Declining Trend of Fertility Change: A Parity Progression Ratio Approach

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INTRODUCTION

The estimation of trends of parity progression ratios (PPR here after) obtained in birth history surveys has recently become more important. PPR, the proportion of women with an i^{th} births who continue to an $(i+1)^{th}$ birth during their lifetime is a sensitive indicator of changes in family-building process which follow the adoption of contraception. They are much less affected than the traditional aggregate measures of total fertility by changes in proximate determinants, such as age at marriage, birth intervals or sterility.

Henery (1953) first introduced the concept of PPR as a useful measure of fertility. Later, a number of researchers proposed methodologies to estimate parity progression ratio and instantaneous parity progression ratio (IPPR) mainly utilizing the data on open and closed birth intervals (Srinivasan 1967a, 1967b. 1968, Feeney 1983, Feeney and Ross 1984, Yadava and Bhattacharya 1985, Yadava & Saxena 1989, Yadava and Saxena, 1989, Islam and Yadava, 1997 etc.).

Recently, Blacker et al. (1989), have elucidated a technique to estimate PPR from the data on births in a given year tabulated by birth order and age of mother. This procedure needs, besides other information, the estimate of mean reproduction rate, which is approximated by the product of gross reproduction rate (GRR) and infant mortality rate. Yadava & Srivastava (1993) suggested an alternative methodology to that of Blacker et al (1989). To obtain PPR which does not need estimate of gross reproduction rate as well as the infant mortality rate but it requires knowledge of the growth rate of the population. The authors have also seen the applicability of the technique on the data given in Blacker et al (1989). The procedure suggested by Yadava and Srivastava (1993) needs some logical modification. Latter Yadava et. al. (2006) have explained the shortcomings and gave a simple procedure which requires growth rate and i^{th} order closed birth interval. For application purpose they have taken the value of closed birth interval as 3 years for all the parities.

The objective of this paper is to obtain an alternative procedure for estimating PPR after using some approximations in procedure given by Blacker et al. (1989). The proposed

procedure is almost same as procedure given by Yadava and Srivastava (1993) and Yadava et. al. (2006).

A BRIEF DISCUSSION OF DIFFERENT PROCEDURES

To estimate Parity Progression Ratios, a formula to compute weighted number of i^{th} order births has been given by Blacker et. al. which is given below

$$F_i = B_i (G.l_1)^{k_i}$$

where F_i is weighted number of births at i^{th} order, B_i is reported number of births at i^{th} order, G is the gross reproduction rate and l_1 is survivors at age 1 such that (1- l_1) is the infant mortality. k_i is the relative difference in age of mothers at different order so that

$$k_i = \frac{(M_{i+1} - M_1)}{M} \quad , \qquad i = 1,2,3.....$$

Here M is the mean age of mothers at all births and M_1 is the mean age of mothers at 1^{st} order birth. M_{i+1} is the mean age of mothers at $(i+1)^{th}$ order births.

According to the Blacker et. al. $(G.l_1)^{k_i}$ is the correction factor and he obtained PPR as follows

$$PPR = \frac{F_{i+1}}{F_i}$$

The procedure suggested by Yadava and Srivastava (1993) to obtain the adjusted number $(i+1)^{th}$ order birth is as follows

$$B`_{i+1} = B_{i+1} + B_i (M_{i+1} - M_i)\, r$$

where M_i and M_{i+1} are the average ages of mothers at i^{th} and $(i+1)^{th}$ births and 'r' is the growth rate of population. $B`_{i+1}$ is the adjusted figure for $B_{i+1}$ accounting for the variation in the number of females. They proposed that $B`_{i+1} / B_i$ gives an estimate of PPR for parity i.

The suggested adjustment is based on some heuristic reasoning and lack sound proof for the same. In fact the adjustment factor itself needs some logical change. Yadava et. al. have modified $B`_{i+1}$ as

$$B^*_{i+1} = B_{i+1} / (1 - rC_i) \approx B_{i+1} (1 + rC_i)$$

Where r is the growth rate of population and C_i is i^{th} order closed birth interval and it was suggested that it is equal to 3 years for all the parities for application purpose. The obtained estimate of PPR for parity i as B^*_{i+1} / B_i .

PROPOSED PROCEDURE

For simplification purpose if we assume that l_1 is same for all reproductive intervals then the correction factor given by Blacker et. al. will become

$$(G.l_1)^{k_i} = (NRR)^{k_i}$$

Further we know that $NRR = e^{rM}$ for the stable population. Here *r* is the growth rate and *M* is the mean age of mothers at all births so that

$$(NRR)^{k_i} = \{e^{rM}\}^{\left(\frac{M_{i+1}-M_1}{M}\right)}$$

$$\Rightarrow (NRR)^{k_i} = e^{r.(M_{i+1}-M_1)}$$

Hence the weighted number of ith order births will become

$$F_i = B_i.e^{r.(M_{i+1}-M_1)}$$

in this proposed procedure we need only growth rate instead of *G* the gross reproduction rate and l_1 the survivors at age 1 or infant mortality required in the procedure given by Blacker et. al. Finally we calculate the PPR by the following formula

$$PPR = \frac{F_{i+1}}{F_i} = \frac{B_{i+1}}{B_i}\left[\frac{e^{r(M_{i+2}-M_1)}}{e^{r(M_{i+1}-M_1)}}\right] = \frac{B_{i+1}}{B_i}\left[e^{r(M_{i+2}-M_{i+1})}\right]$$

$(M_{i+2} - M_{i+1})$ can be approximated as C_{i+1} the closed birth interval between (i+1)th and (i+2)th order births. To check the suitability of the proposed procedure we have used the published data in Blacker et. al. and found a very good approximation of the procedure given by Blacker et. al. Further we have obtained the PPR for Uttar Pradesh and India for all the three set of NFHS data to know the pattern of change of fertility and sterility.

APPLICATION

The proposed procedure is applied to the data on birth order obtained in the three set of NFHS dada i.e. NFHS I, NFHS II and NFHS III. The proposed procedure requires information on mean ages of females at various orders of birth along with the value of growth rate r. The value of r may be taken as the rate of natural increase which is easily obtained by subtracting crude death rate from crude birth rate.

The total fertility rate of any population considering only the married females can be estimated with the help of PPR's as follows

TFR= P1 + P1 P2 + P1 P2 P3 + ……

RESULTS AND DISCUSSIONS

The fertility is declined but it is more than two. The PPR show that it is declined after parity two means society still believe in two child norm.