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Demand for a Child in Bangladesh: A Multivariate Statistical Analysis

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Abstract

In Bangladesh children are considered as an important part of standard of living as well as "poor man's capital". So in this paper an attempt is made to highlight some socio-economic and demographic factors, which are affecting the demand for a child. It is observed that for achieving the replacement level fertility the family planning program should be strengthened among the ever-married i.e., eligible women under age 30. The probability of demand for an additional child is significantly higher in Chittagong and Sylhet divisions than that in Rajshahi and Khulna divisions. It is also clearly observed that demand for an additional child is lower among working women than among housewives. Women having access to mass media specially televisions have a statistically lower probability of demand for an additional child than those without access.

Keywords and Phrases: Demand, Logistic regression, Correct classification rate.

AMS Classification: 60K10, 62J$_{XX}$, 90B06, 13C05.

1 Introduction

Reproductive behavior of parents is, in large part, a response to the underlying preferences of parents for children. Given the state of birth control technology and the various classes of uncertainty associated with contraception, infant mortality, the health and fecundity of the parents, and the income and wage rates parents expect to realize over their life cycles, these preferences are constrained by the parents' resources and the associated alternative economic opportunities in using their resources. In turn,

these resources imply sacrifices, measured in terms of opportunity costs that parents must be prepared to make in acquiring the future satisfactions and productive service they expect to realize from children.

It could, of course, be argued that parents are nevertheless indifferent to these and all other economic considerations when it comes to having children, on the grounds that children are in considerable part the unintended outcome of sexual activity, that parents in general do not engage in any practical family planning, and that the lifetime resource constraints are not known to parents with enough certainty to influence their decisions at the time they bear their children. In brief, when parents expect the "baby" with their family decision as well as with the view of their surrounding economic and social constraints, is termed as demand for a child (Schultz, 1972).

In recent years, fertility has become an important subject to inquiry of economists. The decision to have children and their number and timing involve trade-offs which constrain the purchase and consumption of durables and other household items vying for the family's scarce resources. Moreover, resources are spent on products and services used in the prevention of childbirth and in child-rearing. Both the bearing and rearing of children are costly activities; goods and services invested on children have to be purchased in the market by paying a price. In addition, the time of parents, particularly the mother's time, is an important input in childbearing and rearing, and has an opportunity cost. In return, parents derive pleasure from having their own children. This is termed as benefits or utility from children. Parents allocate their resources among various items which yield satisfaction, including the number of children, such that they derive the maximum satisfaction. This is a typical choice problem. Thus the decision to have the children can be fruitfully modeled as an outcome of optimizing household production and consumption decision-making. In this process, important determinants of the demand for a child are household income and the cost of children. Many studies in both developed and developing countries indicate that childbearing and rearing have economic consequences for families and that economic factors exert a considerable influence on a couple's reproductive decisions. Thus, when parents desire a child considering their economic framework as well as social constraints is defined as demand for a child (T. Lakshmanasamy, 1991).

2 Factors affecting the demand for a child

1. The most important among various developments in economic analysis is the investment in human capital. Investment in human capital, as we know, rests on the proposition that there are certain expenditures (sacrifices) that are made deliberately to create productive stocks, embodied in human beings, which provide services over future periods. These services consist of producer services revealed in future earnings and of consume services that accrue to the individual as satisfactions over his lifetime.

2. Children are here viewed as forms of human capital. From the point of view of the sacrifices that are made in bearing and rearing them, parents in rich countries acquire mainly future personal satisfactions from them, while in poor countries children also contribute substantially to the future real income of their parents by the work that children do in the household and on the farm and by the food and shelter they provide for their parents when they no longer are able to provide these for themselves. Children in a very important sense are the "poor man's capital". It is becoming clear that the investment in children is in many ways akin to the investment in home grown trees for their beauty and utility.

   A very young child is highly labor intensive in terms of cost and the rewards are wholly psychic in terms of utility. As a child becomes a teen-ager the additional cost borne by the parents involves less labor intensiveness and the rewards, especially in poor countries, consists in increasing part of useful work that the teen-ager performs.

