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Fertility and Its Proximate Determinants of Bangladesh

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***Abstract*— The study of determinants of fertility in a population is a complex process. While fertility behaviour influences population growth, which has consequences towards pressure on resources, employment situations, health and other social facilities, and saving and investment, such consequences, in turn, have great bearing on the socio-economic variables that affect fertility behaviour. The issues are further complicated because the factors that are perceived to influence fertility are highly interrelated. The conceptualization of the determinants of fertility involves a multitude of factors that vary greatly in the intensity and direction of force they exert on fertility. The study of the relationship of fertility levels to specific economic, social and cultural variables in the low as well as high fertility countries has "led to the hypothesis that for the most part the same factors which are thought to account for the decline of fertility in the low fertility countries are, in a reverse sense, also responsible for the continued high levels of fertility in the high fertility group" (UN, 1973).**

***Index Terms*— Fertility, Proximate, Determinant, Bangladesh, Population, Behaviour.**

I. INTRODUCTION

The determinants of fertility may be grouped into two: proximate determinants and socio-economic determinants. Proximate determinants are those that have a direct on fertility. Davis and Blake's (1956) framework of intermediate variables and later on Bongaart's model provides a systematic scheme for studying the proximate determinants of fertility which are analyzed in this study. Other determinants (socio-economic determinants) cannot directly influence fertility but must act on fertility through their effect on one or more of the proximate determinants.

There has been a growing interest in quantifying the changes in fertility in Bangladesh in the recent past. Application of Bongaart's model for identification of change in terms of proximate variables seems to be rewarding on many occasions. The model is necessarily multiplicative in nature and requires data, among others, on proportion married, extent of use effectiveness of contraception, Prevalence of induced abortion and lactational infecundability. In this study, an attempt is made to assess the above parameters of fertility change and their contraception thereof, with recourse to Bongaart's model for proximate determinants of fertility. The special interest of this section is

to study the contribution of the index of proportion married on the decline of fertility. The model is discussed briefly here.

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II. THE MODEL

In this model Bongaart's (1978) expressed TFR as the product of four indices measuring the fertility inhibiting effect of these four indices and the total fecundity (TF). The total fecundity rate is the average number of live births expected among women who during their reproductive period, remain married, do not use contraception, do not have any induced abortion and do not breastfeed their children (Bongaart's, 1982). Under Bongaart's framework four proximate determinants (indicated below) seen to be the most important and useful in general, to represent TFR. According to Bongaart's model, the total fertility rate (TFR) can be written as

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \qquad (1)$$

Where C_m is the index of proportion married, C_c is the index of non-contraception, C_a is the index of induced abortion and C_i is the index of lactational infecundability. Each index indicates the extent to which fertility reduced from maximal level (i.e. TF=15.3) by the specific proximate determinants. The indices can only take the values between 0 and 1. If there is no fertility inhibiting effect of a given intermediate fertility variables, the corresponding index equals 1; if the fertility inhibiting is complete, the index is 0. The estimation procedure of the indices of intermediate fertility variables are as follows:

Index of proportion married (C_m)

The index of proportion married is estimated by the equation

$$Cm = \frac{\sum m(a).g(a)}{\sum g(a)} \qquad (2)$$

Where m(a) is the age specific proportion of females currently married and g(a) is the age specific marital fertility rate. Equation (2) can also be written as

$$C_m = \frac{TFR}{TM}$$ so that TFR = $C_m \times TM$ (3)

The index C_m gives the proportion by which TFR is smaller than TM, as the result of non-marriage, C_m=0, if no body is married and C_m=1, if all women are married during the entire reproductive period. Here TM = $\sum g(a)$ = total marital fertility rate, equal to the number of births a women would have at the end of the reproductive years if she were to bear children at prevailing age specific marital fertility rates and to remain married during the entire reproductive period (based on the fertility of married women 15-19). If C_m=1, than TFR = TM and hence the difference between TM and TFR are accounted for by the effects of the marriage.

