FERTILITY DECLINE AND GENDER BIAS IN NORTHERN INDIA

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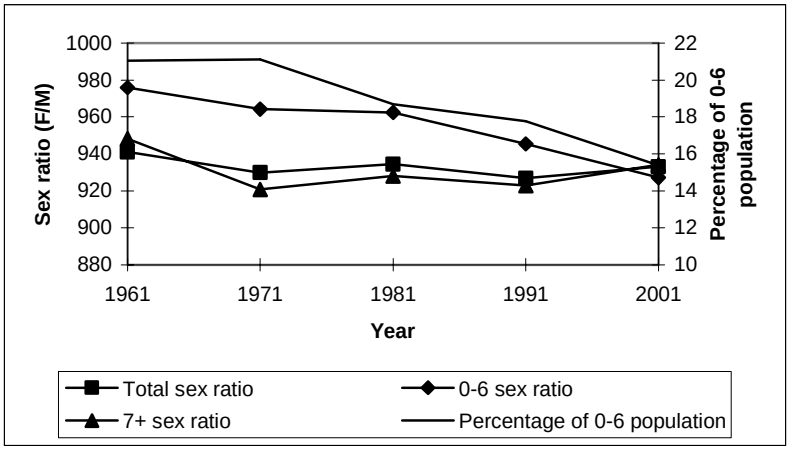
The existence of strong preference for sons in India, particularly in northern parts of the country, has now been thoroughly established through wide varity of data (Willamson, 1976; Miller, 1981; Arnold *et al*., 1998). There also exists considerable body of research that shows that, in the Indian context, son preference has a sizable positive effect on fertility and contraceptive practice (Das, 1987; Malhotra *et al*., 1995; Murthi *et al*., 1995; Mutharayappa *et al.*, 1997; Kulkarni, 1999). At the same time, there has been a growing international concern on the issue of 'missing' females and the increasing masculinity of India's population (Sen, 1989; Coale, 1991; Das Gupta and Bhat, 1997; Mayer, 1999; Griffiths *et al*, 2000; Sudha and Rajan, 1999; Agnihotri 2000). A noteworthy aspect of the century-long trend of rising masculinity of India's population is that since 1961 this rise has been mainly due to the deterioration of the sex ratio in juvenile ages (see Figure 1). Quite significantly, as juvenile sex ratios were falling, the level of fertility too was declining as indicated by the downward trend in the proportion of population of age 0-6 years. By showing a further fall in the juvenile sex ratio (girls in the age group 0-6 years per 1000 boys), the preliminary results of the latest Indian census (India, Registrar General, 2001) has fuelled the speculation that gender discrimination is intensifying in India.

The concomitant falls in fertility and juvenile sex ratios suggest that the two trends could be related. Das Gupta and Bhat (1997) have hypothesized that as fertility declines, two opposing forces could affect the juvenile sex ratio. When fertility is high, many of the higher-order female births were unwanted, and were subject to higher mortality, as suggested by Das Gutpa's classic study in Punjab (Das Gupta, 1987). As fertility falls, the percentage of higher-order births would reduce, which ought to improve the survival chances of female children because a larger proportion of those born are wanted ones. Left to it, this 'parity effect' on child survival should help to improve the juvenile sex ratio. But Das Gupta and Bhat suggest that as fertility falls, the sex discrimination could also spread to lower-order female births if the fall in desired family size is not accompanied by a proportionate fall in desired number of sons. When faced with such a situation, couples may try to achieve their desired family size and sex composition of children by resorting to female feticide or infanticide. From a scattered but persistent media reports of such incidences, and downward trend in the juvenile sex ratios, Das Gupta and Bhat have suggested that the 'intensification effect' is outweighing the parity effect in India. The preliminary results of the 2001 Census appear to confirm their view.

