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Generation of Model Life Tables for the Major States of India

Labananda Choudhury[1] and Rajan Sarma[2]

[1]*Department of Statistics, Gauhati University, Guwahati- 781014, Assam, India*
[2]*Department of Statistics, Darrang College, Tezpur-784001, Assam, India*

Abstract

Life tables are, in essence, one form of combining age specific mortality rates of a population into a single statistical model. In India, registration of deaths is not satisfactory and the conventional way of constructing life tables from age specific deaths cannot be adopted. Sample registration system (SRS) provides life tables only for the country and the major states. Life tables for the districts of India are not available. However, districts in India are large enough both in population and geographical sizes; some even have a population larger than some smaller European countries. At the time when 2001 census was carried out, India has 28 states and 7 union territories with 593 districts. It may be immensely useful for health and planning purposes to have life tables for these districts.

The present study proposes a new method of generating model life tables for India and its major states. The life tables of the major states obtained from the model life tables are satisfactorily closer to the corresponding SRS life tables. The life table of a district can be obtained from the model life table of the state to which it belongs.

Keywords: Life Table, Life expectancy at birth, Model Life Table, India, Districts.

Introduction

A life table is designed essentially to measure mortality, but has been employed in various fields by various specialists. It is used by public health workers, demographers, actuaries, and many others in studies of longevity, fertility, migration, population growth, etc. as well as in studies of widowhood, orphanhood, length of married life, length of working life and length of disability free life. In other

applications the mortality rates in the life table are combined with other demographic data into a complex model which measures the combined effect of mortality and changes in one or more socio-economic characteristics [1].

The life expectancy at birth (e_0^0), the final output of a life table, is the average number of years a new born of a particular place can expect to live if the current age schedule of mortality prevails. It is usually considered as an important indicator of the mortality level of a population [2].

The conventional way of constructing life tables is by using the information on age specific deaths provided by a vital registration system. Unfortunately, in India, the registration of deaths is not satisfactory and this procedure cannot be adopted [3, 4]. Sample Registration System (SRS) is the main source of reliable information on vital statistics for the country and its constituent states. However, possibly due to its sample size problems, SRS has not gone beyond the 16 major states in estimating the life expectancy at birth (e_0^0) and the construction of the life tables. The life tables for the sub-state units like the districts are not available.

A number of indirect techniques are available in the literature of mortality estimation in the absence of observed age specific deaths [5]. Most of these methods are not applicable at the sub state level of India as either one or more required data elements are not available or the underlying assumptions are not fulfilled. In cases where the required data are available, the results obtained from the application of these methods reveal inconsistencies which lead to suspect the quality of data or the applicability of the methods at the sub state level.

However, life expectancy at birth for the districts of India can indirectly be estimated by regression method using estimated infant mortality rates (q (1) or ${}_1q_0$) and the proportion of persons above 65 years of age (P(65+)) as independent variables [6].

Generally, after estimation of e_0^0 for a district of India, the usual procedure to construct the life table, is to look for a suitable model life table, particularly, the United Nations South Asian Model, select two life tables of this model corresponding to two consecutive e_0^0 within which the estimated e_0^0 of the district falls and interpolate the values of the life table functions. It is often found that such interpolated life tables differ considerably with the SRS life tables of many states of India. For instance, the SRS life tables (${}_nq_x$ and e_x^0 portion) of Tamil Nadu (Rural-Female: 1993-97), and Orissa (Urban-Female: 2001-05) differ considerably with the interpolated South Asian Model life tables (Tables1-2, Figures 1-2). Another problem of using the model life table is that it will yield the same life table for the different districts of different states having the same e_0^0. For example, the e_0^0 of a developed district of Assam may be same to that of a less developed district of say, Kerala or Punjab, and the life tables constructed from a model one with the given e_0^0 will be identical. But these states generally differ in population structure, religion, culture and the people are from different racial and ethnic background. With so many differences in socio-cultural and demographic factors it is unlikely that districts of different states will have the same mortality pattern even if they have the same e_0^0. For example, consider the SRS life tables (${}_nq_x$ and e_x^0 portion) of Uttar Pradesh (2000-04) and Assam (1989-93) for urban female; Haryana and Tamil Nadu (1993-97) for rural

female; though their e_0^0's are same, the life table functions ${}_nq_x$'s (probability of dying in the age group x to x + n) and e_x^0's (life expectancy at age x) differ (Table 3, Figures 3-4). This necessitates the search for an alternative method.

Office of the Registrar General of India produces SRS based abridged life tables for India and its major states starting from 1970-75 onwards almost at regular intervals [7]. It is found from these life tables that e_x^0 and ${}_nq_x$ can be obtained from e_0^0 by different regression equations for different x's. Clubbing all these life tables and carrying out regression analysis, a set of one parameter model life tables can be generated for India which can further be used to estimate life tables for the districts with e_0^0 as the only input. But, this does not eliminate the problem of having identical life tables for the districts of different states with the same e_0^0. This problem may be reduced by generating separate model life tables for India and its 16 major states from the SRS based abridged life tables. The life table of a district can be obtained from the model life table of the state to which the district belongs. The districts of the same state with same e_0^0 will, Of course, have partly identical life tables (from age 5 and above), but it will, at least, bring down the problem of overlooking the macro (state) level heterogeneity to micro (district) level heterogeneity.

Objectives

The present study proposes a new method of constructing life tables by estimating the life table functions e_x^0's and ${}_nq_x$'s from the estimated e_0^0 using the regression method of curve estimation for India and its major states. The generated life tables of India serve as model life tables for the smaller states and the union territories and the generated life tables of the major states serve as the model life tables for their constituent districts.

Methods and Materials

Adekola [8] presented a mathematical life expectancy model for a non homogeneous population, which depends on the life expectancy at birth and age of the population:

$$L(A) = L(0)(1-\beta A)^{\theta} \quad 0 \le A \le \varpi, \quad \theta \ge 0$$

Where $L(A)$ and $L(0)$ are non-negative constants and denote the life expectancy at age A and at birth respectively, and θ and β are constants representing the scale and shape parameters respectively, ϖ is the maximum age lived in the population.

Following Adekola's model, we have checked how the e_x^0's changes from e_0^0 in SRS life tables of India for different periods and found that the percentage change in e_x^0 (x=1,5,10,…,70) from e_0^0 is almost constant in different periods and the difference, if any, is not more than 1% (Table 4). Similar situations are found in the SRS life tables of the major states of India.

SRS data covering a period of 30 years from 1970-75 to 2001-05 for India and its major states (Government of India, 1970-75 to 2001-05) were used to check for the existence of appropriate functional relationship (Mth) between e_x^0 and e_0^0. It is found

that different functional relationships exist between e_x^0 and e_0^0 for different x's with very high R^2 (Rsq). Generally, a linear (LIN) or a quadratic (QUA) relationship will satisfactorily estimate the e_x^0's (Table 5).

In the Coale Demeny [9] regional model life tables four patterns observed in the 192 life tables by sex were identified. For each of these patterns coefficients of linear equations relating to ${}_nq_x$ and e_{10}^0 were obtained by least square regression. From the equations thus established, it was simple to derive a complete set of ${}_nq_x$ values and, therefore, a model life table from any given value of e_{10}^0 [5].

Following the above procedure, the SRS data covering 30 years from 1970-75 to 2001-05 were used to estimate the curve of ${}_nq_x$ from e_0^0 instead of e_{10}^0 (as we have only the estimated e_0^0 for the districts). It is found that ${}_nq_x$'s are also related to e_0^0 by different functions (linear, quadratic or cubic (CUB)) for different x's with very high R^2 (Table 6). We select the function with the maximum R^2 and calculate the ${}_nq_x$'s. If for some x, the calculated ${}_nq_x$ results in some negative value or the ${}_nq_x$ curve shows some irregularities we take the function with the next highest R^2 and so on till all ${}_nq_x$ values are calculated up to x=65.