3. Children are considered as an important part of the standard of living of most families in our elite society. Also most of the couples in our society expect children to preserve the successor as well as new generation. Most married couples want their own children, and they proceed to bear and rear them. What is not clear is that parents derive satisfactions and productive services from their children and that the sacrifices made by parents in bearing children and in the investment they make in the care, health and education of their children are in substantial part deliberate family decisions. (Schultz, 1972)

4. It may proceed on the postulate that parents respond to economic considerations in the children they bear and rear and that parents equate the marginal sacrifices and satisfactions including the productive services they expect from children, in arriving at the value of children to them. Thus, in thinking about the economics of fertility, social cost and benefits aside, the analytical key in determining the value of children to their parents is in the interactions between the supply and demand factors that influence these family decisions.

5. Demand for a child may also be influenced by the value of time of women as well as sufficient manpower associated with them to bear and rear the expected children. Because sound economic status, enough time and manpower is essential to grow up and establish a baby, by the availability of the above mentioned constraints, the couple may be influenced to demand for a child.

3 Objectives

1. To isolate some factors which are associated with the demand for a child.

2. To provide a basis for drawing out some policy implications and making recommendation with the aim of achieving further decline in fertility.

3. To highlight some socio-economic factors where policy makers should pay their attention to strengthen its family planning program efforts, to accelerate the rate of fertility decline to be able to achieve replacement level by the year 2005. For example, the government should attach greater priority to development in the social sector, including enhancement of women status, especially through increased female educational and employment opportunities; and through improved access to the media, such efforts, in addition to their direct benefits, would accelerate the process of fertility decline in the country.

4. To identify the income-generating projects like BRAC, Grameen Bank, BRDP, Mothers' Club etc. that have independent effect on the demand for a child as well as fertility regulation.

5. To establish a way to draw poor women out of their traditional female confinement within the households, providing opportunities for female income-generating activities; this will lead to increased contraceptive use and desire for decreased family size.

4 Data and Methodology

The study will utilize data from the 1999-2000 Bangladesh Demographic and Health Survey (BDHS) based on a nationally representative, two-stage sample that was selected from the master sample maintained by the Bangladesh Bureau of Statistics (BBS). A total of 10,268 households were selected for the sample, of which 9,854 were successfully interviewed. In these households, 10,885 women were identified as eligible for the individual interview (i.e. ever-married and aged 10-49) and interviews were completed for 10,544 or 97% of them. But my analysis covered only 8759 eligible women who are able to bear children. The women under sterilization, declared infecund, divorced, widowed etc. are not involved in the analysis.

The logistic regression model is being used in many different areas and has become the standard method of analyzing models in which the dependency of a binary response variable is being tested on a number of explanatory variables. Suppose that a response (dependent) variable Y can take one of the two values "0" or "1" i.e., occurrence or nonoccurrence of an event such as demand for a child. Variables of this type are often called binary or dichotomous variables. For dichotomous variables such as Y, one object is to develop a method for estimating P, where P is the probability of occurrence of an event as a function of a number of independent variables. It has been shown, theoretically and empirically, that when the dependent variable is dichotomous, the shape of the response function is frequently curvilinear. The logistic regression model is a curvilinear response function, which has been found to be appropriate in many cases involving a binary dependent variable. This response function assures that the

estimated value of P (Probability of occurrence of an event) is always between 0 and 1.

5 Development of the model

In my problem the dependent variable is demand for additional child (Y) which is taken to be dichotomous one. It indicates the demand for a child of ever-married women in Bangladesh. It takes on the value one (Y=1) with probability P (say) if the respondent demands one or more children and zero (Y=0) with probability 1-P if she does not demand any more. Most of the explanatory variables in our analysis are qualitative.