More recently, Dreze and Murthi (2001) have taken exception to the contention of Das Gupta and Bhat. From an analysis of fertility change between 1981 and 1991 at the district level, they conclude that high fertility and son preference are complimentary by nature, and consequently there is no grounds for believing that gender bias would intensify when fertility falls. Their criticism, however, appears to stem from a misunderstanding of what Das Gupta and Bhat have stated, and from a digression far removed from the main

thrust of their statistical exercise. Dreze-Murthi analysis is mainly concerned with how son preference (measured through excess mortality of girls over boys) affects fertility and not how fertility decline could influence sex differentials in foetal or child mortality. Das Gupta and Bhat's thesis is mainly concerned with the latter. All that Dreze and Murthi have shown is that son preference and fertility are positively related. But Das Gupta and Bhat have not contested this well-established fact. A positive relationship between the two could exist even if son preference does not change, but fertility rates fall more rapidly in regions of low son preference (i.e., gender equity acts as a catalyst rather than a cause of fertility decline). Das Gupta and Bhat's proposal is based on the assumption that a fall in son preference is not a necessary condition for fertility decline, though it could be a sufficient condition. According them, new technologies could make it possible for some to reduce fertility even in a situation where son preference remains strong, with disastrous consequences for the sex composition of population.

Figure 1. Tends in population sex ratios by age, and percentage of child population, India 1961-2001



Source: India, Registrar General (2001).

Although the conditionality assumption is difficult to verify directly, its implication could be tested by checking whether the relationship between son preference and fertility is changing with time, space or availability of technologies of pre-natal selection. But Dreze and Murthi have not only imposed a static model of fertility determination on the data, they have assumed that son preference has remained unchanged during 1981-91! Their use of sex differentials in child mortality as proxy for son preference is also questionable in a situation where female feticide is emerging as a superior substitute for post-natal discrimination. When pre-selection becomes possible sex differentials in child mortality could decline, as more of those born are wanted ones.

Dreze and Murthi contend that the rising incidence of female feticide is purely the result of a technological diffusion, quite independent of fertility decline. Such a stand is probably prompted by a narrow, demand-side view of fertility transition. Most demographers view the entire demographic transition as a process by which levels of fertility and mortality shift from the natural or societal control to the manipulation of

individual couples or households (e.g., Easterlin, 1978). The ability to have only wanted births is seen an important component of this change. The objective of pre-natal sex selection is to avoid unwanted births of a given sex, similar in its effects on fertility of using contraceptives to avoid unwanted birth of any sex. There is thus merit in viewing the adoption of such technologies as an integral part of fertility decline.

A more substantial criticism against the Das Gupta and Bhat's thesis is made in an earlier paper of Murthi *et al.* (1995). They suggest that the total number of sons desired by couples falls more rapidly than the desired number of total children. If true, this would negate the intensification effect hypothesized by Das Gupta and Bhat. But the evidence marshalled by Murthi *et al.* in support of their contention is very sketchy. Nor have Das Gupta and Bhat provided any direct evidence in support of their contrary view.

In this paper we propose to explore this question in greater detail using the data on size and sex composition of ideal number of children reported by ever-married women in the National Family Health Survey of 1992-93 (hereafter NFHS-1). As Das Gupta and Bhat expect the intensification effect to be dominant in regions characterised by strong son preference, the analysis has been done for northern India, comprising of states of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab and Haryana. A second objective of this paper is to estimate wanted fertility by sex and measure the potential impact of fertility decline on sex ratios. We use the data from the NFHS-1 to estimate what would be the sex ratio at birth in northern India if women were successful in eliminating all of their unwanted births.

