Estimation of TFR, GRR, NRR, MAC, MLG and RSR of Bangladesh

M. Rafiqul Islam

Dept. of Population Science and Human Resource Development, Rajshahi University, Bangladesh

Abstract   The purpose of this study is to estimate TFR, GRR, NRR, MAC, MLG and RSR of Bangladesh and observe their trends during the period 1961-1991 at the census years. For this, the secondary data on age specific fertility rates (ASFRs) at the Census years 1961, 1974, 1981 and 1991 have been taken from (Islam, 2003). In this study, total fertility rate (TFR), gross reproduction rate (GRR), net reproduction rate (NRR), reproduction survival ratio (RSR), mean age of childbearing (MAC) and mean length of generation (MLG) of Bangladesh have been estimated. It is found that all fertility schedules show the traditional (reciprocal of V-shape) pattern. It is observed that TFR, GRR, NRR exhibit increasing trend during 1961-1974 and declining trend during 1974-1991. Moreover, MAC, MLG and RSR have been showing monotonically increasing trend over time.

Keywords   Age Specific Fertility Rates (ASFRs), Linear Interpolation, Life Expectancy at Birth

1. Introduction

Total fertility rate (TFR), gross reproduction rate (GRR), net reproduction rate (NRR), reproduction survival ratio (RSR), mean age of childbearing (MAC) and mean length of generation (MLG) are actually the measures of reproductivity. These reproduction rates have been computed only from current vital statistics or any indirect technique. For this, it is to be thought that the fertility of women in, say, 30 or 35 successive years of age in the reproductive span in a single calendar year could be combined to approximate the fertility and reproductivity of a real cohort of women passing through the reproductive span (15-49 years in Bangladesh) of life. The measures of reproductivity can be used to assess the fertility behaviors of an area. Therefore, the main aims and objectives of this study are as follows:

i) to study the trend and pattern of age specific fertility schedules, and

ii) to estimate the various measures of reproductivity and observe their trends.

2. Sources of Data

A secondary data on ASFRs of Bangladesh at the Census years 1961, 1974, 1981 and 1991 have been taken from[4] which is shown in Table 1.

* Corresponding author:
rafique_pops@yahoo.com (M. Rafiqul Islam)
Published online at http://journal.sapub.org/ijas

Table 1.   The ASFRs of Bangladesh in the Census Years 1961, 1974, 1981 and 1991

Age Group in Years	ASFRs			
	1961	**1974**	**1981**	**1991**
15-19	0.131385	0.132824	0.119225	0.058075
20-24	0.288695	0.308664	0.286265	0.153931
25-29	0.35409	0.414449	0.388549	0.220901
30-34	0.269555	0.327574	0.309873	0.184026
35-39	0.16588	0.209014	0.198513	0.120122
40-44	0.05423	0.076145	0.074444	0.050994
45-49	0.011165	0.015331	0.015131	0.010751

3. Methodology

3.1. Total Fertility Rate (TFR)

It has been estimated using the traditional formula of

$$\text{TFR} = 5 \sum_{a=15-19}^{45-49} \text{ASFR}_a$$

under usual assumptions from the above secondary data which can be approximated by

$$\text{TFR} = \int_{a=15}^{49} f(a)\, da$$

3.2. Gross Reproduction Rate (GRR)

GRR is enumerated using the formula

$$GRR = \frac{B^F}{B^T} \int_{a=15}^{49} f(a)\, da$$

which can be approximated as

$$GRR = 5 \frac{B^F}{B^T} \sum_{a=15-19}^{45-49} f_a$$

where $\frac{B^F}{B^T}$ is the proportion of all births which are female and f_a is the ASFRs at the age group 'a to a +5' in the reproductive ages. To estimate GRR, the sex ratio at birth is assumed to be 1.05 as developing country like Bangladesh[8].

3.3. Net Reproduction Rate (NRR)

NRR is estimated using the formula

$$NRR = \frac{B^F}{B^T} \int_{a=15}^{49} p(a)\ f(a)\ da \quad [5]$$

which can be approximately estimated as

$$NRR = 5 \frac{B^F}{B^T} \sum_{a=15-19}^{45-49} p(a)\ f_a$$

where f_a is the ASFRs at age 'a' or age group 'a to a+5' and p(a) is the probability of surviving from birth to age a.

It is to be noted that to select life table female stationary population for the Census years 1961, 1974, 1981 and 1991, the e_x^0 values for the corresponding years have been taken from the Statistical Year Book of Bangladesh of 1986, 1998 and 1999. South Asian Model life tables have been chosen from United Nation's Model Life Tables for Developing Countries[9]. It should be mentioned here that linear interpolation technique[10] has also been applied to estimate female stationary population for the years 1961, 1974, 1981 and 1991 for the corresponding life expectancy at birth.