In order to interpret the qualitative independent variable, age of ever-married women has been taken into an interval scale, such as age group 10-14, 15-19, 20-24, 25-29, 30-39 and 40-49 and the corresponding variables are denoted by X_{11}= age group 10-14, X_{12}= age group 15-19, X_{13}= age group 20-24, X_{14}= age group 25-29, X_{15}= age group 30-39 and X_{16}= age group 40-49 respectively. Each of the age group is considered as an indicator variable i.e., the respondent belongs to a particular age group has the value 1 and 0 otherwise.

The geographic region is also a qualitative variable and we denote these regions by X_{21}= Dhaka, X_{22}= Chittagong, X_{23}=Rajshahi, X_{24}= Khulna, X_{25}= Barisal and X_{26}=Sylhet. Each of the sub variables is an indicator variable.

The level of education is taken as qualitative and has been expressed into interval scale and denoted by X_{31}= No education, X_{32}=Primary level, X_{33}= Secondary level, X_{34}= Higher. Each of the sub variables is an indicator variable.

Next, religion is a qualitative variable and various religious groups are denoted by X_{41}= Islam, X_{42}=Christianity, X_{43}= Hinduism and X_{44}= Buddhist respectively. Each of the religious groups is considered as an indicator variable.

The variable current pregnancy is qualitative as well as dichotomous one and it is denoted by X_5

The variable total number of living children is quantitative but for the comparison we convert it into qualitative variable of interval scale. We denote them by X_{61}= Number of children is below 2, X_{62}= Number of children is exactly 2 and X_{63}= Number of children is above 2. Each of the sub variables is an indicator variable.

The variable working status is qualitative and dichotomous one and it is denoted by X_7.

The variable expected number of children is a quantitative variable and for the purpose of comparison we convert it into qualitative variable of interval scale and denote by X_{81}= Expected number of children is up to 2 and X_{82}= Expected number of children is above 2. Each of the variables is an indicator variable.

The variable access of mass media is also a qualitative variable. The media radio and television are denoted by the variables X_{91} and X_{92} respectively. Each of the variables is an indicator variable.

Similarly the variable involvement in N. G. O's is also a qualitative one. The mentioned categories of N. G. O's are denoted by $X_{10.1}$= Grameen Bank, $X_{10.2}$=BRAC, $X_{10.2}$=BRDP, $X_{10.4}$= Mothers' Club and $X_{10.5}$= other organizations. Each of the variables is an indicator variable.

Now the expression P_i is given by

$$\begin{aligned} P_i &= E[Y_i = 1|X_{11} = x_{11}, X_{12} = x_{12}, X_{13} = x_{13}, X14 = 0, X_{15} = x_{15}, X_{16} = x_{16}, \\ &\quad X_{21} = 0, X_{22} = x_{22}, X_{23} = x_{23}, X_{24} = x_{24}, X_{25} = x_{25}, X_{26} = x_{26}, X_{31} = x_{31}, \\ &\quad X_{32} = x_{32}, X_{33} = 0, X_{34} = x_{34}, X_{41} = 0, X_{42} = x_{42}, X_{43} = x_{43}, X_{44} = x_{44}, \\ &\quad X_5 = 0, X_{61} = x_{61}, X_{62} = 0, X_{63} = x_{63}, X_7 = 0, X_{81} = 0, X_{82} = x_{82}, X_{91} = 0, \\ &\quad X_{92} = 0, X_{10.1} = x_{10.1}, X_{10.2} = x_{10.2}, X_{10.3} = 0, X_{10.4} = x_{10.4}, X_{10.5} = x_{10.5}]. \end{aligned}$$

(Here the values of the variables corresponding to the reference category are considered as "0"). That is

$$P_i = \frac{1}{1 + e^{-(\beta_0 + \sum \beta_j X_j)}}$$

And

$$1 - Pi = \frac{e^{-(\beta_0 + \sum \beta_j X_j)}}{1 + e^{-(\beta_0 + \sum \beta_j X_j)}}$$

