

Population Estimation and Projection Methods at National and Provincial Levels for the Years between 1996-2006

Introduction

One of the factors influencing the short-run and long-run planning and decision-making activities in each institution active in the social, economic, and political fields is to have accurate and appropriate statistical data on the present state and to enjoy reliable estimates in the related field. Thus the population estimates and forecasts are determining factors in planning and decision-making activities of the different government organizations both at national and provincial levels. This has attracted the attention of managers and researchers.

Although the General Censuses of Population and Housing are conducted decennially nationwide to provide the users with the most complete and reliable data on the population and its characteristics at the national and sub-national levels and various sampling surveys dealing with the population-related features are carried out between them, none of these sources could alone be used to meet the current and future needs, particularly when most of the sampling surveys are not optimized at the provincial levels and as such their results are not applicable.

It should be mentioned that the demographers have managed to present national and provincial estimates from long ago, however, they have rarely been able to study the demographic models' theoretical details along with the statistical and stochastic models. The present report attempts to deal with this significant matter from two perspectives, statistics and demography.

The project manager's comments

The objective of the project conducted at the Statistical Research Center, resulting in this report was to present estimates and projections for the country's provinces for the years after the census enumeration. However, in order for the would-be users, naturally from a variety of specialized groups, to make a better use of this report, and for the purpose of determining more accurately and clearly the population projection and estimation methods, and dealing with the theoretical foundations of these methods, it has been prepared in two sections, "estimation and projection methods" and "presentation of projections and estimates". It is hoped this effort might have resulted in a relatively complete collection containing theoretical concepts and practical results on the population projection and estimation methods.

Moreover, in view of the fact that in most methods applied for population projection and estimation at the sub-national level (whether statistical methods or demographic methods), the focus has been on the total country's population projections and estimates as a prerequisite, the methods used for the total country's population projection and estimation should be taken into consideration in order to achieve the terminal goal of the project. Accordingly, discussions pertaining to the population projection and estimation has been presented separately, by national and sub-national (provincial) levels in the two sections of the report.

Considering the existing conditions of the statistical methods, the most appropriate methods for the total country's population projection and estimation are introduced below (table 1) together with the resulting figures based on the first-order autoregressive model with confidence coefficients, 70 and 90 percents.

Table 1. Total country's population projection and estimation, 1997-2006

Year	70 percent bounds			90 percent bounds		
	Lower bound	median	Upper bound	Lower bound	median	Upper bound
1997	60927054	60946653	60966257	60898769	60946653	60994574
1998	61833007	61852897	61872793	61804301	61852897	61901531
1999	62754314	62774500	62794692	62725180	62774500	62823858
2000	63691258	63711746	63732240	63661689	63711746	63761841
2001	64644131	64664925	646857725	64614120	64664925	64715770
2002	65613228	65634333	65655446	65582767	65634333	65685941
2003	66598851	66620273	66641703	66567932	66620273	66672656
2004	67601307	67623052	67644804	67569923	67623052	67676223
2005	68620911	68642985	68665065	68586054	68642985	68696958
2006	69657984	69680390	69702804	69625645	69680390	69735179

To estimate population at the provincial level for years 1997 through 2000 and for years 2001 through 2006, the ratio correlation method and geometric growth ratio method were respectively used. These estimates are presented in the following (table 2).

Table 2. population projection at provincial level, 1997-2006

provinces	Ratio correlation method				Geometric growth rate method					
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
East Azarbayejan	3365880	3462834	3485626	3476798	3373031	3382610	3392216	3401850	3411511	3421199
West Azarbayejan	2526984	2586284	2650284	2720956	2728129	2777012	2826772	2877422	2928981	2981463
Ardebil	1233251	1234545	1242220	1241838	1195007	1200480	1205979	1211503	1217052	1222627
Esfahan	3991229	4013587	4030655	4087720	4179814	4233105	4287075	4341733	4397089	4453150
Ilam	493666	503256	506857	510854	540133	551235	562566	574130	585931	597975
Bushehr	755306	772287	781476	784534	796616	807649	818834	830173	841670	853327
Tehran	10407353	10443472	10564981	10868883	11598453	11867048	12141862	12423041	12710731	13005083
Chaharmahal & Bakhtiari	779836	790540	804875	804246	775296	778153	781021	783899	786788	789687
Khorasan	6159305	6230881	6397378	6464235	6082319	6089275	6096238	6103210	6110189	6117177
Khuzestan	3824039	3943318	3932967	4090545	4420326	4568921	4722512	4881266	5045357	5214964
Zanjan	923944	951547	969334	954813	936001	943186	950426	957721	965073	972481
Semnan	508460	516665	525790	525707	548866	558874	569066	579443	590009	600768
Sistan & Baluchestan	1787563	1883093	1919810	2033042	2039224	2109221	2181620	2256505	2333960	2414074
Fars	3817372	3902742	3948179	3944289	4111285	4172805	4235246	4298620	4362943	4428229
Qazvin	964761	966603	972104	1006735	1031335	1044435	1057702	1071137	1084743	1098522
Qom	875957	867088	886322	905063	961087	984285	1008043	1032375	1057294	1082814
Kordestan	1382923	1399904	1425131	1428775	1469620	1495590	1522018	1548913	1571284	1604138
Kerman	2021293	2061253	2099629	2141164	2156907	2188790	2221143	2253975	2287292	2321102
Kermanshah	1772850	1789185	1821449	1853846	1950119	1986360	2023274	2060874	2099173	2138184
Kohgiluyeh & Boyerahmad	551539	570984	579726	583965	596538	607559	618785	630218	641862	653721
Golestan	1437321	1449945	1487520	1507596	1546543	1571784	1597437	1623509	1650006	1676936
Gilan	2294576	2312161	2358729	2392530	2280395	2288174	2295979	2303811	2311670	2319555
Lorestan	1597876	1631416	1662310	1677214	1671639	1689648	1707851	1726250	1744847	1763644
Mazandaran	2593943	2622689	2669409	2675237	2732481	2759350	2786484	2813884	2841554	2869496
Markazi	1245632	1258639	1255638	1266990	1276818	1286642	1296541	1306517	1316570	1326699
Hormozgan	1119465	1106960	1130687	1175056	1220395	1254766	1290106	1326441	1363799	1402209
Hamedan	1674936	1695021	1723907	1727068	1705024	1710489	1715972	1721473	1726991	1732527
Yazd	757905	767865	782173	784052	815567	829183	843027	857101	871410	885958