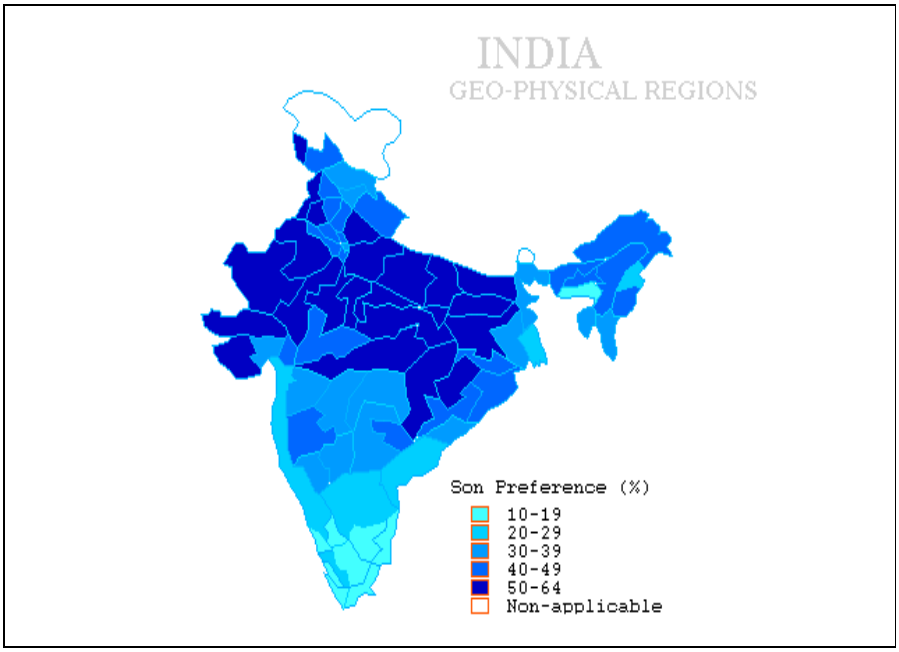
Son Preference and Family Size

In the NFHS-1, women were asked to state the number of children she would like to have if she could start childbearing all over again, and choose the number exactly. The question was intended to capture preferences regarding ideal family size rather than the desired family size. But given the difficulties in answering such hypothetical questions, a slight conceptual difference between the two measures could be ignored. In the NFHS-1, about 90 percent of women gave a numeric answer to the question on ideal family size. They were further asked to report how many of these children they would like to be boys and how many they would like to be girls. This information can be invaluable in studying the extent of son preference in India and its relationship with various factors, including the ideal family size. It is to be noted that all other indicators of son preference measure the 'revealed preferences', which could be contaminated by the changing ability of parents to translate preferences into practice.

One simple index of son preference that can be constructed from the NFHS data is the proportion of women who reported more boys than girls in their ideal family size. We have computed this index for 76 natural regions of India (Bhat and Zavier, 1999). Figure 2 presents a map showing the regional variation in this indicator of son preference. The regions of high and low son preference are clearly demarcated in the map. Son preference is highest in the northern plains and central uplands of India. Here the proportion of women wanting more sons than daughters range from 50 to 64 percent. But as one moves southward

from the Vindhyas (central uplands), son preference diminishes, and the proportion wanting more boys than girls fall below 20 percent when one reaches the borders of Tamil Nadu and Kerala. The regional variation in son preference depicted by our index corresponds well with the regional variation in female autonomy described by Dyson and Moore (1983).

Figure 2. Percentage of women reporting more boys than girls in their ideal family size, 76 natural regions, 1992-93



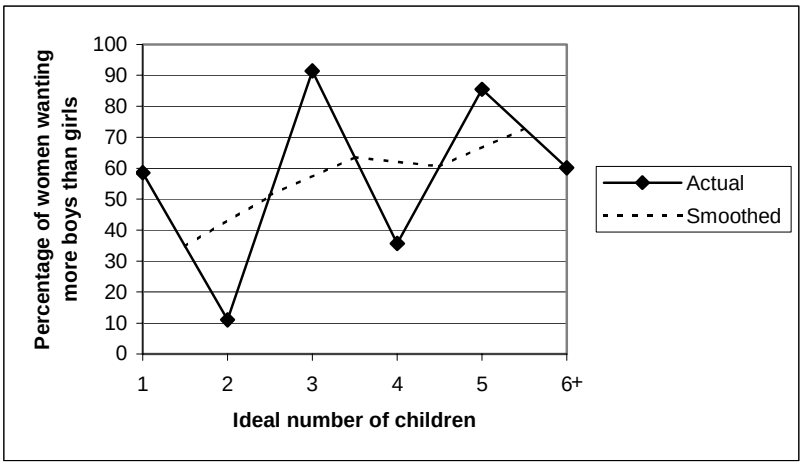
Source: Bhat and Zavier (1997).