After calculating the ${}_nq_x$ and e_x^0, the other life table functions are calculated as:

$$d_x = q_x l_x \quad for \;\; x = 1,5,...65, \;\; and \;\; l_0 = 100000$$

$$l_{x+n} = l_x - d_x$$

$${}_1L_0 = 0.276l_0 + 0.724l_1$$

$${}_4L_1 = 0.034l_0 + 1.184l_1 + 2.782l_5$$

$${}_5L_5 = -0.003l_0 + 2.242l_5 + 2.761l_{10}$$

The values of ${}_5L_x$ from ages 10 and above are obtained as ${}_5L_x = T_x - T_{x+5}$ and

$$T_x = \frac{e_x^0}{l_x}.$$

It is to be noted that ${}_1q_0$ and ${}_4q_1$ (= q(5)-q(1)) values for the districts are estimated from 2001 census data using Trussell's variant of the Brass method and used in estimating e_0^0 for the districts[6] and are generally different for districts even with same e_0^0.

Results and Discussion

From the life table functions generated from SRS life tables of India a set of life tables corresponding to different e_0^0's can be derived. The life table for India generated from the SRS e_0^0 of different periods and the corresponding SRS life tables are compared and found to be satisfactorily closer to each other. For instance, the generated life table of India corresponding to the SRS e_0^0 of 2001-05 (=63.2) well approximates the SRS life table of India for that period (Table 7, Fig 5).

It is also seen that SRS life table of a state whose e_0^0 is not far away from the range of the e_0^0's of India (i.e., 48.9 in 1970-75 and 63.2 in 2001-05) is almost

identical with the generated life table of India corresponding to that e_0^0. For example, the generated life table of India corresponding to e_0^0 = 58.7 which is the life expectancy at birth for Assam (Person) during 2001-05 (SRS), is almost identical with the SRS Life table of Assam for that period (Table 8, Figure 6). The generated life table of India corresponding to e_0^0 = 59.6 which is the life expectancy at birth of Uttar Pradesh (person) during 2000-04 (SRS), is almost identical with the SRS life table of Uttar Pradesh for 2000-04 (Table 9, Figure 7), etc. Thus, the set of the generated life tables of India for different e_0^0's acts as Model life tables.

The problem arises with the states whose e_0^0 is outside the range of e_0^0 of India. In that case the generated life table may show some unacceptable results. Therefore, the generated life table for India may be used only to obtain the life tables of the states and union territories for which SRS life tables were not available and whose estimated e_0^0 is not too far from the range of e_0^0 of India. The life tables for the districts of the major states (whose SRS life tables are available) may be constructed by generating separate life tables for these states by exploiting the relationship of the life table functions with e_0^0 found from the SRS life tables of these states. As the life table of a constituent state of India can be obtained from the generated life tables of India corresponding to the e_0^0 of that state, the life table of a district of a particular state can be obtained from the generated life tables of that state corresponding to the estimated e_0^0 of that district.

In the SRS life tables sometimes a few irregularities are found in the ${}_nq_x$ values. For example, in the SRS life tables of Kerala, ${}_1q_0$ values shows a decreasing trend from 0.04233 in 1970-75 to 0.00264 in 1997-2001. Then it jumps to 0.00875 in 2000-2004 and 0.00606 in 2001-2005. Such irregularities result in a very low R^2 in the regression and may distort the curve. Elimination of such irregular data points from the regression analysis increases the R^2 considerably. Thus, whenever such a situation is encountered, data points responsible for the irregularities are to be eliminated at the cost of degrees of freedom.

For the sake saving space, instead of the Model life tables we are presenting the coefficients of the curve fit of e_x^0 and ${}_nq_x$ with e_0^0 as the independent variable, for a few selected major states belonging to different zones of India viz., Himachal Pradesh (North), Assam (North East), Kerala (South), Uttar Pradesh (Central), West Bengal (East), Gujarat (West) (Table 10). Using these coefficients, e_x^0 and ${}_nq_x$ portion of the life table can be completed for different age groups from a given e_0^0 of the state or any of its districts and the whole abridged life table can be completed using the formulas as given above.

In Table 11 (1-6) (Figures 8(1)-8(6)), the life tables generated by using the equations of the curve fit and 2001-05 SRS e_0^0 of the selected major states and the SRS life table (the ${}_nq_x$ and e_x^0 portion only) of these states for that period are presented.

Table 1: SRS (Female-Rural: 1993-97) and South Asian Model Life Tables (Interpolated) for Tamil Nadu (qx and ex portion):

	SRS		South Asian Model	
Age	qx	e_x^0	${}_nq_x$	e_x^0
0	0.05375	63.3	0.080055	63.30
1	0.01541	65.9	0.040408	67.78
5	0.00703	62.9	0.008606	66.58
10	0.00499	58.3	0.003748	62.13
15	0.01015	53.6	0.005136	57.18
20	0.01148	49.1	0.006186	52.64
25	0.01282	44.6	0.007118	47.95
30	0.0139	40.2	0.008898	43.28
35	0.01499	35.7	0.011482	38.64
40	0.0204	31.2	0.015847	34.06
45	0.02681	26.8	0.022862	29.57
50	0.0481	22.5	0.037254	25.2
55	0.06676	18.5	0.060611	21.07
60	0.12121	14.6	0.099105	17.25
65	0.20038	11.2	0.153409	13.86
70	1	8.4	1.000000	10.89

Table 2: SRS (Female-Urban: 2001-05) and South Asian Model Life Tables (Interpolated) for Orissa (qx and ex portion):

	SRS		South Asian Model	
Age	${}_nq_x$	e_x^0	${}_nq_x$	e_x^0
0	0.06482	67.5	0.06371	67.50
1	0.04422	71.2	0.02687	71.08
5	0.00588	70.4	0.00564	69.00
10	0.00643	65.8	0.00248	64.38
15	0.00633	61.2	0.00334	59.53
20	0.00777	56.6	0.004	54.72
25	0.00822	52	0.00472	49.93
30	0.00946	47.5	0.00604	45.15
35	0.01015	42.9	0.00813	40.41
40	0.01327	38.3	0.01181	35.72
45	0.01937	33.8	0.01775	31.12
50	0.02545	29.4	0.02977	26.63
55	0.05324	25.1	0.04963	22.36
60	0.08847	21.3	0.08322	18.39
65	0.11274	18.2	0.13249	14.82
70	1	15.1	1	11.67

Table 3: SRS Life Tables of U.P. (2000-04) and Assam (2001-05) for female (Urban) and Haryana and Tamil Nadu (1993-97) for Female (Rural) (qx and ex portion):

Age	Uttar Pradesh(Female)		Assam(F)		Haryna(Female)		Tamil Nadu(Female)	
	Urban(00-04)		Urban(89-93)		Rural(93-97)		Rural(93-97)	
	${}_nq_x$	e_x^0	${}_nq_x$	e_x^0	qx	e_x^0	qx	e_x^0
0	0.06252	64.1	0.06974	64.1	0.07792	63.3	0.05375	63.3
1	0.05632	67.4	0.01576	67.9	0.04602	67.6	0.01541	65.9
5	0.00742	67.3	0.00573	65.0	0.01173	66.8	0.00703	62.9
10	0.00603	62.8	0.00451	60.3	0.00568	62.6	0.00499	58.3
15	0.01030	58.2	0.00329	55.6	0.01079	57.9	0.01015	53.6
20	0.01139	53.8	0.00872	50.8	0.01148	53.5	0.01148	49.1
25	0.01237	49.4	0.00911	46.2	0.01168	49.1	0.01282	44.6
30	0.01331	44.9	0.01198	41.6	0.01272	44.7	0.01390	40.2
35	0.01395	40.5	0.01484	37.1	0.01390	40.2	0.01499	35.7
40	0.01691	36.1	0.01307	32.6	0.01514	35.7	0.02040	31.2
45	0.02001	31.6	0.02540	28.0	0.01962	31.2	0.02681	26.8
50	0.04112	27.2	0.03688	23.6	0.03386	26.8	0.04810	22.5
55	0.06286	23.3	0.09897	19.4	0.04581	22.7	0.06676	18.5
60	0.10665	19.7	0.11168	16.3	0.08806	18.6	0.12121	14.6
65	0.13572	16.7	0.18794	13.0	0.12894	15.2	0.20038	11.2
70	1.00000	13.9	1.00000	10.4	1.00000	12.0	1.00000	8.4

Table 4: Percentage change in e_x^0 in SRS Life Tables of India for different periods.