Believing in the accuracy of the 1997-2000 estimates, the 1997-2000 growth rate similar to that obtained from the two censuses can be calculated as $r = \sqrt{\frac{P_{2000}}{P_{1997}}} - 1$ and projections presented in the following table (table 3) using geometric growth rate with the new growth rate.

Table 3. population projection at provincial level, 1997-2006

provinces	Ratio correlation method				Geometric growth rate method					
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
East Azarbayejan	3365880	3462834	3485626	3476798	3514577	3552767	3591371	3630395	3669843	3709720
West Azarbayejan	2526984	2586284	2650284	2720956	2788867	2858474	2929817	3002942	3077891	3154711
Ardebil	1233251	1234545	1242220	1241838	1244714	1247596	1250484	1253380	1256283	1259192
Esfahan	3991229	4013587	4030655	4087720	4120399	4153340	4186544	4220013	4253750	4287757
Ilam	493666	503256	506857	510854	516715	522644	528640	534706	540841	547046
Bushehr	755306	772287	781476	784534	794526	804645	814893	825272	835872	846427
Tehran	10407353	10443472	10564981	10868883	11027231	11187885	11350880	11516250	11684029	11854252
Chaharmahal & Bakhtiari	779836	790540	804875	804246	812551	820942	829420	837985	846639	855382
Khorasan	6159305	6230881	6397378	6464235	6569204	66675872	6784272	6894432	7006381	7120148
Khuzestan	3824039	3943318	3932967	4090545	4183446	4278456	4375624	4474999	4576631	4680572
Zanjan	923944	951547	969334	954813	965330	975963	986713	997582	1008570	1019679
Semnan	508460	516665	525790	525707	531585	537529	543539	54316	555762	561976
Sistan & Baluchestan	1787563	1883093	1919810	2033042	2122143	2215149	2312232	2419569	2519347	2629761
Fars	3817372	3902742	3948179	3944289	3957526	4031236	4075426	4120100	4165263	4210922
Qazvin	964761	966603	972104	1006735	1021128	1035727	1050535	1065555	1080789	1096241
Qom	875957	867088	886322	905063	914978	925002	935136	945381	955738	966209
Kordestan	1382923	1399904	1425131	1428775	1444394	1460185	1476147	1492285	1508598	1525090
Kerman	2021293	2061253	2099629	2141164	2182680	2225002	2268144	2312122	2356954	2402654
Kermanshah	1772850	1789185	1821449	1853846	1881659	1909889	1938542	1967626	1997146	2027108
Kohgiluyeh & Boyerahmad	551539	570984	579726	583965	595192	606635	618297	630184	642300	654648
Golestan	1437321	1449945	1487520	1507596	1531777	1556354	1581308	1606671	1632441	1658624
Gilan	2294576	2312161	2358729	2392530	2426102	2460145	2494	2529671	2565167	2601161
Lorestan	1597876	1631416	1662310	1677214	1704526	1732283	1760491	1789159	1818294	1847904
Mazandaran	2593943	2622689	2669409	2675237	2702897	2730844	2759079	2787606	2816428	2845548
Markazi	1245632	1258639	1255638	1266990	1274190	1281432	1288714	1296038	1303404	1310811
Hormozgan	1119465	1106960	1130687	1175056	1194193	1213642	1233408	1253495	1273910	1294657
Hamedan	1674936	1695021	1723907	1727068	1748403	1762721	1780823	1799110	1817585	1836250
Yazd	757905	767865	782173	784052	792967	801983	811101	820323	829650	839083