Index of Non-contraception (C_c)

To estimate the effect of contraception on marital fertility, the following equation expresses marital fertility as the interaction of contraceptive practice and natural fertility

$$TM = C_c \times TNM \qquad (4)$$

Where TNM is the total natural marital fertility rate which is equal to TM in the absence of contraception and induced abortion. Equation (4) simply states that TM is smaller than TNM by a proportion C_c, with the value of C_c depending on the prevalence of contraception, that is the extent of use effectiveness of contraception(induced abortion is assumed absent for the moment). When no contraception is practiced, C_c = 1 and when all non-sterile women in the reproductive years are protected by 100 percent effective contraception, C_c = 0 and then TM = 0. If all couples who practice contraception are assumed non-sterile, the index C_c can be written as

$$C_c = 1\text{-}s \times u \times e \qquad (5)$$

Where u is the average proportion of married women currently using contraception (average of age specific use rate), e is the average contraceptive effectiveness and a value for s = 1.08 obtained by Henry (1961) is likely to provide a good approximation for many countries (Bongaart's 1978). To relate the index of contraception to the total fertility rate, equation (4) is substituted in equation (3) and becomes

$$TFR = C_m \times C_c \times TNM \qquad (6)$$

This equation gives the total fertility rate from the natural marital fertility rate by taking into account the fertility reducing impact of contraception and marriage measured by the index of C_c and C_m respectively.

Index of Induced Abortion (C_a)

Although reliable measurements of the prevalence of induced abortion is practiced in many societies, even in cases where good estimates are available, it has proven difficult to determine the reduction in fertility that is associated with the practice of induced abortion. Estimates of the number of births averted by induced abortion are largely based on numerical exercises using mathematical reproductive models. The most detailed studies of this topic have been made Potter (1976), whose work has demonstrated the following:

In the absence of contraception, an induced abortion averts about 0.4 births, while about 0.8 births are averts when moderately effective contraceptive is practiced. To generalize from these finding the births averted per induced abortion b, may be estimated with the following equation

$$b = 0.4\,(1 + u) \qquad (7)$$

A convenient overall measure of the incidence of induced abortion is provided by the total abortion rate (TA), equal to the average number of induced abortions per women at the end of the reproductive period, if induced abortion rates remain at prevailing levels through the reproductive period (excluding induced abortions to women who are not married). The reduction in fertility associated with a given level of total abortion rate is calculated as

$$A = b \times TA = 0.4\,(1 + u) \times TA$$

Where A equals the average number of births averted per women by the end of the reproductive years. The index of induced abortion is defined as the ratio of the observed total fertility rate (TFR), to the estimated total fertility rate without induced abortion, TFR+A.

i.e. $$C_a = \frac{TFR}{TFR + A} \qquad (8)$$

The index C_a equals the proportion by which fertility is reduced as the consequence of the practice of induced abortion (Note that C_a declines with increasing incidence of induced abortion). Modifying equation (6) accordingly, the relationship between TFR and TNM becomes

$$TFR = C_m \times C_c \times C_a \times TNM \qquad (9)$$

Index of lactational Infecundability (C_i)

In modern western population lactation is generally short and many women do not lactate at all. In traditional societies in Africa, Latin America and Asia, lactation is usually long and lasts unit the next pregnancy occurs. Lactation has an inhibiting effect on fertility and thus increases the birth interval and reduces natural fertility (Potter, 1965). A typical average birth interval with lactation can be estimated to be 18.5 months. The ratio of the average birth intervals without and with lactation is given by

$$C_i = \frac{20}{18.5 + i} \qquad (10)$$

Where i is the average duration (in months) of infecundability from birth to the first post-partum ovulation (menses).

An indirect estimate of i as developed by Bongaart's is given by

$$i = 1.753\exp(0.1396B\text{-}0.001872B)$$

Where B is the duration of breastfeeding. The relationship between lactation and the total natural marital fertility rate becomes

$$TNM = C_i \times TF$$

Where TF is the total fecundity rate equal to the natural marital fertility rate in the absence of lactation. Then the model is represented including lactational infecundability as

$$TFR = C_m \times C_c \times C_a \times C_i \times TF$$

The Estimated Proximate Variables and Implications

On the basis of Bongaart's model given in equation 1, the estimated values of the measures and indices are presented in Table 1.