INDIA								
Age	1990-94		1992-96		2000-04		2001-05	
x	e_x^0	%change	e_x^0	%change	e_x^0	%change	e_x^0	%change
0	60.0		60.7		63.0		63.2	
1	64.1	0.07	64.9	0.07	66.5	0.06	66.6	0.05
5	62.6	0.04	63.2	0.04	65.0	0.03	65.2	0.03
10	58.3	-0.03	58.9	-0.03	60.5	-0.04	60.7	-0.04
15	53.7	-0.11	54.3	-0.11	55.8	-0.11	56.0	-0.11
20	49.2	-0.18	49.8	-0.18	51.2	-0.19	51.5	-0.19
25	44.8	-0.25	45.4	-0.25	46.8	-0.26	47.0	-0.26
30	40.4	-0.33	41.0	-0.32	42.3	-0.33	42.5	-0.33
35	36.0	-0.40	36.5	-0.40	37.9	-0.40	38.1	-0.40
40	31.6	-0.47	32.1	-0.47	33.5	-0.47	33.7	-0.47
45	27.3	-0.55	27.9	-0.54	29.2	-0.54	29.4	-0.53
50	23.2	-0.61	23.8	-0.61	25.1	-0.60	25.2	-0.60
55	19.4	-0.68	19.9	-0.67	21.1	-0.67	21.3	-0.66
60	15.9	-0.74	16.4	-0.73	17.6	-0.72	17.7	-0.72
65	12.9	-0.79	13.4	-0.78	14.4	-0.77	14.5	-0.77
70	10.3	-0.83	10.7	-0.82	11.6	-0.82	11.7	-0.81

Table 5: Curve Fit of e_x^0 (E_x) and e_0^0 (India):Independent-e_0^0

Dependent	Mth	Rsq	d.f.	b0	b1	b2
E_1	LIN	.998	10	18.4830	.7626	
E_5	QUA	.984	9	61.2566	-.5330	.0093
E_10	LIN	.970	10	30.4455	.4710	
E_15	LIN	.970	10	27.5999	.4414	
E_20	LIN	.965	10	25.6859	.3986	
E_25	LIN	.959	10	18.8852	.4382	
E_30	LIN	.965	10	17.2735	.3916	
E_35	LIN	.953	10	14.9689	.3565	
E_40	LIN	.939	10	11.9323	.3342	
E_45	LIN	.937	10	7.8301	.3315	
E_50	LIN	.928	10	4.0926	.3255	
E_55	LIN	.861	10	5.1418	.2444	
E_60	LIN	.868	10	1.7264	.2431	
E_65	LIN	.763	10	2.6410	.1776	
E_70	LIN	.720	10	.2971	.1725	

Table 6: Curve Fit of q_x (Q_x) and e_0^0 (India):Independent-e_0^0

Dependent	Mth	Rsq	d.f.	b0	b1	b2	b3
Q_0	LIN	.989	10	.3893	-.0051		
Q_1	CUB	.955	8	.7353	-.0159		1.2E-06
Q_5	LIN	.990	10	.0832	-.0012		
Q_10	LIN	.988	10	.0296	-.0004		
Q_15	LIN	.978	10	.0348	-.0004		
Q_20	LIN	.936	10	.0440	-.0005		
Q_25	LIN	.974	10	.0428	-.0005		
Q_30	LIN	.917	10	.0523	-.0006		
Q_35	LIN	.900	10	.0671	-.0008		
Q_40	LIN	.978	10	.0900	-.0011		
Q_45	LIN	.970	10	.1238	-.0015		
Q_50	LIN	.968	10	.2028	-.0025		
Q_55	QUA	.987	8	.3714	-.0069	3.4E-05	
Q_60	LIN	.982	10	.4142	-.0048		
Q_65	LIN	.964	10	.5267	-.0058		

Table 7: Generated and SRS Life Tables for India (2001-05) (Generated from SRS life tables of India):

INDIA								
Generated from e_0^0							SRS (2001-05)	
AGE	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.06698	6698	95151	6320000	63.20	0.06534	63.2
1	93302	0.03334	3111	364781	6221314	66.68	0.03939	66.6
5	90191	0.00736	664	449093	5836931	64.72	0.00777	65.2
10	89527	0.00432	387	443703	5390675	60.21	0.00529	60.7
15	89140	0.00952	849	454912	4946972	55.50	0.00807	56.0
20	88292	0.01240	1095	433368	4492061	50.88	0.01055	51.5
25	87197	0.01120	977	435486	4058693	46.55	0.01208	47.0
30	86220	0.01438	1240	436462	3623208	42.02	0.01425	42.5
35	84981	0.01654	1406	424280	3186746	37.50	0.01706	38.1
40	83575	0.02048	1712	406364	2762466	33.05	0.02123	33.7
45	81863	0.02900	2374	395561	2356101	28.78	0.03031	29.4
50	79489	0.04480	3561	397340	1960541	24.66	0.04407	25.2
55	75928	0.07112	5400	318609	1563201	20.59	0.06970	21.3
60	70528	0.11084	7817	354180	1244592	17.65	0.10887	17.7
65	62711	0.16014	10042	300577	890412	14.20	0.15506	14.5
70	52668	1.00000	52668	589835	589835	11.20	1.00000	11.7

Table 8: Generated and SRS Life Tables for Assam (2001-05) (Generated from SRS life tables of India).

	Assam 01-05 (Generated)						SRS (2001-05)	
age	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.08993	8993	93489	5870000	58.70	0.07981	58.7
1	91007	0.04809	4377	352158	5755976	63.25	0.04043	62.8
5	86630	0.01276	1105	430060	5396564	62.29	0.01237	61.4
10	85525	0.00612	523	419980	4968425	58.09	0.00663	57.1
15	85002	0.01132	962	423477	4548445	53.51	0.01272	52.5
20	84039	0.01465	1231	433845	4124968	49.08	0.01514	48.2
25	82808	0.01345	1114	402069	3691123	44.57	0.01563	43.9
30	81694	0.01708	1395	406680	3289054	40.26	0.01711	39.5
35	80299	0.02014	1617	399972	2882374	35.90	0.02299	35.2
40	78682	0.02543	2001	389842	2482402	31.55	0.02397	30.9
45	76681	0.03575	2741	377200	2092560	27.29	0.04365	26.6
50	73940	0.05605	4144	355182	1715360	23.20	0.06388	22.7
55	69795	0.08680	6058	340615	1360178	19.49	0.10285	19.1
60	63737	0.13244	8441	297061	1019563	16.00	0.13364	16.0
65	55296	0.18624	10298	253499	722501	13.07	0.19823	13.0
70	44998	1.00000	44998	469002	469002	10.42	1.00000	10.6

Table 9: Generated and SRS Life Tables for Uttar Pradesh (2000-04) (Generated from SRS life tables of India).