3.4. The Mean Age of Childbearing (MAC)

It can be expressed as

$$MAC = \frac{\int_{a=15}^{49} a\ f(a)\ da}{\int_{a=15}^{49} f(a)\ da}$$

which can be approximately estimated by

$$\overline{m} = \frac{\sum_{a=15-19}^{45-49} a\ f_a}{\sum_{a=15-19}^{45-49} f_a}$$

where 'a' represents the mid-point of each age group 'a to a+5' in the reproductive span of life and f_a represents an ASFR in the same age group . It should be noted that in the population of high fertility, the mean age of childbearing is

usually high. On the other hand, in low fertility population the mean age of childbearing is lower[6].

3.5. The Mean Length of Generation (MLG)

MLG is defined as the mean age of mothers at the birth of their daughters. MLG has been approximately estimated applying the formula

$$MLG = \frac{\int_{a=15}^{49} x\ p(x)\ f(x)\ dx}{\int_{a=15}^{49} p(x)\ f(x)\ dx} \quad [7]$$

where p(x) is the probability of surviving from birth to age x and f(x) is the number of live female births to each woman of age x.

3.6. Reproduction Survival Ratio (RSR)

It has been approximately estimated using the formula

$$RSR = \frac{\int_{a=15}^{49} p(a)\ f(a)\ da}{\int_{a=15}^{49} f(a)\ da} \quad [5]$$

where f(a) is the ASFRs in the age group 'a to a+5' and p(a) is the probability of surviving from birth to age group 'a to a+5'. The RSR is the proportion of potential reproductivity that survives the effects of mortality.

4. Results and Discussion

To see the trend and pattern of fertility schedules, the data have been plotted in graph paper shown in Figure 1. From the figure, it is observed that all fertility schedules show the traditional (reciprocal of V-shape) pattern. It can also be observed that with passing of time the peaks of the curves are showing declining trend of fertility during 1961-1991 excepting 1961. That is, ASFRs in 1974 is higher than that of 1961 at each age in the reproductive age group. Then, ASFRs at each age strictly started to decrease during 1974-1981 slowly where as it rapidly commenced to decrease during 1981 census to 1991 census. It is observed that all these curves are unimodal. It is also found that the highest ASFRs in the age group 25-29 years were 354, 415, 389 and 221 per thousand for the years 1961, 1974, 1981 and 1991 respectively where as corresponding lowest ASFRs are 11, 15, 15, 10 in the last age group of the reproductive life respectively. From the above observations, it is found that the age interval 25-29 years is the most fertile period and the age interval 45-49 years is the least fertile period in the reproductive ages of women of Bangladesh.
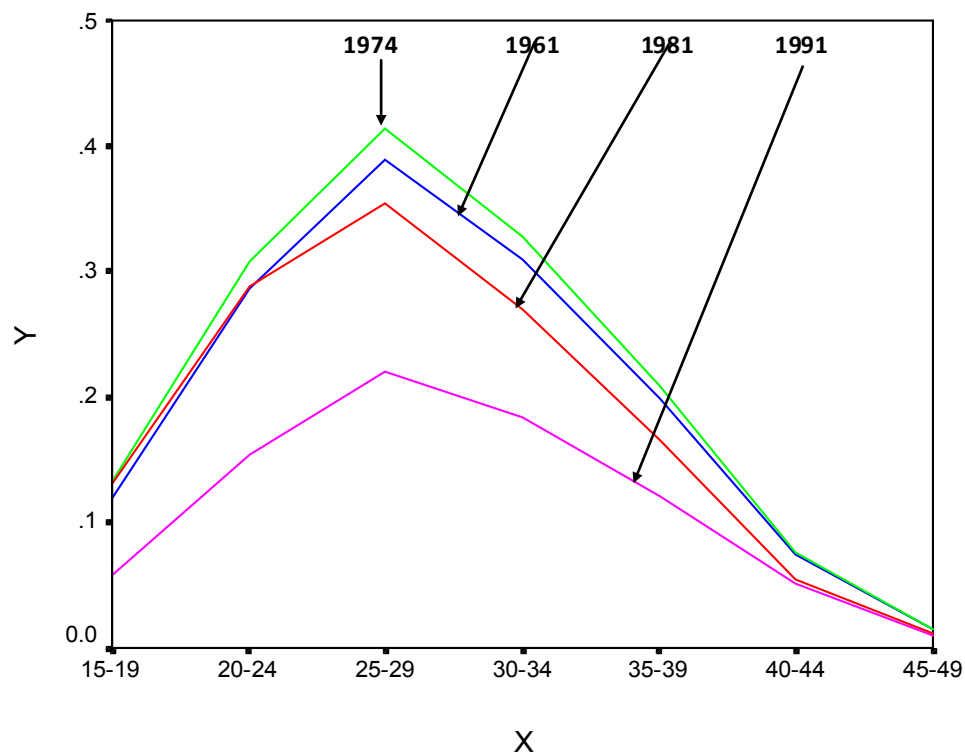
Figure 1. The ASFRs of Bangladesh in the Census Years 1961, 1974, 1981 and 1991. X: Age Group in Years and Y: ASFRs