Therefore,

$$\frac{P_i}{1 - P_i} = e^{\beta_0 + \sum \beta_j X_j}$$

Hence multiple binary logistic regression model is given by

$$\begin{aligned} log_e \frac{P_i}{1 - P_i} &= \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{15} + \beta_5 X_{16} + \beta_6 X_{22} + \beta_7 X_{23} \\ &\quad + \beta_8 X_{24} + \beta_9 X_{25} + \beta_{10} X_{26} + \beta_{11} X_{31} + \beta_{12} X_{33} + \beta_{13} X_{34} + \beta_{14} X_{42} \\ &\quad + \beta_{15} X_{43} + \beta_{16} X_{44} + \beta_{17} X_5 + \beta_{18} X_{61} + \beta_{19} X_{63} + \beta_{20} X_7 + \beta_{21} X_{82} \\ &\quad + \beta_{22} X_{91} + \beta_{23} X_{92} + \beta_{24} X_{10.1} + \beta_{25} X_{10.2} + \beta_{26} X_{10.4} + \beta_{27} X_{10.5} \quad (1) \end{aligned}$$

Here an attempt has been made to examine the relationship between a dichotomous dependent variable (demand for a child) and a set of explanatory variables as selected and discussed earlier. The main feature of the analysis is to identify the factors that affect demand for a child of a respondent that is ever-married women of age 10-49. In order to get the solution of the above problem, a well-known and now-a-days widely used statistical technique (multiple binary logistic regression model) is used.

The regression coefficient β_j can be obtained with the help of maximum likelihood estimation from the log-likelihood function suggested by Cox and is given by

$$Log_e L(\beta_0, \beta_1, \beta_2 \cdots, \beta_k) = \sum_{j=0}^{k} \beta_j t_j - log_e\{(1 + exp(\sum_{j=0}^{k} \beta_j X_{tj})\}$$

where $t_j = \sum_{t=1}^{n} X_{tj} Y_t, \quad j = 0, 1, 2, 3, \cdots, k$, and n is the number of respondents.

But we utilize the Computer package SPSS (Statistical Package for Social Sciences) for windows base 10.0 version and the binary logistic regression parameters β_j 's are iteratively obtained with the help of this package programme.

Since the dependent variable Y_i is coded as '1' if the respondent wants one or more child and '0' if the respondent does not want any more, positive coefficient indicates that the respondent is likely to demand one or more children; on the other hand negative coefficient indicates that the respondent does not expect any more. In order to obtain the increment of the regressor we have calculated odds ratio of the j_{th} regressor which is the anti-log of the j^{th} slope coefficient.

Table 1: Logistic regression estimates of the odds ratios [Exp (β)] of background characteristics of ever-married women of reproductive age 10-49 in Bangladesh: Data from BDHS 1999-2000.

Background characteristics (variable)	Estimated regression coefficient	Odds ratio [Exp (β)]
1. **Age**		
10-14	2.261^{*}	9.590
15-19	0.967^{*}	2.631
20-24	0.443^{*}	1.558
25-29^{r}	-	1.000
30-39	-0.750^{*}	0.472
40-49	-2.688^{*}	0.068
2. **Geographic region** (Division)		
Dhaka^{r}	-	1.000
Chittagong	0.402^{*}	1.494
Rajshahi	-0.244^{***}	0.783
Khulna	-0.380^{*}	0.684
Barisal	-0.057	0.944
Sylhet	0.390^{**}	1.477
3. **Level of education**		
No education	-0.014	0.986
Primary level	0.060	1.062
Secondary level^{r}	-	1.000
Higher	0.224	1.251
4. **Religion**		
Islam^{r}	-	1.000
Christianity	-0.349^{**}	0.705
Hinduism	-1.222^{**}	0.326
Buddhist	0.812^{**}	2.321

Table 1(continued)