Uttar Pradesh Generated 2000-04							SRS 2000-04	
AGE	lx	qx	dx	Lx	Tx	ex0	qx	ex0
0	100000	0.08534	8534	93821	5960000	59.60	0.08716	59.6
1	91466	0.04422	4045	354902	5847784	63.93	0.03891	64.2
5	87421	0.01168	1021	434250	5486966	62.76	0.01045	62.8
10	86400	0.00576	498	425112	5055895	58.52	0.00653	58.4
15	85903	0.01096	941	430095	4630782	53.91	0.00976	53.8
20	84961	0.01420	1206	434346	4200687	49.44	0.01356	49.3
25	83755	0.01300	1089	409043	3766341	44.97	0.01588	44.9
30	82666	0.01654	1367	412964	3357298	40.61	0.01922	40.6
35	81299	0.01942	1579	405210	2944334	36.22	0.02128	36.4
40	79720	0.02444	1948	393605	2539124	31.85	0.02636	32.1
45	77771	0.03440	2675	381332	2145519	27.59	0.03559	27.9
50	75096	0.05380	4040	363814	1764187	23.49	0.04837	23.8
55	71056	0.08410	5976	345088	1400373	19.71	0.07562	19.9
60	65080	0.12812	8338	304816	1055284	16.22	0.11471	16.3
65	56742	0.18102	10271	258897	750468	13.23	0.17293	13.1
70	46471	1.00000	46471	491571	491571	10.58	1.00000	10.3

Table 10: Coefficients of `curve Fit of` e_x^0`: Independent-` e_0^0

Dependent	b0	b1	b2	b3
Himachal Pradesh				
E_1	16.7441	.7937		
E_5	26.5504	.6036		
E_10	26.0623	.5396		
E_15	23.5012	.5050		
E_20	21.2368	.4678		
E_25	18.2941	.4429		
E_30	15.2877	.4202		
E_35	12.4981	.3939		
E_40	9.3874	.3735		
E_45	6.3571	.3532		
E_50	4.4165	.3188		
E_55	1.9128	.2975		
E_60	.4670	.2635		
E_65	.7086	.2087		
E_70	-.3263	.1807		

Dependent	b0	b1	b2	b3
Assam				
E_1	13.9180	.8303		
E_5	23.7617	.6308		
E_10	23.3085	.5682		
E_15	20.3605	.5404		
E_20	17.3094	.5159		
E_25	13.0518	.5154		
E_30	9.2427	.5075		
E_35	6.1510	.4867		
E_40	2.9495	.4692		
E_45	.7939	.4346		
E_50	-.9447	.3975		
E_55	-2.3354	.3602		
E_60	-2.8967	.3140		
E_65	-1.8696	.2481		
E_70	-1.0909	.1933		
Kerala				
E_1	18.1500	.7520		
E_5	28.8749	.5548		
E_10	27.4519	.5082		
E_15	23.4201	.4967		
E_20	19.6201	.4827		
E_25	15.5692	.4735		
E_30	11.6962	.4623		
E_35	7.5712	.4553		
E_40	4.6977	.4314		
E_45	1.9974	.4065		
E_50	-1.3915	.3938		
E_55	-4.9607	.3861		
E_60	-8.0157	.3754		
E_65	-9.7199	.3521		
E_70	-10.773	.3245		
Uttar Pradesh				
E_1	20.2518	.7351		
E_5	41.5156	.3516		
E_10	41.3796	.2821		
E_15	37.6442	.2673		
E_20	33.9462	.2537		
E_25	30.6255	.2365		
E_30	26.8835	.2263		
E_35	22.8246	.2228		
E_40	18.8160	.2182		

E_45	15.7242	.1983	
E_50	12.6440	.1818	
E_55	10.7195	.1488	
E_60	9.0924	.1162	
E_65	7.9764	.0806	
E_70	7.5071	.0440	

Dependent	b0	b1	b2	b3
West Bengal				
E_1	-98.354	4.6457	-.0323	
E_5	229.840	-6.3292	.0587	
E_10	224.027	-6.2016	.0570	
E_15	208.966	-5.8269	.0537	
E_20	195.657	-5.4922	.0506	
E_25	179.339	-5.0569	.0466	
E_30	172.991	-4.9686	.0457	
E_35	168.187	-4.9312	.0452	
E_40	157.856	-4.7091	.0431	
E_45	162.263	-4.9662	.0450	
E_50	171.511	-5.3681	.0480	
E_55	155.860	-4.9076	.0436	
E_60	134.298	-4.2775	.0381	
E_65	108.045	-3.4539	.0309	
E_70	86.772	-2.7797	.0249	
Gujarat				
E_1	21.6989	.7086		
E_5	88.6366	-1.3746	.0156	
E_10	77.7003	-1.0911	.0128	
E_15	70.6763	-.9848	.0116	
E_20	66.4520	-.9803	.0115	
E_25	60.1811	-.8930	.0105	
E_30	51.4494	-.7242	.0089	
E_35	51.2093	-.8514	.0099	
E_40	46.6815	-.8200	.0094	
E_45	42.0611	-.8019	.0092	
E_50	39.1074	-.7999	.0088	
E_55	51.2385	-1.3928	.0142	
E_60	40.0496	-1.0794	.0011	
E_65	30.0388	-.7715	.0079	
E_70	48.4889	-1.5284	.0145	

Coefficients of curve Fit of q_x: Independent-e_0^0

Dependent	b0	b1	b2	b3
Himachal Pradesh				
Q_0	.3347	-.0042		
Q_1	1.1871	-.0272		2.2E-06
Q_5	.3150	-.0090	6.5E-05	
Q_10	.0480	-.0007		
Q_15	.2179	-.0062	4.5E-05	
Q_20	.0519	-.0007		
Q_25	.0675	-.0009		
Q_30	.0621	-.0008		
Q_35	.0732	-.0009		
Q_40	.0777	-.0009		
Q_45	.1495	-.0018		
Q_50	.1539	-.0017		
Q_55	.2579	-.0029		
Q_60	.4427	-.0053		
Q_65	.6520	-.0076		

Dependent	b0	b1	b2	b3
Assam				
Q_0	.3337	-.0044		
Q_1	.3817	-.0083	4.1E-05	
Q_5	.0937	-.0014		
Q_10	.0480	-.0007		
Q_15	.2407	-.0062		6.8E-07
Q_20	.0441	-.0005		
Q_25	.0499	-.0006		
Q_30	.0753	-.0010		
Q_35	.0766	-.0009		
Q_40	.3505	-.0099	7.4E-05	
Q_45	.2034	-.0027		
Q_50	.2846	-.0037		
Q_55	.4119	-.0054		
Q_60	.6305	-.0084		
Q_65	.7030	-.0086		
Kerala				
Q_0	.2950	-.0038		
Q_1	.2276	-.0030		
Q_5	.2797	-.0068	4.4E-05	
Q_10	.0415	-.0009	4.8E-06	
Q_15	.0031	.0003	-4.0E-06	

Q_20	.1036	-.0026	1.7E-05
Q_25	.1265	-.0031	2.0E-05
Q_30	.0961	-.0020	1.1E-05
Q_35	.0534	-.0006	
Q_40	.0784	-.0009	
Q_45	.1372	-.0022	8.1E-06
Q_50	.1217	-.0012	
Q_55	.2009	-.0020	
Q_60	.2619	-.0024	
Q_65	.8117	-.00135	5.6E--05