Having demonstrated the utility of these data, we can now address the issue of what happens to son preference when ideal family size changes. In Table 1 we have presented some data relevant to this topic for northern India, that is, states of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab and Haryana. In this region, 55 percent women have reported more boys than girls in their ideal number of children, while only less than 2 percent of women have reported more girls than boys in their ideal family size. The proportion of women wanting more boys than girls is substantially higher among women who report their ideal family size in odd numbers compared with women who reported this in even numbers. This naturally happens because an even number can be divided into two equal integers, while an odd number cannot be so divided. Consequently, the proportion of women wanting more boys than girls shows a zigzag pattern of change with ideal family size (see Figure 3). A smoother pattern of change is discernible when the proportions for the two consecutive odd and even ideal family sizes are averaged (shown by the dotted line in Figure 3). It clearly shows that as ideal family size falls the son preference too falls. The proportion of women wanting more boys than girls is 73 percent when the ideal family size is 5 or 6, 64 percent when it is 3 or 4, and 35 percent when it is 1 or 2 (see Table 1). Thus it appears that as family size desires fall, the fall in son preference is initially slow, but it gains momentum when the family size desires becomes really small.

Table 1. Mean ideal number of sons, daughters, and children of either sex, percentage of women who want more sons than daughters and percentage who want more daughters than sons by ideal family size, northern India 1992-93

Ideal number of children	Mean Ideal number of Sons	Daughters	Either sex	Proportion of males In ideal family size	Percentage who want more boys than girls	Percentage who want more girls than boys	Number of women
1	0.59	0.07	0.34	0.59	58.6	7.4	440
2	1.02	0.82	0.16	0.51	11.1	0.2	9445
3	1.91	0.98	0.11	0.64	91.4	2.3	13219
4	2.29	1.60	0.11	0.57	35.7	0.6	7964
5	3.07	1.72	0.21	0.61	85.5	6.1	2082
6+	3.89	2.46	0.33	0.58	60.2	5.7	1387
Total	1.89	1.17	0.14	0.59	54.6	1.8	34537

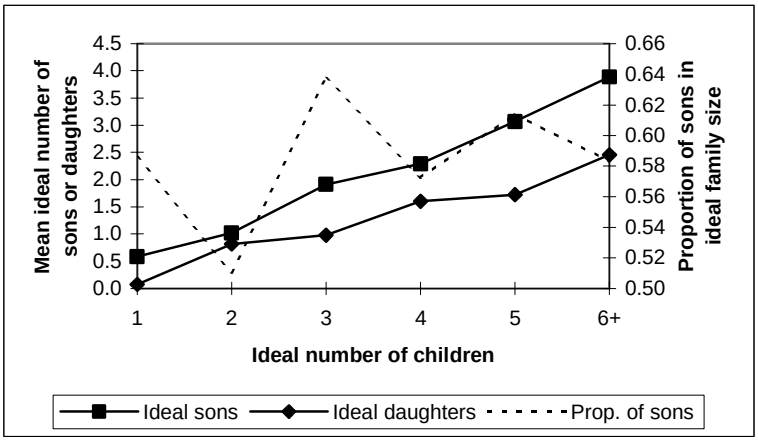
Figure 3. Percentage of women wanting more boys than girls, by ideal family size, northern India 1992-93



The observation that as family size desires fall, son preference too falls is contrary to what Das Gupta and Bhat had expected, but consistent with what Murthi *et al.* had suggested. In order to further understand how this relationship gets evolved, Figure 4 shows the reported mean sex composition of ideal number of children of 1, 2, 3... 6 and over. Women who have reported an ideal family size of three children wanted, on an average, 1 girl, 1.9 boys and 0.1 child of either sex (see Table 1). Women who have reported an ideal family size of five children wanted 1.7 girls, 3.1 boys and 0.2 child of either sex. It is clear from Figure 4 that although both ideal number of boys and ideal number of girls rise when women want more number of children, it is the former that rises more than the latter. But is the change in ideal number sons is proportionately more than the change in ideal number of children? Suppose, the ideal number of sons rises from 2 to 4 while ideal number of daughters rises from 1 to 2. This would imply a larger increase in ideal number of sons than

in ideal number of daughters but it will have no impact on the sex ratio of ideal number of children. Therefore in Figure 4 we have also shown the proportion of sons in deal number of children by ideal family size. It also shows a zigzag pattern of change associated with odd and even numbers of ideal family size. But there is an unmistakable suggestion of ideal number of sons increasing more rapidly than total ideal family size when odd and even family sizes are considered separately. For example, the proportion of sons in ideal family size increases from 0.59 to 0.64 when the ideal family size increases from 1 to 3, and from 0.51 to 0.57 when the ideal family size increases from 2 to 4 (see Table 6).

