

Some Reflections on Son Preference and its Influence on Additional Desired Fertility

1. Introduction

PARENTAL preference for male children seems to be a world-wide phenomenon. World Fertility Survey has revealed the prevalence of son preference in almost all the countries except Jamaica and Venezuela (Cleland, Verall, and Valssen, 1983). But the extent of sex preference has been noted to vary substantially between countries depending upon factors like levels of development, extent of urbanization or modernization, female participation in labour force, educational standards, social security systems and insurance schemes, cultural and religious practices, etc. Theoretically, one can argue that motivations for having children of any sex will have positive impact on completed fertility, whereas it has no implications for imbalances in the sex composition of population.*

To date, no biological technique or medical advancement has made any breakthrough to control the sex of the child to be born. Thus sex imbalances in the population are not generated by natural or biological processes. However, gender inequalities in nutritional and medical care standards, maltreatment or wilful neglect of children of one sex, or sex preference can lead to differential mortality by sex and cause sex imbalance in a society.

Alternative techniques for eliciting or indexing the sex preference have been utilised in empirical literature. Some of the studies have observed son prefer-

* Available empirical literature reflects that male female sex ratio at birth is almost constant, of the order of 106. The composition is independent of age of the mother, parity, social, economic and demographic classification of the parents. Furthermore, the sex composition of the new born children follow negative binomial distribution and the expected proportion of sons or daughters is .5. For details see Gulati (1985).

ence on the basis of parent's stated preference about the desired or ideal family size and its composition, Similarly, sex composition of the last born children in families in favour of males as compared to all the children has also been utilised to reflect son preference. A third variant of the measure could be sex composition of children in favour of males in smaller families as compared to larger families. It also suggests that couples who achieve desired sex composition or number of sons among the first few children curtail further child bearing. Another way of ascertaining son preference in a society is to study the contraceptive behaviour among couples with different sex composition of the surviving children. For instance, preference for more effective or permanent methods of contraception is found among couples with a sex composition of the surviving children biased in favour of males. Some studies have highlighted the phenomenon of finding high abortion rates among couples with family composition already in favour of male children compared to those with preponderance of female children. Hitherto, these indices have not been utilised to quantify the intensity of son preference.

Parental preference for sons over daughters is also manifested if parents with preponderance of male children do not desire additional children compared to those who have preponderance of female children. Such expression of preference for sons over daughters can also be utilised to quantify the intensity of sex preference in terms of their detrimental effects on probability of having additional children. Demand for additional children being dichotomous choice variable depicting parental desire for having additional children or not can be analysed through logit analysis. The logit maximum likelihood estimational procedure is utilised to analyse parental preferences for additional children and highlight the intensity of son preference in the Indian context.

2. Son Preference in India

Consistent decline of male-female sex composition in India until 1971 (except a slight improvement in 1981) has been largely due to sex selective mortality unfavourable to females. Sen (1984) attributed this persistence of high male-female sex composition phenomenon to lower status accorded to women in Indian society. The overall gender inequality against female health in terms of nutritional and health care standards operating against females (both children as well as adults) has been highlighted by Radhika (1984) and Prमित (1984).

Several studies have highlighted the age old practices of female infanticide in different parts of India. Pakrasi (1970) provides a detailed account of these practices in Gujarat, Graves (1978) in West Bengal and Dyson(1983) in north western regions of India. Despite strict statutory regulations protecting the legitimate rights and interests of women and children the sporadic incidents of female infanticide are still not unheard of in India.

Large number of studies, e.g. Opler (1964), Mathur (1974), Poffenberger (1967), Mandelbaum (1970), Operations Research Group (1971), Sarma (1974), Kendall (1979), Narayan Das (1984), Lahiri (1984) have highlighted the prevalence of strong son preference in India. Anand (1964) on the basis of a survey data found that couples stating preference in terms of ideal or desired family size of three desired two sons and one daughter. While analysing the threshold effects of number of living sons on additional desired fertility in an earlier study (Gulati, 1985) it was shown that the point of inflexion was at two sons, signifying the critical minimum number of surviving sons beyond which couples would want to curtail child-bearing. This empirical evidence in a way suggests the prevalence of strong son preference in the Indian society.