Uttar Pradesh

Q_0	.3644	-.0029	-3.E-05
Q_1	.4402	-.0068	
Q_5	.0916	-.0013	
Q_10	.0257	-.0003	
Q_15	.0305	-.0003	
Q_20	.0392	-.0004	
Q_25	.0352	-.0003	
Q_30	.0353	-.0003	
Q_35	.0433	-.0004	
Q_40	.0715	-.0008	
Q_45	.0988	-.0011	
Q_50	.1679	-.0020	
Q_55	.2443	-.0028	
Q_60	.3650	-.0042	
Q_65	.4305	-.0042	

Dependent	b0	b1	b2	b3

West Bengal

Q_0	.3517	-.0047		
Q_1	3.2101	.0789		7.2E-06
Q_5	.0970	-.0014		
Q_10	.0386	-.0005		
Q_15	.0661	-.0009		
Q_20	.0646	-.0009		
Q_25	.0609	-.0008		
Q_30	.0668	-.0009		
Q_35	.0731	-.0009		
Q_40	.1210	-.0016		
Q_45	.1676	-.0022		
Q_50	.2918	-.0039		
Q_55	.2667	-.0030		
Q_60	.4420	-.0051		
Q_65	.6364	-.0073		

Gujarat

Q_0	.4285	-.0058	
Q_1	.3609	-.0053	
Q_5	.0636	-.0009	
Q_10	.0085	.0004	7.E-06
Q_15	.0334	-.0004	
Q_20	.0471	-.0006	
Q_25	.0412	-.0005	
Q_30	.0907	-.0019	1.5E-05
Q_35	.0653	-.0008	
Q_40	.0895	-.0011	
Q_45	.1250	-.0015	
Q_50	.2079	-.0026	
Q_55	.2800	-.0033	
Q_60	.3944	-.0045	
Q_65	.3975	-.0035	

Table 11: Generated and SRS (2001-05) Life Tables of the major states:

Himachal Pradesh (2001-05) (Generated from SRS life tables of Himachal Pradesh)

age	Generated						SRS	
	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.05414	5414	96080	6680000	66.80	0.05081	66.8
1	94586	0.02591	2451	371710	6598628	69.76	0.03364	69.4
5	92135	0.00385	354	459674	6161162	66.87	0.00374	67.8
10	91781	0.00124	114	453705	5700289	62.11	0.00160	63.0
15	91667	0.00454	416	457207	5246584	57.24	0.00454	58.1
20	91251	0.00514	469	442760	4789377	52.49	0.00578	53.3
25	90782	0.00738	670	439632	4346617	47.88	0.00683	48.6
30	90112	0.00866	780	439975	3906984	43.36	0.01025	44.0
35	89331	0.01218	1088	436978	3467010	38.81	0.01312	39.4
40	88243	0.01758	1551	433529	3030032	34.34	0.01991	34.9
45	86692	0.02926	2537	432668	2596503	29.95	0.02612	30.5
50	84155	0.04034	3395	404399	2163834	25.71	0.03434	26.3
55	80761	0.06418	5183	393842	1759435	21.79	0.06256	22.1
60	75577	0.08866	6701	356566	1365593	18.07	0.08171	18.4
65	68877	0.14432	9940	316851	1009028	14.65	0.13460	14.8
70	58936	1.00000	58936	692177	692177	11.74	1.00000	11.7

Assam (2001-05) (Generated from SRS life tables of Assam)

	Generated						SRS	
age	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.07459	7459	94600	5870000	58.7	0.07981	58.7
1	92541	0.03364	3113	361757	5810914	62.79	0.04043	62.8
5	89428	0.01152	1030	444263	5460863	61.06	0.01237	61.4
10	88398	0.00411	363	423377	5028031	56.88	0.00663	57.1
15	88034	0.01058	931	447713	4604654	52.31	0.01272	52.5
20	87103	0.01178	1026	418340	4156941	47.72	0.01514	48.2
25	86077	0.01381	1189	417051	3738600	43.43	0.01563	43.9
30	84888	0.01960	1664	424167	3321550	39.13	0.01711	39.5
35	83224	0.02506	2086	416799	2897382	34.81	0.02299	35.2
40	81139	0.02339	1898	393958	2480584	30.57	0.02397	30.9
45	79241	0.04250	3368	391972	2086626	26.33	0.04365	26.6
50	75873	0.06878	5219	367751	1694654	22.34	0.06388	22.7
55	70654	0.09388	6633	335425	1326903	18.78	0.10285	19.1
60	64021	0.14162	9067	296764	991479	15.49	0.13364	16.0
65	54955	0.20472	11250	248611	694714	12.64	0.19823	13.0
70	43704	1.00000	43704	446103	446103	10.21	1.00000	10.6

Kerala (2001-05) (Generated from SRS life tables of Kerala)

age	Generated						SRS	
	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.01418	1418	98973	7390000	73.90	0.01169	73.9
1	98582	0.00590	582	392758	7267741	73.72	0.00606	73.8
5	98000	0.00177	174	489516	6847738	69.87	0.00215	70.2
10	97827	0.00120	118	484636	6359499	65.01	0.0018	65.4
15	97709	0.00343	335	490887	5874863	60.13	0.00295	60.5
20	97374	0.00430	419	481829	5383976	55.29	0.00504	55.6
25	96955	0.00663	643	485255	4902147	50.56	0.00643	50.9
30	96312	0.00837	806	494466	4416892	45.86	0.00767	46.2
35	95506	0.00906	865	460654	3922427	41.07	0.01065	41.6
40	94640	0.01189	1125	465758	3461773	36.58	0.01253	37.0
45	93515	0.01886	1763	453542	2996015	32.04	0.02045	32.4
50	91752	0.03302	3030	451105	2542473	27.71	0.03056	28.0
55	88722	0.04608	4089	421853	2091368	23.57	0.04657	23.8
60	84634	0.08454	7155	406588	1669515	19.73	0.0799	19.9
65	77479	0.11988	9288	362293	1262926	16.30	0.11748	16.4
70	68191	1.00000	68191	900633	900633	13.21	1.00000	13.2

Uttar Pradesh (2001-05) (Generated from SRS life tables of Uttar Pradesh)

age	Generated						SRS	
	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.08370	8370	93940	5980000	59.80	0.08627	59.8
1	91630	0.03356	3075	358250	5883641	64.21	0.03910	64.4
5	88555	0.01386	1227	439352	5538344	62.54	0.01025	63.0
10	87328	0.00776	678	439834	5086763	58.25	0.00658	58.6
15	86650	0.01256	1088	444358	4646929	53.63	0.00946	54.0
20	85562	0.01528	1307	430659	4202571	49.12	0.01430	49.5
25	84254	0.01826	1538	428851	3771912	44.77	0.01509	45.2
30	82716	0.01736	1436	404954	3343061	40.42	0.01878	40.8
35	81280	0.01938	1575	398370	2938107	36.15	0.02049	36.6
40	79705	0.02366	1886	393296	2539737	31.86	0.02592	32.3
45	77819	0.03302	2570	376907	2146441	27.58	0.03616	28.1
50	75249	0.04830	3635	364615	1769534	23.52	0.04693	24.0
55	71615	0.07686	5504	344431	1404919	19.62	0.07423	20.1
60	66110	0.11384	7526	310825	1060488	16.04	0.11355	16.5
65	58584	0.17934	10507	262234	749662	12.80	0.16995	13.2
70	48078	1.00000	48078	487428	487428	10.14	1.00000	10.4