Figure 4. Mean ideal number of sons and daughters, proportion of sons in ideal family size, by ideal number of children, northern India 1992-93



Thus this simple bivariate analysis does indicate that ideal number of sons is more elastic to changes in ideal family size than ideal number of daughters. A more robust test will be performed later. But it is not difficult to understand why this should be the case. In India, women generally want no more than one female child. If they have reported more than one daughter, it is more often than not for keeping with their actual family composition (evidence for this is presented below). When women desire larger family sizes, they primarily want many sons. This has the necessary implication that when family sizes diminish, the desired number of sons would fall faster than the total number of children desired.

Determinants of Son Preference

The evidence based on desired or ideal family size is often viewed with scepticism. Women generally have difficulty in understanding and answering the hypothetical questions from which this information is collected. They also tend to adjust their fertility ideals upward to be consistent with their actual family size and composition. In spite of this, as the map in Figure 2 shows, the geographical variations implied by such data seem reliable. But how plausible are the variations by socio-economic groups? In an attempt to show that inferences drawn from the data on ideal family size are not misleading, we have analysed the determinants of son-preference as implied by the data on sex composition of ideal family

size. Although there is a vast literature on the effects of sex preference on demographic comes, rigorous, quantitative research on factors influencing sex preference has been scanty. Thus the following analysis may generally be valuable in understanding gender bias.

The analysis pertains to 26,605 ever-married women of age 13-49 belonging to the six states of northern India and had at least one live birth and supplied a numeric response to the question on ideal family size. As in the bivariate analysis, son preference is measured in two slightly different forms. In one form, if a woman had reported higher number sons than daughters in her ideal family size, she is assigned a value of one, and zero otherwise. As this version of the dependent variable is binary, it calls for a logistic regression. In another form, the dependent variable is the proportion of sons in the ideal family size reported by each respondent. It can be analysed through the ordinary least squares regression. The regression in this case is designed to test whether explanatory variables of the analysis affect the sex ratio of ideal family size.

As explanatory variables, the following variables are selected from the NFHS-1 data set: Women's age, residence, educational level, work status, religion and caste, exposure to media, and actual mortality of male and female children born. The size of the land owned by the household, and whether any part of the land is irrigated, are also considered for the analysis. But for the purpose of this analysis, the key explanatory variable is the ideal number of children. Although the ideal family size *per se* does not 'affect' its own sex composition, it is used here as a proxy to capture the effects of ideational changes associated with fertility decline when effects of other covariates are controlled.

In addition to these explanatory variables, we have included two special control variables in two alternate specifications of the base model. Earlier it has been noted that our index of son preference is sensitive to whether ideal family size is an odd or even number. To control for the fluctuations resulting from this, in one version of the model, we have used a dummy variable to represent the odd ideal family sizes. But because reporting an odd ideal family size could imply a predisposition to son preference, for measuring the covariate effects this model is not necessarily superior to the base model. In another specification, we have included a dummy variable to represent the sex of the last child. In cases where the last child is unwanted, there may be a tendency to rationalize its birth, and to include it in the counts of ideal family size. This could tilt the stated sex composition of ideal family size towards the sex of the last child.

Table 2 shows the results of our regression analyses. The results of the logistic and OLS regressions are very similar. They show that urban residence, educational level, and regular media exposure have independent, negative effects on son preference. It is interesting to note that husband's education too matters, as the results show that illiterate women with literate husbands have lower son preference than illiterate women with illiterate husbands. It is also observed that Muslim women and members of scheduled tribes have lower son preference than other women. But Sikh women and members of schedule castes are not significantly different from other Hindu women.

Table 2. Results of logistic and ordinary least-squares regressions of determinants of son preference, northern India, 1992-93.