Background characteristics (variable)		Estimated regression coefficient	Odds ratio [Exp (β)]
5.	**Current pregnancy**		
	Not pregnant^r	-	1.000
	Pregnant	2.399*	0.091
6.	**Number of living children**		
	Below 2	3.194*	24.374
	Exactly 2^r	-	0.179
	Above 2	−1.718*	0.179
7.	**Working status**		
	Not working^r	-	1.000
	Working	−0.335*	0.715
8.	**Expected number of children**		
	Exactly 2^r	-	1.000
	Above 2	1.943*	6.977
9.	**Access of mass media**		
	a) Listen to radio irregularly^r	-	1.000
	Listen to radio regularly	0.151	1.163
	b) Watch TV Irregularly^r	-	1.000
	Watch TV regularly	−0.251**	0.778
10.	**Involvement in N G O's**		
	Grameen Bank	0.041	1.041
	BRAC	−0.262***	0.769
	BRDP^r	-	1.000
	Mothers Club	-0.477	0.620
	Others organization	0.032	1.032
	Intercept	−1.306*	
	-2log likelihood	5536.052	
	Cox & Snell R^2	0.511	
	Nagelkerke R^2	0.691	
	Modelχ^2	6270.112	
	Df	27	

r =Reference category, '$*'$ Significant at $P < 0.001$, '$**'$ Significant at$P < 0.01$, '$***'$ Significant at $P < 0.05$, '$****'$ Significant at $P < 0.10$

6 Empirical results and discussion

The logistic regression coefficients of ever-married women for the age group 10-14, 15-19, 20-24, 30-39 and 40-49 are shown in table 1. Since in Bangladesh population

growth rate was very high in the 1970s and that population is now in the age group 25-29 and this young age structure constitutes a built-in "Population momentum", which will continue to generate population increases well into the future, even in the face of rapid fertility decline. Considering median age group 25-29 as reference category the regression coefficients of eligible women corresponding to age group 10-14, 15-19 and 20-24 are 2.261, 0.967 and 0.443 respectively and these are positive in sign, but for the age group 30-39 and 40-49 the coefficients are -0.750 and -2.688 respectively and negative in sign. The results illustrate that the ever-married women under age 30 are likely to demand more children and above age 30 are less likely to demand any more children and the results are statistically significant as compared to the reference age group 25-29. The odds ratio corresponding to the age group 10-14, 15-19 and 20-24 are 9.590, 2.631 and 1.558 respectively. It indicates that the ever-married women of age group 10-14, 15-19 and 20-24 have 9.590, 2.631 and 1.558 times higher risk to demand for additional children than that of age group 25-29 (reference category). On the contrarily, the odds ratio corresponding to the age group 30-39 and 40-49 are 0.472 and 0.068 respectively. It indicates that the women of age group 30-39 and 40-49 have (1-0.472)100=52.8%, (1-0.068)100=93.2% lower risk to demand for additional children as compared to the age group 25-29. So for achieving the replacement level fertility the family planning programme should be strengthened among the ever-married women under age 30.

The regression coefficients of ever-married women under different geographic region are calculated. Dhaka is the capital of Bangladesh and 24% respondent of the sample is from Dhaka division. Also I think population of Dhaka division is the combination and interactions of all other divisions. Therefore considering Dhaka division as reference category the coefficients corresponding to Chittagong and Sylhet divisions are 0.402 and 0.390 respectively and positive in sign, but for the divisions Rajshahi, Khulna and Barisal the coefficients are -0.244, -0.380 and -0.057 respectively and negative in sign. Except for Barisal division all the results are statistically significant. The odds ratio corresponding to Chittagong and Sylhet divisions are 1.494 and 1.477 respectively. The results indicate that the demand for additional children among ever- married women under Chittagong and Sylhet divisions are 1.494 and 1.477 times higher than that of women in Dhaka division. On the contrary, the odds ratio corresponding to Rajshahi, Khulna and Barisal divisions are 0.783, 0.684 and 0.944 respectively. It indicates that the demand for additional children among women under Rajshahi, Khulna and Barisal divisions are (1-0.783)100=21.7% (1-0.684)100=31.6% and (1-0.944)100=5.6% less than that of Dhaka division. It is evident from data of BDHS 1996/97 that there are regional variations in contraceptive use, with Rajshahi and Khulna divisions having the highest prevalence and Chittagong and Sylhet divisions the lowest prevalence. That is from the data of BDHS 1996/97, the proportion of women currently using any contraceptive methods by the regions of Dhaka, Chittagong, Rajshahi, Khulna, Barisal and Sylhet are 50.4, 39.0, 50.8, 62.7, 59.5 and 21.3 respectively. This result is consistent with that of mine. It may be the impact of ritual sentiment. Therefore,

in order to achieve our target the family planning program should be strengthened in Chittagong and Sylhet divisions.