3. Objective of the Present Study

Although, a large number of demographic and socio-economic factors have been suggested as responsible for the strong sex preference, no attempt seems to have been made to quantify its intensity. The present study is focussed on quantifying the intensity of preference for sons over daughters in terms of their adverse effect on probability of having additional children. The demand or desire for additional children, being a dichotomous choice variable, is analysed through a logit model, estimated by maximum likelihood procedure. Also the study intends to identify some of the crucial demographic and socio-economic variables influencing the demand for additional children. A brief description of the logit model is presented below.

4. The Model

For a mathematical description of the model, we rely mainly on Amemiya (1981). Let Y_i denote the demand for additional children, assuming value 1 if the couple wants to have additional children and 0 otherwise. Thus the demand for additional children is a dichotomous dependent variable reflecting binary choices. Let us assume that the desire for additional children depends on a set of social, economic, demographic and psychological characteristics, to be represented by a vector X . Let β be the column vector of unknown parameters associated with the independent variables A . Using the subscript i to denote the i th individual, we can write mathematically a univariate dichotomous model in a general form as

$$P_i = P(Y_i = 1) = F\{H(X_i > \beta)\}, \quad (1)$$

where P_i is the probability that the i th individual wants to have additional children, H is an appropriate function known up to the parameter vector β and F is the appropriate probability function, Amemiya (1981 : 1486) provides a detailed discussion of linear specification of the functional form H and logit

form of probability function F , which yields the logit probability model as follows :

$$P_i \equiv P(Y_i = 1) \equiv \frac{e^{X_i \beta}}{1 + e^{X_i \beta}} \quad (2)$$

The principal advantage of this model over the linear form of probability function* is that the predicted values of the dependent variable are always constrained to the unit interval (0, 1) and thus does not violate its usual interpretation of probability.

The logit model assumes the generation of the values of the dependent variable by Nature as follows : (1) For each observation, say the i th, Nature computes the probability $X_i \beta$; (2) It further generates a logistically distributed variable Z with mean = 0 and variance = 1; (3) If $Z \leq X_i \beta$, Y_i is set equal to 1, otherwise Y_i is set equal to 0.

Let $f(Z)$ represent the density function with mean (μ) = 0 and $F(Z)$ the corresponding cumulative distribution. We then have

$$Pr[Y_i = 1/X_i \beta] = Pr[Z < X_i \beta] = \int_{-\infty}^{X_i \beta} f(z) dz = F(X_i \beta) \quad (3)$$

and

$$Pr[Y_i = 0/X_i \beta] = 1 - F(X_i \beta), \quad (4)$$

where

$$F(X_i \beta) = \frac{e^{\lambda X_i \beta}}{1 + e^{\lambda X_i \beta}}, \quad (5)$$

and

$$\dagger \lambda = \sqrt{\pi/3}.$$

*In linear probability model, the functional form is as follows :

$$F(X_i, \beta) = X_i \beta.$$

The linear probability model is heteroscedastic regression model since $V(y_i) = V(ui) = X_i \beta (1 - X_i \beta)$. Since, variance of the stochastic disturbance term i is not constant as it depends upon the value of the regressand. Thus using the weighted least squares procedure, one can arrive at consistent and asymptotically more efficient estimates of β provided $0 < X_i \beta < 1$. But the inherent weakness that the predicted values cannot be constrained to the unit interval (0, 1), thus violating its usual interpretation of probability and also the weighted least squares procedure may fail because of negative diagonal elements in the variance-covariance matrix of the stochastic disturbance term. For details see Amemiya (1981 : 1487), among others.

$\dagger \lambda = \sqrt{\pi/3}$, yields the logistic distribution with zero mean and unit variance.

which determines probability as a function of X_1 . In particular, for estimates β and predicted values $X_1(\beta)$, the predicted probability would be

$$\hat{F}(X_i, \hat{\beta}) = \frac{e^{\lambda X_i \hat{\beta}}}{1 + e^{\lambda X_i \hat{\beta}}} \quad (6)$$

Thus, no matter what value is assumed by X_i , it is always the case that $0 < \hat{F}(X_i, \hat{\beta}) < 1$.