Explanatory Variables	Logistic Regression: Ideal number of boys greater than ideal number of girls			Least-Squares Regression: Proportion of sons in ideal family size		
	Model I	Model II	Model III	Model I	Model II	Model III
Age of woman	-0.0157	-0.0164	-0.0226	0.0006	0.0006	0.0001
Age of woman sq.	0.0002	0.0002	0.0002	-0.0000	-0.0000	-0.0000
Urban residence	-0.1548 ***	-0.2539 ***	-0.1577 ***	-0.0191 ***	-0.0184 ***	-0.0192 ***
Size of landholding	0.0015	0.0030	0.0013	0.0002	0.0002 *	0.0002
Landholding sq.	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Have irrigated land	-0.0110	0.0055	-0.0129	0.0029	0.0034	0.0028
Exposed to media	-0.0982 **	-0.0862 *	-0.0950 **	-0.0124 ***	-0.0107 ***	-0.0122 ***
Ideal family size	1.7051***	0.9266 ***	1.7321***	0.0254 ***	0.0155 ***	0.0259 ***
Ideal family size sq.	-0.1739 ***	-0.0663 ***	-0.1764 ***	-0.0023 ***	-0.0014 ***	-0.0024 ***
Odd ideal family size	---	3.4375 ***	---	---	0.0837 ***	---
Last child is girl	---	---	-0.3408 ***	---	---	-0.0238 ***
Religion (Hindu = 0)						
Muslims	-0.1567 **	-0.0587	-0.1493 **	-0.0182 ***	-0.0139 ***	-0.0177 ***
Sikhs	-0.0704	0.1192	-0.0703	0.0016	0.0056	0.0016
Others	0.1077	0.0168	0.0993	-0.0119	-0.0151	-0.0125
Caste (Other castes = 0)						
Scheduled caste	0.0073	0.0100	0.0078	0.0033	0.0027	0.0033
Scheduled tribe	-0.2080 ***	-0.2486 ***	-0.2011***	-0.0154 ***	-0.0140 ***	-0.0148 ***
Education (Husband and wife illiterate = 0)						
Wife illiterate but husband literate	-0.0684 *	-0.1393 ***	-0.0692 *	-0.0076 **	-0.0083 **	-0.0076 **
Wife literate	-0.1756 ***	-0.3546 ***	-0.1814 ***	-0.0278 ***	-0.0278 ***	-0.0281 ***
Wife middle school Complete	-0.1966 **	-0.3351***	-0.2003 **	-0.0339 ***	-0.0318 ***	-0.0341 ***
Wife high school complete and above	-0.6929 ***	-0.7221 ***	-0.6955 ***	-0.0792 ***	-0.0670 ***	-0.0790 ***
Work status (Not working = 0)						
Working for wages	-0.0712	0.0168	-0.0694	-0.0104 *	-0.0082 *	-0.0102 *
Other workers	-0.0280	0.0543	-0.0296	-0.0008	0.0011	-0.0009
Number of children dead						
Males	0.0239	0.0383	0.0075	-0.0002	-0.0001	-0.0014
Females	0.0124	0.0474	0.0341	0.0001	0.0010	0.0016
State of residence (Uttar Pradesh = 0)						
Bihar	-0.0645	-0.0633	-0.0658	0.0013	0.0018	0.0012
Madhya Pradesh	-0.0793	-0.1392 *	-0.0826	0.0033	0.0035	0.0031
Rajasthan	0.1982 ***	0.2915 ***	0.1954 ***	0.0294 ***	0.0288 ***	0.0290 ***
Punjab	0.2043 ***	0.1473	0.1914 **	0.0014	-0.0013	0.0004
Haryana	-0.0297	-0.0605	-0.0427	-0.0330 ***	-0.0316 ***	-0.0340 ***
Constant	-2.6893 ***	-2.8561***	-2.4697 ***	0.5461 ***	0.5218 ***	0.5637 ***
-2LL	33713	21962	33548	---	---	---
Adjusted R^2	---	---	---	0.057	0.110	0.061
N	26605	26605	26605	26605	26605	26605

* p< 0.05, ** p< 0.01, and *** p<0.001.

Interestingly, size of landholding, possession of irrigated land and female work status do not show any significant effect on son preference when the dependent variable is binary, and marginal effects when it is proportion of sons. But the strong negative effect of urban residence is confirmed by both the versions of the dependent variable. This suggests that what matters to son preference is the sector of economy rather than the little distinctions within the traditional, agricultural sector. For example, a woman of landless households may aspire for many sons because with their help they could acquire land, even though she and her daughters go for wage employment for subsistence.

Son preference seems to be unaffected by age of women or by the number of dead sons or daughters. The non-existence of an age effect suggests that there is no cohort effect on son preference, but it does not rule out the possibility of a time effect. To keep with changing times, older women could have revised their son preference downward.

