to a "push" (i.e. the repulsion of the rural and small-town environments). If "pull" is a prevalent factor, the "downward" procedure may be more to the point. If "push" is the dominant phenomenon, then there may seem to be more reason to accept

the results of the "upward" procedure. Thus, specific information regarding conditions in Iran may assist in making a choice, in the particular instance. It does not follow that the same choice would be equally pertinent in other countries where conditions may differ.