The TFR, GRR and NRR have been estimated and presented in Table 2. To see the trends of them from the table, it is observed that they were increasing in the interval 1961 to 1974 years but they were decreasing in the interval 1974 to 1991 years. The rate of increment of TFR during the intercensal period 1961 to 1974 was 16.14% which was faster but it decreased at a speed at 6.07% during 1974-1981 and it rapidly decreased at a greater speed at 42.67% during 1981-1991 which was more faster than the previous intercensal period. The rate of increment of GRR during 1961-1974 was 16.08% which was faster but it started to decrease at a slower speed at 6.09% during 1974-1981 and at a greater speed at 42.77% during 1981-1991. The NRR increased at a larger rate of 17.82% during 1961 to 1991 but it started to decrease at a slower rate of 5.88% during 1974-1981 and at a greater rate of 32.14% during 1981 to 1991.

The 4th column of Table 2 indicates MAC of Bangladesh during 1961 to 1991. From the table, it is observed that MAC is increasing in the whole intercensal period. The rate of increment of MAC were 2.00%, 0.31% and 2.13% during the intercensal periods 1961-1974, 1974-1981 and 1981-1991, respectively. And, the fifth column of Table 2 indicates MLG of Bangladesh during 1961-1991. From this table, it is seen that MLG was increasing in the whole intercensal period 1961 to 1991. The rate of increment of MLG were 2.16%, 0.52% and 2.24% during the intercensal periods 1961-1974, 1974-1981 and 1981-1991, respectively.

The RSR has been estimated and presented in Table 2. From the table it is observed that RSR was increasing trend during 1961-1991. The rate of increment of RSR were 1.54%, 1.52% and 16.42% during the intercensal periods 1961-1974, 1974-1981 and 1981-1991 respectively in which the rate of increment during 1981-1991 was a greater speed than other inter-censual periods.

Table 2.   The TFR, GRR, NRR, MAC, MLG and RSR of Bangladesh in the Census Years 1961, 1974, 1981 and 1991

Census Years	TFR	GRR	NRR	MAC	MLG	RSR
1961	6.38	3.11	2.02	28.51	28.23	65
1974	7.41	3.61	2.38	29.08	28.84	66
1981	6.96	3.39	2.24	29.17	28.99	67
1991	3.99	1.94	1.52	29.79	29.64	78

5. Conclusions

In this study, ASFRs at the Census years 1961, 1974, 1981 and 1991 of Bangladesh show the traditional (reciprocal of V-shape) pattern and declining trend over time excepting 1961 census. The parameters TFR, GRR, NRR of reproductivity have been gradually increasing during 1961-1974 but decreasing during 1974-1991. Moreover, MAC, MLG and RSR have been monotonically increasing during the study period.

REFERENCES

[1]   BBS (1986). Statistical Year Book of Bangladesh 1986.

[2] BBS (1999). Statistical Year Book of Bangladesh 1998.

[3] BBS (2001). Statistical Year Book of Bangladesh 1999.

[4] Islam, Md. Rafiqul (2003). Modeling of Demographic Parameters of Bangladesh-An Empirical Forecasting, Unpublished Ph.D. Thesis, Rajshahi University.

[5] Keyfitz, N (1968). Introduction to the Mathematics of Population, Addison Wesley Publishing Company, Reading, Massachusetts.

[6] Misra, B. D (1995). An Introduction to the Study of Population, Second Edition, South Asian Publishers Pvt. Ltd., New Delhi.

[7] Shryock, H.S. and Siegel J.S. and Associates (1975). The Methods and Materials of Demography, Vol. II, U.S. Government Printing Office, Washington.

[8] United Nations (1967). Manual IV, Methods of Estimating Basic Demographic Measures from Incomplete Data, Department of Economic and Social Affairs, Population Studies, No. 42, New York.

[9] United Nations (1982). Model Life Tables for Developing Countries, Department of International Economic and Social Affairs, Population Studies, No.77.

[10] United Nations (1983). Manual X, Indirect Techniques for Demographic Estimation, Department of International Economic and Social Affairs, Population Studies, No.81.