The regression coefficients of women corresponding to different levels of education are obtained but the coefficients are not statistically significant even, except primary level, they do not show the expected sign. We consider secondary level of education as reference category because at this stage a girl becomes mature gradually and she may achieve sufficient knowledge about the impact of family planning program. The coefficients corresponding to no education, primary level and higher are -0.014, 0.060 and 0.224 respectively. It is observed from the data that the literacy rate of women in Chittagong and Sylhet divisions are significantly lower than that of Dhaka division. It is general convention that demand for a child reduces as level of education raises up to secondary level. Data from the world fertility surveys and the demographic and health surveys in Bangladesh and worldwide confirm the positive effect of education on reproductive behavior (Schultz, 1994; World Bank, 1994). Since the results are not consistent as desired, the economic condition of the respondent should be investigated and a further analysis is required.

The regression coefficients of ever-married women under different religion are computed. In my analysis 87% of the respondent is in the religion Islam and it is evident from data of BDHS 1996/97 that the percentage of women currently using any contraceptive method among Muslims and non-Muslims are 48.6 and 58.5 respectively. That is probability of contraceptive use is higher among non-Muslims than Muslims. Therefore, considering Islam as a reference category the coefficients corresponding to Christianity, Hinduism and Buddhist are -0.349, - 1. 112 and 0.842 respectively and first two are negative in sign. Except for Buddhist the remaining results are statistically significant. The odds ratio corresponding to the religion Christianity and Hinduism are 0.705 and 0.326 respectively. The results indicate that the demand for additional children among women under religion Christianity and Hinduism are (1-0.705) 100 = 29.5% and (1-0.326) 100 =67.4% less than that of Islam. The odds ratio corresponding to the religion Buddhist is 2.321 which indicate that demand for children among ever-married women under Buddhist is 2.321 times higher than that of Islam. It may due to the fact that many of the male population among Buddhist are "Bhikku". They are life long bachelor. Also it is observed that the growth rate in many Buddhist countries like China, Japan etc. are negative. So the women among Buddhist are likely to demand more children for their social security. Though the result is not significant the activities of family planning programme should enhance among the Buddhist women.

The logistic regression coefficient of currently pregnant women is -2.399 and statistically significant. Non-pregnant women are considered as reference category. The odds ratio corresponding to the coefficient is 0.091. The result indicates that the demand for an additional child is too much lower i.e., (1-0.091) 100 =90.9% lower among the currently pregnant women than that of non-pregnant women. It may be due to complicacy of pregnancy. Therefore the field worker of family planning programme

should explain the complicacy of pregnancy among the eligible women and discourage them for further issue. Though the birth order is available in the data set but it is not considered in my selected variables, the results can not be obtained about order of parity of the women at which she was pregnant. It would be taken into consideration for further analysis.

The logistic regression coefficients corresponding to the total number of children below 2 and above 2 are 3.194 and -1.718 respectively and each has expected sign. Also the results are statistically significant. In order to achieve replacement level fertility the norm of total number of children should be 2. Therefore total number of children exactly 2 is considered as reference category. The odds ratios indicate that the eligible women having less than two children are likely to have 24.374 times higher as well as the women having more than 2 children are likely to (1-0.179) 100=82.1% less demand for additional child than that among the women having two children. Therefore the family planning program should be strengthened and widely acceptable especially among the women having less than two children.