West Bengal (2001-05) (Generated from SRS life tables of West Bengal)

age	Generated						SRS	
	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.04667	4667	96621	6490000	64.9	0.04346	64.9
1	95333	0.05768	5499	366194	6397226	67.1	0.05465	66.9
5	89834	0.00614	552	447618	5957808	66.32	0.00514	66.7
10	89283	0.00615	549	445794	5502296	61.63	0.00354	62
15	88734	0.00769	682	447813	5056502	56.99	0.00623	57.2
20	88051	0.00619	545	458627	4608689	52.34	0.00722	52.5
25	87506	0.00898	786	419544	4150062	47.43	0.00866	47.9
30	86721	0.00839	728	416783	3730518	43.02	0.00946	43.3
35	85993	0.01469	1263	452156	3313735	38.53	0.01218	38.7
40	84730	0.01716	1454	405189	2861579	33.77	0.01637	34.1
45	83276	0.02482	2067	401986	2456390	29.5	0.02656	29.7
50	81209	0.03869	3142	414969	2054404	25.3	0.03613	25.4
55	78067	0.07200	5621	395838	1639435	21	0.06570	21.3
60	72446	0.11101	8042	339496	1243596	17.17	0.10186	17.6
65	64404	0.16263	10474	297470	904100	14.04	0.15275	14.2
70	53930	1.00000	53930	606630	606630	11.25	1.00000	11.3

Gujarat (2001-05) (Generated from SRS life tables of Gujarat)

age	Generated						SRS	
	lx	qx	dx	Lx	Tx	e_x^0	qx	e_x^0
0	100000	0.05788	5788	95809	6390000	63.9	0.06143	63.9
1	94212	0.02223	2094	371218	6310173	66.98	0.03183	67.1
5	92118	0.00609	561	459016	5941381	64.50	0.00628	65.2
10	91557	0.00548	502	497442	5515749	60.24	0.00489	60.6
15	91055	0.00784	714	431883	5018307	55.11	0.00668	55.9
20	90341	0.00876	791	467835	4586424	50.77	0.00906	51.3
25	89550	0.01086	973	441423	4118589	45.99	0.01104	46.7
30	88577	0.01421	1258	426395	3677165	41.51	0.01321	42.2
35	87319	0.01418	1238	438879	3250770	37.23	0.01563	37.7
40	86081	0.01921	1654	415404	2811892	32.67	0.01981	33.3
45	84427	0.02915	2461	435360	2396488	28.39	0.02724	28.9
50	81966	0.04176	3423	372969	1961128	23.93	0.03840	24.6
55	78543	0.06862	5390	399642	1588159	20.22	0.06324	20.5
60	73154	0.10685	7816	339361	1188517	16.25	0.10285	16.7
65	65337	0.17385	11359	307716	849156	13.00	0.15985	13.3
70	53978	1.00000	53978	541440	541440	10.03	1.00000	10.4

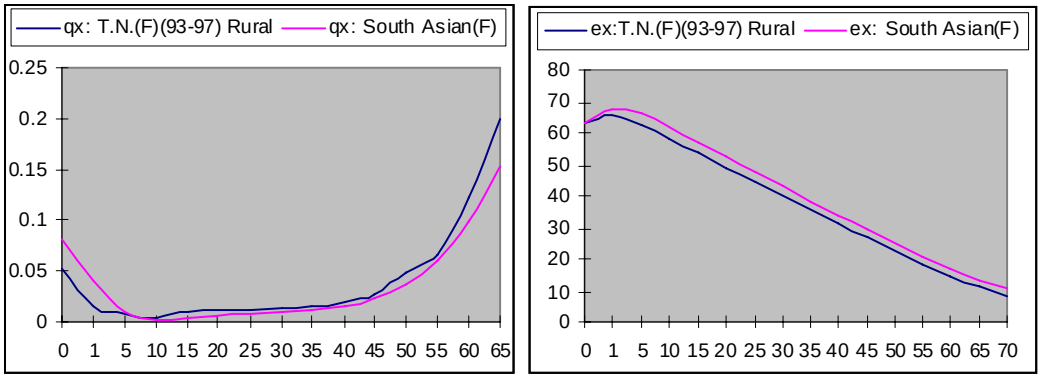

Figure 1: SRS (Female-Rural: 1993-97) and South Asian Model Life Tables (Interpolated) for Tamil Nadu (qx and ex portion):

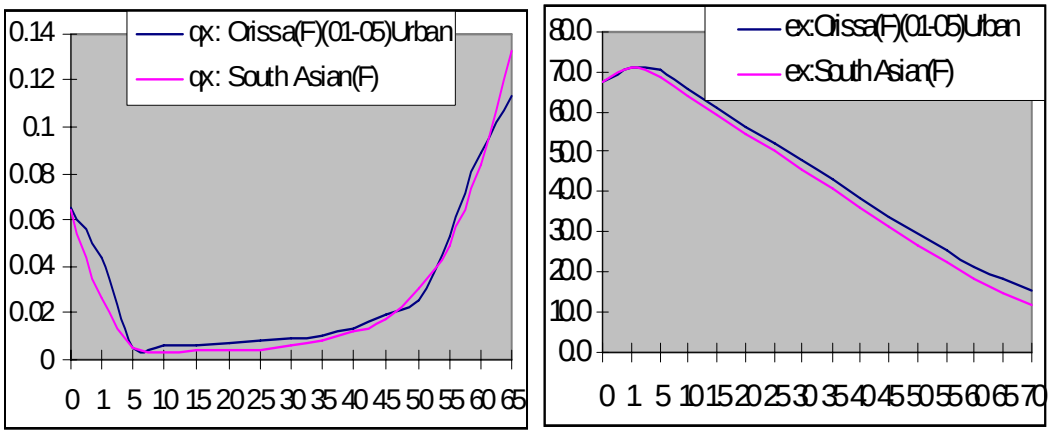

Figure 2: SRS (Female-Urban: 2001-05) and South Asian Model Life Tables (Interpolated) for Orissa:

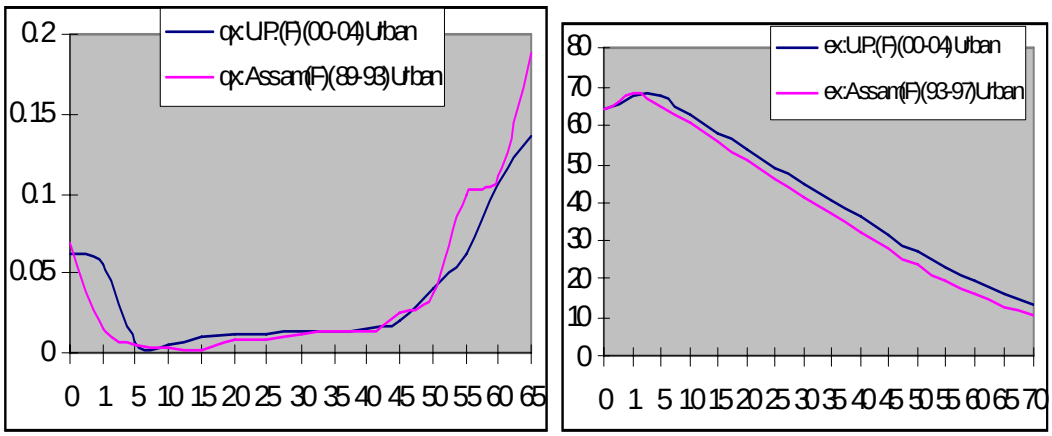

Figure 3: SRS Life Tables of U.P. (2000-04) and Assam (2001-05) for female (Urban):