From (4) and (5), that likelihood function of the model is given by

$$L = \prod_1^n F(X_i, \beta)^{Y_i} [1 - F(X_i, \beta)]^{1-Y_i} \quad (7)$$

and its natural logarithm is given by

$$l = \sum_1^n Y_i \log F(X_i, \beta) + \sum_1^n (1 - Y_i) \log [1 - F(X_i, \beta)]. \quad (8)$$

The maximum likelihood estimator $\hat{\beta}_{ML}$ is defined as the value of β that maximizes either (7) or (8), where β_{ML} is a solution of the equation

$$\frac{\partial l}{\partial \beta} = 0. \quad (9)$$

It can be shown that l is globally concave (which implies that l has a single local maximum) and therefore, a solution to (8) is unique if it is bounded. Thus, the Newton Raphson's iterative procedure adopted to solve (9) which is non-linear in β converges to a stationary point also yielding the global maximum of L . Furthermore, the asymptotic variance-covariance matrix is given by

$$E \left(\frac{\partial^2 l}{\partial \beta \partial \beta'} \right). \quad (10)$$

The ML estimator is consistent and asymptotically normal with the asymptotic variance-covariance matrix equal to

$$V(\hat{\beta}_{ML}) = -E \left(\frac{\partial^2 l}{\partial \beta \partial \beta'} \right)^{-1}. \quad (11)$$

An estimate of $V(\hat{\beta}_{ML})$ is obtained by evaluating (11) at $\hat{\beta}_{wz}$. Using this matrix, t-tests can be used to test for the significance of estimated β values.

5. The Data

The study is based on responses from 1,052 once ever but currently married

women under 40 years in age from the Delhi metropolis. The survey* (Delhi Demographic Survey) was conducted in urban Delhi in 1970-71. The detailed version of the sampling design and procedure is provided by Desai (1969). Two stage stratified random sampling procedure was adopted for eliciting an intended sample size of around 8,000 of once ever married females. The overall sample size was based on available distribution of women in reproductive age span cross-classified by education and occupation of their husbands or heads of households.

The sampling frame was devised through aerial stratification of the metropolitan population into 4,513 blocks ranging in sizes from 120 to 175 households with an average of 141 households. A sampling fraction of 10 per cent yielded a sample of 452 blocks. A sampling fraction of 15 per cent from the sampling frame of 54,802 selected households yielded a sample of 8,570 households. Out of these, 8,453 households could be contacted. Of these, 8,171 females with the eligibility criteria of once ever married and below fifty years in age, were enumerated. Finally 7,211 filled schedules after proper scrutiny were selected for further analysis. Information regarding fecundity status, family size preference, knowledge, attitude and practice of contraception, opinions regarding marriage, etc. were sought only from females who were currently married and less than 40 years in age. Of the 5,624 female respondents, definite information on couple's decision or desire to have additional children is available only from 1,052. We have concentrated on this subsample of female respondents for the present study.

A brief discussion of the selected characteristics for the present study is as follows: Table 1 provides an account of the variables, while the definitional aspects are provided in the Appendix Table.

Demand for additional children (DAC) is ascertained through couple's desire for having additional children or not. Present study purports to explain variations in the parental preferences for additional children by a set of ten socio-economic and demographic variables. Demand for additional children has often been viewed to be influenced by the size and sex composition of the surviving children. For this purpose, we have included number of surviving sons (NLS) and daughters (NLD) in the study. Socio-economic theories of fertility have noted that demand for children can be analysed like any other consumer durable in the Hicksian choice theoretical framework, it is argued that having a child or not has become a choice variable because of the advent of modern and effective methods of contraception. It can be discerned from the theoretical literature that the basic building blocks for the choice of consumer durables are income, prices and tastes. We have attempted to select some proxy variables to capture these blocks for the analysis of demand for additional children.

*The survey was conducted in 1970-71 by the Population Research Centre of Institute of Economic Growth headed by Prof. P. B. Desai.