The logistic regression coefficient of working women other than housewives is -0.335 with expected sign and statistically significant. Here 82% of the respondent is non-working i.e., housewives and non-working women are considered as reference category because it is evident from data of BDHS 1996/97 that the proportion of women currently using any contraceptive method among working and housewives are 56.0 and 46.3 respectively. That is contraceptive use is higher among working women than among housewives. The odds ratio corresponding to the workingwomen is 0.715. The result indicates that the demand for a child among working women is (1-0.715) 100 = 28.5% less than that among housewives. Also it is evident from the data that the percentage of working women in Chittagong and Sylhet divisions are significantly lower than that of Dhaka division. Therefore in order to get more effective and fruitful responses from family planning program, female empowerment through education, as well as service is necessary.

The logistic regression coefficient among the eligible women with expected number of children above 2 is 1.943, which is statistically significant. Expected number of children up to 2 is considered as reference category because for replacement level fertility number of children up to 2 is tolerable. The odds ratio corresponding to the coefficient is 6.977. The result indicates that the demand for additional children among the women with expected number of children above 2 is 6.977 times higher than that among the women with expected number of children up to 2. Therefore in order to enhance the continual success of family planning programme the field worker should identify the women with expected number of children above 2 and motivate them in favor of replacement level fertility.

The regression coefficient of mass media-listening to radio regularly and watching TV regularly are 0.151 and -0.251 respectively. But the impact of listening to radio on demand for a child does not show the expected result. The impact of television on demand for additional children has shown the expected sign and statistically signifi-

cant. In order to identify the positive impact of access to mass media, irregular access to mass media is considered as reference category. The odds ratio corresponding to the media-watching TV regularly is 0.778. This result indicates that the demand for additional children among the eligible women who watch TV regularly is (1-0.778) 100 = 22.2% less than that among the women who do not watch TV regularly. That is women having access to mass media specially television has a statistically lower probability of demand for additional children than those without access. Therefore it should be ensured that the women have easy access to mass media specially television in rural as well as urban areas. Also family planning program with its positive impact should be broadcast in television.

The logistic regression coefficients of eligible women under the activities of N. G. O's Grameen Bank, BRAC, Mothers Club and Other Organization are 0.041,-0.262, -0.477 and 0.032 respectively. The coefficients corresponding to Grameen Bank and Others Organization do not show expected sign and the results are not statistically significant but for BRAC and Mothers Club the coefficient show expected sign and the result corresponding to BRAC is significant. BRDP is considered as reference category because government finances it. The odds ratio corresponding to BRAC is 0.769. The result indicates that the women under the activities of BRAC have (1-0.769)100=23.1% lower demand for additional children than that for the women under the activities of BRDP. Now there are many N. G. O's working in Bangladesh. If it is possible to attach the activities of family planning programme with their traditional activities, the replacement level fertility may be achieved soon.

7 Measuring the worth of the model

There are various statistics that have been proposed for assessing the worth of a logistic regression model, analogous to those that are used in linear regression. We examine two of the proposed statistics as follows:

7.1 R^2 in logistic regression

The worth of the linear regression model can be determined by using R^2, but R^2 computed as in linear regression should not be used in logistic regression, at least not when the possible values of Y are zero and one. It is evident that R^2 can be dropped considerably for every misfitted point, so R^2 can be less than 0.9 even for near-perfect fitting. Cox and Wermuth (1992) also conclude that R^2 should not be used when Y has only two possible values, and show that frequently $R^2 \approx 0.1$ when good models are used.

Various alternative forms of R^2 have been proposed for the binomial logit model.