Table 1: Estimates of different reproductive measures and indices of fertility

Measures/indices	2007
TFR	2.515
TM	2.608
TNM	8.094
TF	15.30
C_m	0.965
C_c	0.322
C_a	1.000
C_i	0.529

From this table we observed that, the value of C_m is 0.965, indicating that the proportion of women married reduces fertility by 3.5%, the value C_c is 0.322 indicating that the index of contraception reduces fertility by 67.8% and the index C_i indicates that the average estimated effect is very strong for the reduction in fertility by 47.1%.

Now from BDHS 2007 we know that the Total Fertility Rate (TFR) for age group (15-49) is 2.7. But the adolescent women in Bangladesh (15-19) the estimated Total Fertility Rate (TFR) is 2.515. So we can say that the fertility for the age group (15-19) is much higher than the age group (20-49). It may implies that because we want to achieve the replacement level fertility, we should more use contraceptive at the adolescent age so that the adolescent fertility has been decreased and hence we achieve at the replacement level fertility.

III. Association between CPR and ASFR:

To study the association between ASFR and CPR of age 15-19 we compute the correlation coefficient and fit a linear regression equation.

Table 2: Table for calculation ASFR and CPR for the age 15-19.

Age	ASFR	CPR	Correlation between ASFR and CPR
15	0.275	26.81	
16	0.389	30.27	r = -0.374
17	0.527	28.46	
18	0.620	31.78	
19	0.704	19.57	

From the table we observed that, there is a negative correlation between ASFR and CPR, which is expected.

Now, we want to fit a liner regression between the Dependent variable ASFR and the Independent variable CPR, we have the equation

ASFR = 0.876 – 0.014 CPR

From the above equation, we say that per unit change of CPR there is 0.014 unit decrease in ASFR.

Table 3: Table for calculation ASFR and CPR for the age 15-49.

Age	ASFR	CPR	Correlation between ASFR and CPR
15-19	0.126	41.8	
20-24	0.173	52.4	
25-29	0.126	60.9	
30-34	0.07	65.1	r = -0.028
35-39	0.034	66.5	
40-44	0.01	55.3	
45-49	0.001	40.9	

From the table we observed that, there is a negative correlation between ASFR and CPR.

Now, we want to fit a liner regression between the Dependent variable ASFR and the Independent variable CPR, we have

ASFR = 0.087 – 0.0013 CPR

From the above equation, we say that per unit change of CPR there is 0.0013 unit decrease in ASFR.

Conclusion

The demographic process of fertility regulation is influenced by biological, cultural, economic, geographic, political and societal factors. These factors affect this process directly and indirectly through a web of interdependence variables. Human reproduction is complex process and is governed by biological and behavioral factors, which are themselves influenced by socio-economic and cultural factors. Daves and Blake (1956) first identified the mechanism through which socio-economic and cultural factors and human behavior interact with the biological aspects of human reproduction. In the 1980s Bongaart's identified four variables that account for most differences in fertility rates. These are proportion of currently married women; proportion of women using contraception; the proportion of women who cannot conceive a pregnancy, especially during the infertile period following child birth; and the level of abortion (Bongaart's 1982). The importance of each proximate determinant depends on cultural, economic, health and social factors within a population. For studying the differentials use of contraception among female adolescents, which are the important factors of fertility, the data are extracted from the 2007 Bangladesh Demographic and Health Survey (BDHS). According to the objectives of the study 1348 ever married female adolescents (aged 10-19) have been considered out of 10,996 respondents. The major strengths of the study are its representative ness, large sample size and comprehensive information on respondents background characteristics and contraceptive use. In this study an attempts has been made to find the differentials and to identify the factors that associated with contraceptive use. Univariate analysis was performed to analyze the background characteristics of the respondents. The bivariate analysis was done to examine the association of different socio-economic variables with contraceptive use. To reduce the large numbers of factors that associated with contraceptive use factor analysis was carried out. And then Multivariate analysis adopted to identify the socio-economic and demographic factors that associated with the performance of region in contraceptive use.

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