TABLE 1—MINIMUM, MAXIMUM, MEAN VALUES AND STANDARD DEVIATIONS OF VARIABLES OF THE MODEL

<i>Abbreviated Name</i>	<i>Variable</i>	<i>Mm.</i>	<i>Max.</i>	<i>Mean</i>	<i>Standard Deviation</i>
(DAC)	Desire for Additional Children	0	1	0.544	0.498
(NLS)	Number of Surviving Sons	0	7	1.495	1.218
(NLD)	Number of Surviving Daughters	0	8	1.496	1.289
(RED)	Education of the Respondents	0	6	2.526	1.728
(HEX)	Monthly Household Expenditure	0	9	4.697	2.026
(LSS)	Living Style Score	0	80	13.054	12.913
(RAG)	Age of the Respondent	16	39	28.928	5.480
(ROC)	Occupation of the Respondent	0	7	4.000	1.140
(PSP)	Period Since Last Pregnancy	0	8	2.508	2.465
(TFY)	Type of Family	0	1	0.463	0.499
(RIN)	Monthly Income of the Respondent	0	7	0.650	1.738

Easterlin (1974) noted that permanent income as compared to measurable or relative income is more relevant for analysing fertility decisions. Thus household monthly expenditure (HEX) pertaining to latest calendar month in which the family has no extraordinary occasion like celebration of a marriage, etc. has been selected as a proxy for permanent income of the household. Wife's income (RIN) is brought under the purview of the study as a proxy for opportunity cost of mother's time in bearing and rearing of a child. Modern outlook of the couple is revealed through their possession of modern household inventories. Thus living style score (LSS) based on possession of twenty two modern household inventories is included to reflect the modern outlook of the family. Other taste structuring factors such as respondent's education (RED) and her occupation (ROC) are also used in the study. Some demographic characteristics such as age (RAG) and open birth interval (PSP) have been noted to have important bearing on fertility decisions. Thus a total of these ten variables have been brought under the purview of the present study to explain variation in parental preference for additional children.

6. The Results

The model specification for highlighting the desire for additional children (DAC) is of the form

$$DAC = f(\text{RED, HEX, LSS, RAG, ROC, PSP, TFY, RIN, NLS, NLD}). \quad (12)$$

The logit maximum likelihood estimates of the structural coefficients are provided hereunder:

$$\begin{aligned} DAC = & 2.867 - .103^* \text{ RED} - .010^* \text{ HEX} - .004 \text{ LSS} - .043^* \text{ RAG} \\ & (8.26) \quad (59.88) \quad (18.09) \quad (.13 \text{ D} - 08) \quad (.322\text{D} + 38) \\ & - .007 \text{ ROC} - .74^* \text{ PSP} - .033 \text{ TFY} + .029^* \text{ RIN} - .515^* \text{ NLS} \\ & (.69 \text{ D}-05) \quad (2.81) \quad (.260-15) \quad (.62 \text{ D} + 36) \quad (75.10) \\ & - .161^* \text{ NLD} \\ & (50.35) \end{aligned} \quad (13)$$

where the numbers in the parentheses are the estimated asymptotic t-ratios and * denotes significance at 1 per cent level.

Intensity of Son-Preference

The quantification of the intensity of son preference can be done by performing significance tests on the extent of difference in the magnitudes of the coefficients of surviving sons and daughters. For example, in the present analysis one can test a hypothesis that whether the coefficient of the number of living sons (NLS) and 3 times the coefficient of the number of living daughters (NLD) are significantly different from each other or not. The quantity t , where

$$t = \frac{\hat{\beta}_{NLS} - 3\hat{\beta}_{NLD}}{\sqrt{\text{Var } \hat{\beta}_{NLS} + 9\text{Var } \hat{\beta}_{NLD} - 6\text{Cov}\hat{\beta}_{NLS} \hat{\beta}_{NLD}}}$$

turns out to be only 0.02 and is much lower than 1.96, which is the critical value of t to mark the two to be significantly different from each other. Thus the analysis clearly indicates that the intensity of son-preference over daughters is of the order of 3 to 1 among Indian mothers. In other words, the depressing impact of surviving son over daughter on the desire for additional children is more than three times.

An alternative way of examining the preference of sons over daughters is to work out the probabilities of having additional children with different sex composition of the surviving children. The estimated probabilities can be interpreted as intensity of desire for additional children among mothers with

different sex composition of surviving children, such as having two sons or two daughters or some other combination of surviving children. These probabilities are derived from the estimated equation (13) by changing the values of number of surviving sons and daughters while keeping other variables fixed. The other variables are kept at their mean values presented in Table 1 for the sample and the estimated probabilities are presented in Table 2.