Maddala (1983) and Magee (1990) proposed using

$$R^2 = 1 - \left\{ \frac{L(0)}{L(\hat{\beta})} \right\}^{\frac{2}{n}} \tag{2}$$

with $L(0)$ denoting the likelihood for the null model (i.e., with no regressors) and $L(\hat{\beta})$ representing the likelihood function that would result when replaces in the following equation

$$g(Y_1, Y_2, \cdots, Y_n) = \prod_{i=1}^{n} P_i^{Y_i}(1 - P_i)^{1-Y_i} \tag{3}$$

Essentially the same expression, except that $\frac{2}{n}$ was misprinted as $\frac{1}{n}$, was given by Cox and Snell (1989). [Equation (2) is motivated by the form of the likelihood ratio test for testing the fitted model against the null model. It can be shown that R^2 as defined in linear regression is equivalent to the right hand side of equation (2). Hence, this is a natural form for R^2 in logistic regression.] Since the likelihood function $L(\hat{\beta})$ is a product of probabilities, it follows that the value of the function must be less than 1. Thus, the maximum possible value for R^2 defined by equation (2) is max $R^2 = 1 - \{L(0)\}^{\frac{2}{n}}$. In linear regression $\hat{Y} - \overline{Y}$ is used for the null model. Similarly, in logistic regression we would have $\hat{P} - \gamma$ for the null model, with γ_1 denoting the percentage of 1's in the data set. It follows that max $R^2 = 1 - \left\{ \gamma_1^{\gamma_1 n}(1 - \gamma_1)^{1-\gamma_1 n} \right\}^{\frac{2}{n}}$.For example, if $\gamma_1 = .5$, then max $R^2 = 0.75$. This is the largest possible value of R^2 defined by equation (2). When the data are quite sparse, the maximum possible value will be close to zero. Therefore, Nagelkerke (1991) suggests that $\overline{R}^2$ be used, with $\overline{R}^2 - R^2/maxR^2$.

For the above fitted model the Cox and Snell $R^2 = 0.511$ and Nagelkerke $\overline{R}^2 = 0.691$. It is observed that when the value of $\overline{R}^2$ exceeds 0.5 the data fit the binary logistic regression model well. Therefore the model can be used for the significance prediction about the demand for a child in Bangladesh.

7.2 Correct classification rate (CCR)

We may criticize any statistic that is a function of the $\hat{P}_i$ when Y is binary. Each $\hat{P}_i$ and its closeness to Y_i depends on more than the worth of the model. If our objective is to predict whether a subject will or will not have the attribute of interest, a more meaningful measure of the worth of the model would be the percentage of subjects in the data set that are classified correctly. Accordingly, we will use the correct classification rate (CCR) as a measure of the fit of the model. In order to find the CCR we have the following table.

Table 2: Observed classification table[a, b]

Demand for a child		Predicted		Percentage Correct
		No more	Have another	
Observed	No more	5235	0	100
	Have another	3524	0	0
	Overall percentage			59.8

a. Constant is included in the model

b. The cut value is 0.5

Table 3: Predicted classification table[a]

Demand for a child		Predicted		Percentage Correct
		No more	Have another	
Observed	No more	4859	376	92.8
	Have another	616	2908	82.5
	Overall percentage			88.7

a. The cut value is 0.5

If we use 0.5 as the threshold or cut value, we have from Table 3, CCR= 0.89. Since a model that affords better classification should be judged superior by a goodness-of-fit test that indirectly assesses the classification performance of the model. Through classification performance we conclude that our fitted model may be used for prediction.

8 Policy Implications

1. In the present study it is evident that the demand for children decreases as increase of age of the women and it is remarkable among the women under age 30. In order to minimize such demand for children the family planning program efforts should be strengthened among the ever-married women under age 30.

2. An important challenge is to reduce the differentials of demand for children among administrative divisions. As for example, Chittagong and Sylhet division have higher demand for children as any other division in Bangladesh. It is observed that the impact of such higher demand is the lowest contraceptive prevalence among the women in Chittagong and Sylhet division. In order to overcome such differentials about demand for children improved family planning services as well as adult education should be strengthened in Chittagong and Sylhet division.

3. We observed that demand for children is higher among non-working or housewives as compared to working women. In order to reduce the differentials female empowerment as well as women's socio-economic status should be enhanced through proper education and employment.

4. From the study, the mass media especially television plays a vital role to reduce demand for children. Therefore, in order to limit the demand for children it should ensure the women have easy access to mass media especially television in rural as well as urban areas and also the positive impact of small family norm should broadcast in television.

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