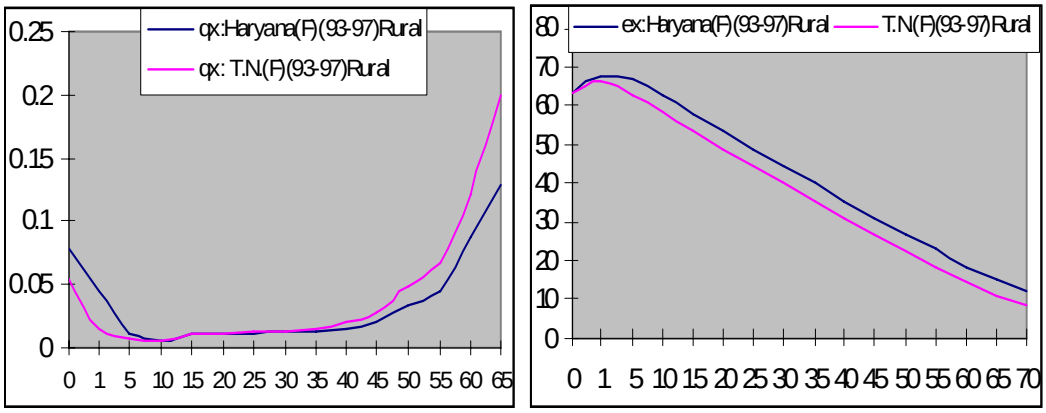

Figure 4: SRS Life Tables of Haryana and Tamil Nadu (1993-97) for Female (Rural):

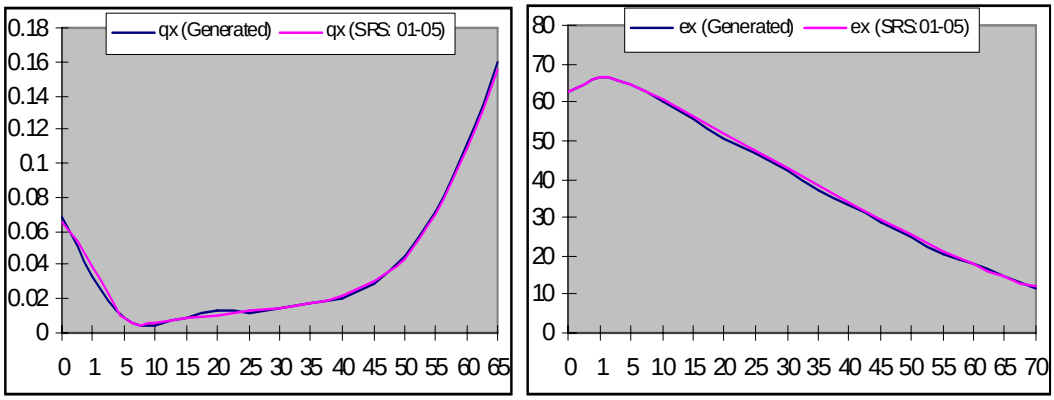

Figure 5: Generated and SRS Life Tables for India (2001-05) (Generated from SRS life tables of India) (qx and ex portion):

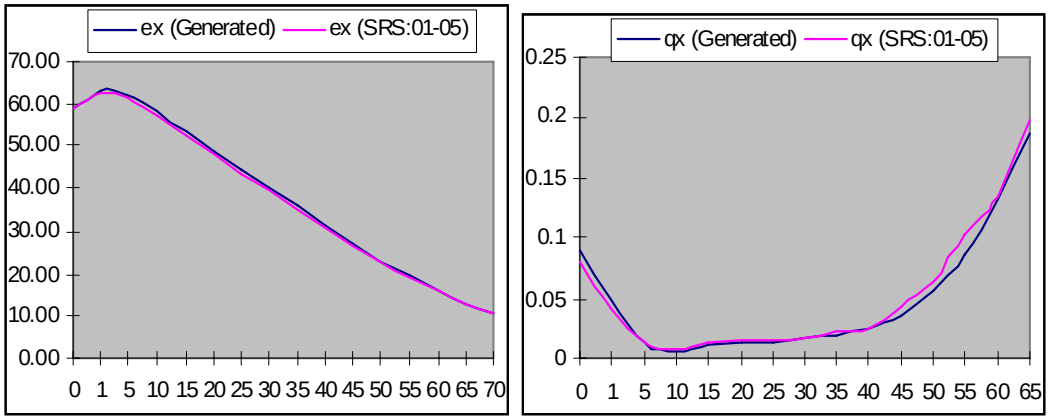

Figure 6: Generated and SRS Life Tables for Assam (2001-05) (Generated from SRS life tables of India) (qx and ex portion):

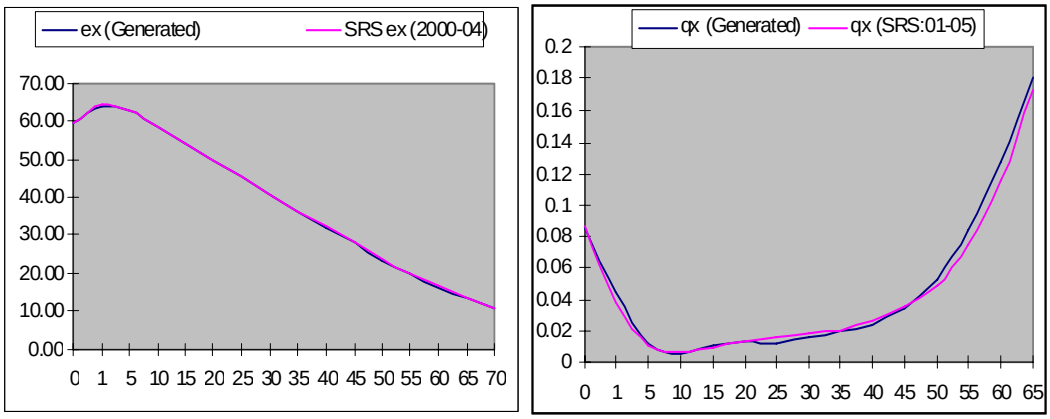

Figure 7: Generated and SRS Life Tables for Uttar Pradesh (2000-04) (Generated from SRS life tables of India) (qx and ex portion):

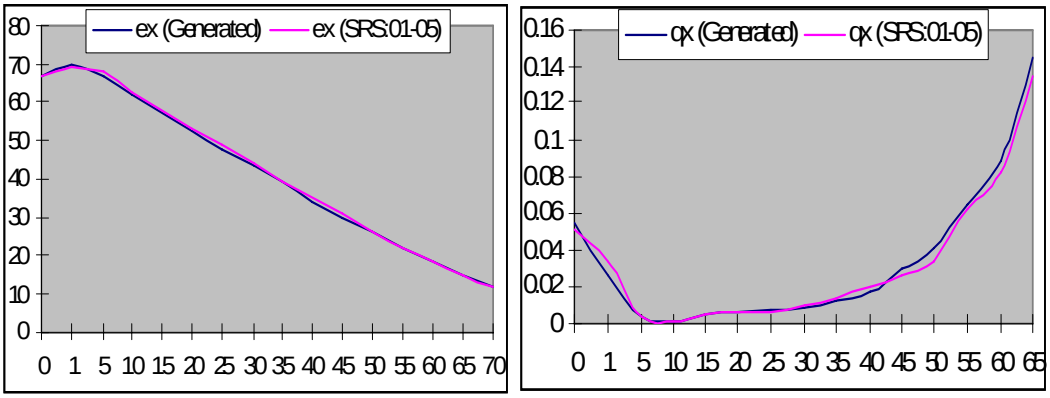

Figure 8(1): qx and ex portion of the Life Table of Himachal Pradesh (2001-05) (Generated from SRS life tables of Himachal Pradesh):