TABLE 2-ESTIMATED PROBABILITY OF HAVING ADDITIONAL CHILDREN BASED ON SEX COMPOSITION OF SURVIVING CHILDREN

No. of surviving sons (No Daughters)	0	1	2	3	4	5	6
Per cent probability	85.5	72.1	53.2	33.3	17.9	8.8	4.6
No- of surviving daughters	0	1	2	3	4	5	6
(Nosons)							
Per cent probability	85.5	82.0	77.9	73.2	67.8	61.9	55.7
Number of sons +	1	2	1	3	1		2
Number of daughters	1	1	2	1	3		2
Per cent probability	66.7	46.7	60.7	27.8	54.5		40.4

These figures are based on the estimated equation (13), for different values of NLS and NLD, while keeping other variables at their mean values provided in Table 1.

Perusal of Table 2 reveals that estimated probabilities of having additional children among women with no children turn out to be 85.5 per cent. Furthermore, the probability of having additional children for women with two surviving sons is 53.2 per cent, whereas with two daughters it is as high as 77.9 per cent. If we turn the question round to ask how long a string of daughters would be needed so that the probability falls to around 53 per cent, the answer comes out to be more than six.

Similarly, probabilities of having additional children can be worked out for females having different sex compositions. Perusal of last row in Table 2 reveals that the probability with one son and one daughter turns out to be 67 per cent, with two sons and one daughter it is 47 per cent but with one son and two daughters it is as high as 61 per cent. Thus preference for sons over daughters is clearly reflected in terms of these probabilities. For family size of four we find that with one son and three daughters, it is 55 per cent, whereas with three sons and one daughter it is only 28 per cent. Thus intensity of desire for additional child turns out to be much higher among mothers with predominance of daughters among surviving children. This clearly reflects the prevalence of son preference among mothers in the Indian society.

Influence of Different Variables on Additional Desired Fertility

The female education (RED) bears significant and negative impact on demand for additional children. The effect of higher permanent income (HEX) on the desire for additional children turns out to be significant and negative. Our results reveal that permanent income of families characterised by household expenditure (HEX) has significant and negative impact on additional desired fertility. In other words, respondents with similar socio-economic status, education and occupational career, etc. but having higher permanent income are less liable to desire additional number of children, which could be possibly because of greater economic security. The strength and direction of impacts reflected in the estimated parameters generally agree with socio-economic theories on fertility.

Respondent's age (RAG) turns out to be an important determinant of additional desired fertility. Age being an important life stage factor linked with other key factors like fecundity status, duration of married life, cumulated fertility, etc. has significant and negative influence on demand for additional children. The non-linear relationship between age and additional desired fertility can be seen in the differential shifts in probabilities of having additional children at different ages.

Postponement of pregnancy or duration of effective contraception characterised by the open birth interval (PSP) depicts significant and negative influence on demand for additional children. This implies that efforts for spacing of children, *ceteris paribus*, will have significant and negative impact on additional desired fertility and thus will result in a lower completed fertility.

One can observe that three factors namely, life style score (LSS), characterising the extent of modern outlook in the household or taste for modern consumption standards, respondent's occupation (ROC), and type of family (i.e. whether nuclear or joint) do not evince any significant influence on the desire for additional children, but the direction of influence is upto general expectation.

Preference for sons over daughters was also reflected in our survey data though average desirable number of sons to be higher than average desirable number of daughters. 'Rather, two surviving sons' turns out to be the crucial event beyond which the desire for additional children declines fast (Gulati, 1985, p. 182).

Number of surviving sons (NLS) as well as daughters (NLD) evince significant and negative influence on the demand for additional children. Interestingly, the depressing effect of the number of surviving sons on desire for having additional children is much larger than the effect of the number of surviving daughters, almost 3.2 times higher.

An alternative way of assessing the impact of any independent variable on the probability of having additional children is to fix the probability at some

level and examine the shifts in the probability due to a unit change in the corresponding independent variable. Table 3 presents these shifts in probabilities (in percentage points) at different levels due to different variables. For example, when the probability is at 90% level, a unit increase in respondent's education (RED) brings about a declining shift in the probability of having an additional child by 1.59 percentage points; likewise, having a son by about 11.21 percentage points. The effects of an independent variable are different at different levels of probability. Significantly, the depressing effects of independent variables improve along with lowering levels of probability from 90% to 50%. At probability level of 50% we find that the depressing effect of having an additional son is around three times more than that of having an additional daughter.

TABLE 3-SHIFT IN PROBABILITY OF HAVING ADDITIONAL CHILDREN (ap/ax) DUE TO UNIT CHANGE IN THE INDEPENDENT VARIABLE (X_i)

INDEPENDENT VARIABLE(X_i)	ap/ax at different levels of P				
	$P = 90\%$	$P = 80\%$	$P = 70\%$	$P = 60\%$	$P = 50\%$
RED	— 1.59	— 2.77	— 3.57	— 4.02	— 4.12
HEX	— .26	— .26	— .34	— .32	— .40
LSS	— .01	— .10	— .14	— .15	— .16
RAG	— .64	— 1.12	— 1.57	— 1.67	— 1.72
ROC	— .10	— .18	— .23	— .27	— .28
PSP	— 1.12	— 1.96	— 2.55	— 2.87	— 2.96
TFY	— .59	— .86	— 1.12	— 1.28	— 1.32
RIN	.41	.73	.97	1.11	— 1.16
NLS	—11.21	—16.30	—19.42	—20.31	—20.51
NLD	— 2.57	— 4.44	— 5.67	— 6.31	— 6.40

Shifts are presented in percentage points.

Perusal of Table 3 reveals that postponement of pregnancy (PSP) bears relatively higher depressing effect on the probability compared to other variables when it is fixed at 90% level. However, the relative impact of female education (RED) turns out to be higher when the intensity of desire comes down to, say 50% level. Thus the relative impact of postponement of preg-

nancy (PSP) compared to female education (RED) and female employment (ROC) is higher when the intensity of desire is greater.

Juxtaposing the results drawn from Tables 2 and 3, one can argue that policy prescription of propagating postponement of pregnancy among early parity women and overall progress in female education and employment will tend to reduce the desire for additional children and thereby help in containing completed fertility. These measures will also reduce the economic and sociological importance of having a son and would thus mitigate preference.

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APPENDIX TABLE—DEFINITIONS OF THE SELECTED VARIABLES

No.	Abbreviated Name	Definition
1.	DAC	Desire for additional children takes value 1 if the respondent wants to have additional children and 0 otherwise,
2.	NLS	Number of living sons is coded as the exact number up to 7 and 8 for 8 and more
3.	NLD	Number of living daughters is coded similar to NLS.
4.	RED	Respondent's education is classified according to the number of schooling years as follows : No schooling = 0, less than 4 years (elementary) = 1, 4-7 years (primary) = 3, 8-9 years (middle) = 3, 10-13 years (matriculation) = 4, 14-15 years (graduation) = 5, 16+ years (post-graduation) = 6
5.	HEX	Monthly Household Expenditure is coded as follows : N. A. = 0; Less than 100 Rs. = 1; 100-199 Rs = 2; 200-299 = 3; 300-399 = 4; 400-499 = 5; 500-749 = 6; 750-999 = 7; 1000-1499 = 8; 1500+ = 9.
6.	LSS	Living Style code is based on items of household inventory divided into eight groups viz. cooking equipments, cooking aids, bathing and washing facilities, drawing and dining room equipments, fan and other equipments, audiovisual equipment. Own conveyance facilities, miscellaneous equipment. Each of the eight groups are assigned maximum of ten points and the sum total of all is termed as life style score.
7.	RAG	Respondents' age is coded as the exact number of years.
8.	ROC	Respondent's occupation is coded as follows : Non-working = 0. Casual labourers = 1, Domestic Servants = 2, Dhobi and Sweepers = 3, Nursing etc. = 4, Clerks = 5. Teachers = 6, Higher profession and executive workers = 7.
9.	PSP	Period since last pregnancy is coded as follows : 1 years = 0,1-2 years = 1, 2-3 years = 2, 3-4 years = 3, 8 and more years = 8.
10.	TFV	Type of family is coded 0 if it is nuclear and 1 if it is joint.
11.	RIN	Respondent's monthly earning at present or earned last is coded as follows : Less than 50 Rs. = 1, 50-74 Rs. = 2, 75-99 Rs. = 3, 100-149 Rs. = 4, 150-249 Rs. = 5, 250-499 Rs = 6, 500+ Rs = 7.