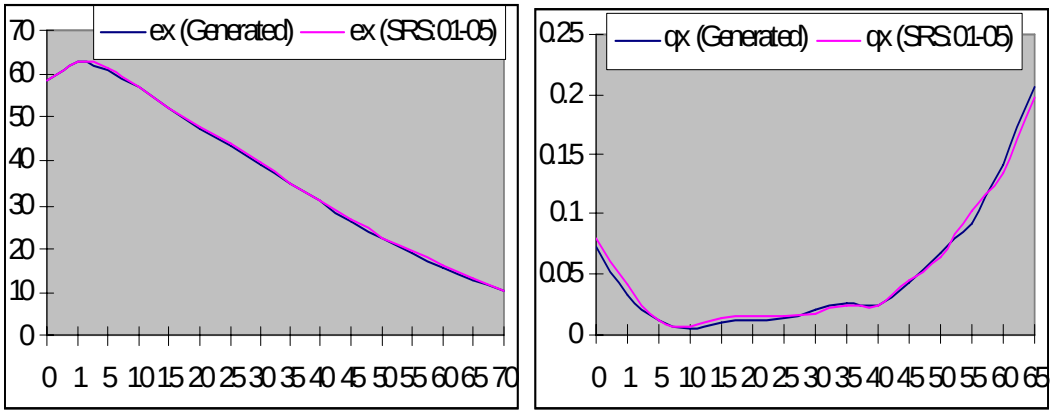

Figure 8(2): qx and ex portion of the Life Table of Assam (2001-05) (Generated from SRS life tables of Assam):

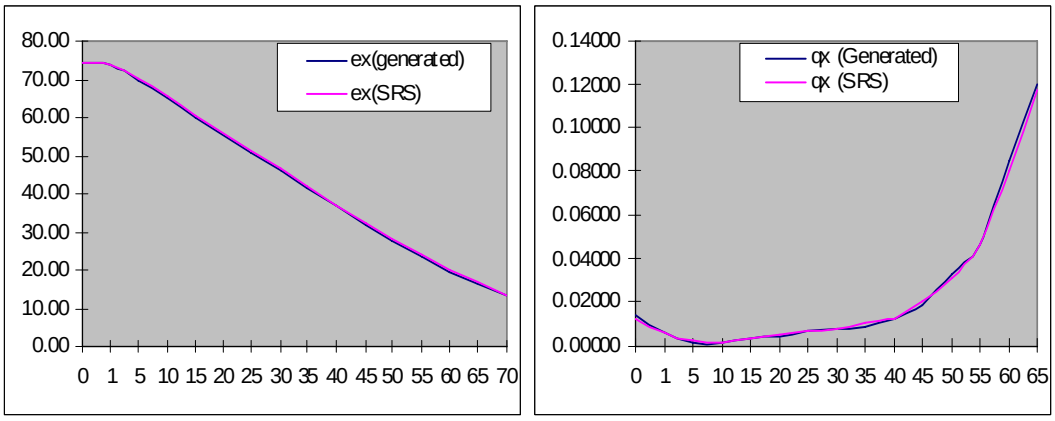

Figure 8(3): qx and ex portion of the Life Table of Kerala (2001-05) (Generated from SRS life tables of Kerala):

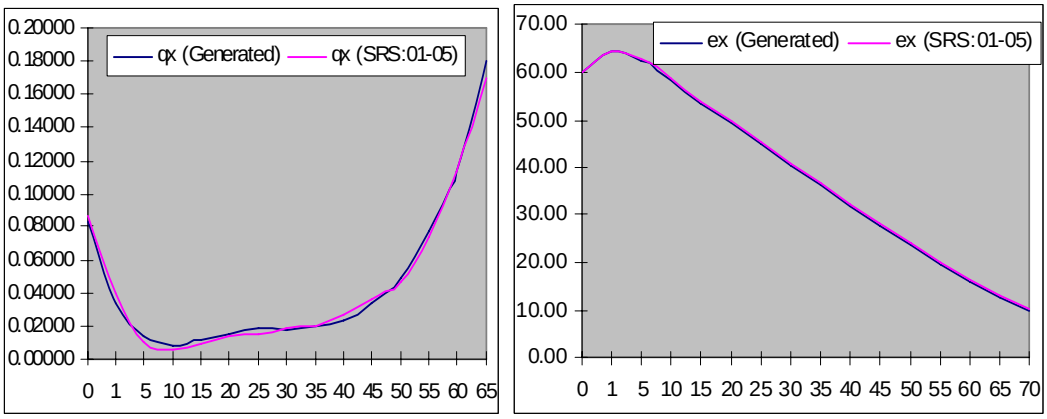

Figure 8(4): qx and ex portion of the Life Table of Uttar Pradesh (2001-05) (Generated from SRS life tables of Uttar Pradesh):

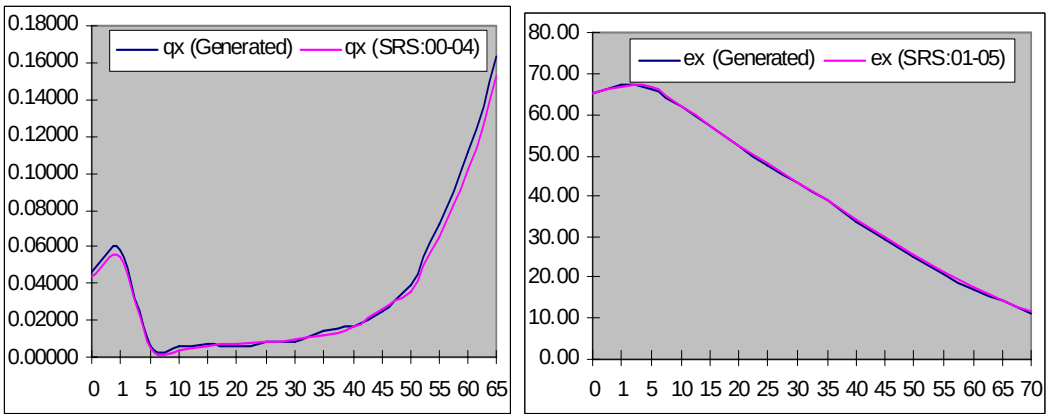

Figure 8(5): qx and ex portion of the Life Table of West Bengal (2001-05) (Generated from SRS life tables of West Bengal):

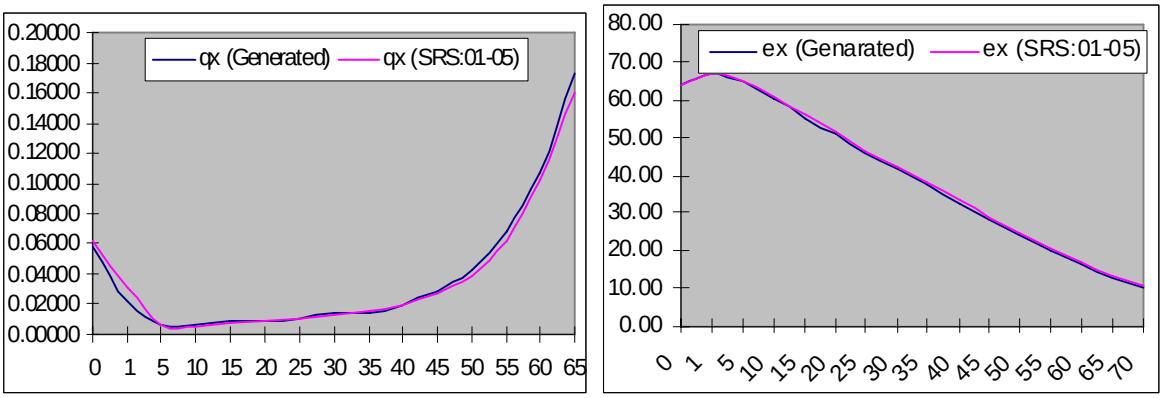

Figure 8(6): qx and ex portion of the Life Table of Gujarat (2001-05) (Generated from SRS life tables of Gujarat):

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