The results of the logistic and OLS regressions are slightly at variance when it comes to the significance of state dummies. Both types of regressions show that after controlling for covariate effects, son preference is higher in Rajasthan than in Uttar Pradesh while Bihar and Madhya Pradesh are not significantly different from Uttar Pradesh. But the logistic regressions show that son preference is also higher in Punjab than in Uttar Pradesh, while the OLS regressions fail to confirm this but show that son preference is lower in Haryana than in Uttar Pradesh. The result for Haryana is unexpected, as like Punjab and Rajasthan, it belongs to a region known for strong son preference (see Miller, 1981). In part, the state dummies in the regressions may be capturing variations in data quality, as in each state different field organisations were in charge of data collection.

Most importantly, even after controlling for other covariate effects, ideal family size exhibits strong positive effect on son preference. The fact that its effect is also significant when the dependent variable is proportion of sons in ideal family size confirms that ideal number of sons does fall more rapidly than ideal family size. As the square term of this variable is negative, declines in son-preference is found to be particularly large when ideal family size is small than when it is large. The bivariate analysis had also suggested such a non-linearity in the relationship (see Figure 3 or 4).

As expected, the dummy variable for odd ideal family size shows a strong positive effect on son preference (Model II). Although its inclusion in the model reduces substantially the residual variance, it has little impact on the estimated effects of other covariates, including ideal family size.

When a dummy variable for women whose last child was a girl is introduced, it shows a strong negative effect on son preference (Model III). This suggests that, other things remaining the same, those who had a girl as the last child reported relatively more number of females in their ideal family size than those who had a boy as the last child. This strongly suggests that women's reports of ideal family size and its sex composition were affected to some extent by rationalization. But as the inclusion of this dummy variable does not significantly alter the coefficients of other variables in the model, our main conclusions could be taken as largely valid.

Trends in Son Preference

A shortcoming of the above analysis is that it is based on the cross-sectional data. At times, the results of the cross-sectional analysis could be misleading. Data from the second round of the National Family Health Survey carried out in 1998-99 (hereafter NFHS-2) can be used to study the changes diachronically. Table 3 shows ideal number of children, proportion of sons in ideal family size, and percentage of women who reported more ideal number of boys than girls from the two rounds of the survey in 16 major states of India. At the all-India level, the ideal number of children has declined from 2.9 to 2.7 during the six-year interval between the NFHS-1 and NFHS-2. During the same period, percentage of women reporting more boys than girls in their ideal family size decreased from 42 to 33 percent and proportion of sons in ideal family size has declined from 55 to 52 percent. The table also shows that ideal number of children and percentage of women reporting more boys than girls in ideal family size have declined in every state, including those in the northern region. The proportion of sons in ideal family size too has declined in every state except Assam, Haryana and Maharashtra. The contrary tend seen in the three states could simply be due to rounding-off errors in the data on ideal number of children (data on ideal number of children and ideal number of sons are provided in the NFHS reports only up to the first decimal place).

Table 3. Percentage of women wanting more boys than girls, ideal number of children, proportion of sons in ideal family size, by state, NFHS 1992-93 and 1998-99

State	Percentage of women wanting more boys than girls			Ideal number of children			Proportion of sons in ideal family size		
	NFHS-1	NFHS-2	Change	NFHS-1	NFHS-2	Change	NFHS-1	NFHS-2	Change
Andhra Pradesh	33.0	19.8	-13.2	2.7	2.4	-0.3	51.9	41.7	-10.2
Assam	43.6	38.2	-5.4	3.2	2.9	-0.3	53.1	55.2	2.0
Bihar	55.8	47.9	-7.9	3.4	3.3	-0.1	58.8	57.6	-1.2
Gujarat	42.4	33.1	-9.3	2.6	2.5	-0.1	53.8	48.0	-5.8
Haryana	45.1	37.5	-7.6	2.6	2.5	-0.1	53.8	56.0	2.2
Himachal Pradesh	36.7	25.9	-10.8	2.4	2.2	-0.2	54.2	50.0	-4.2
Karnataka	27.0	13.0	-14.0	2.5	2.2	-0.3	52.0	40.9	-11.1
Kerala	18.3	14.0	-4.3	2.6	2.5	-0.1	42.3	40.0	-2.3
Madhya Pradesh	51.5	42.5	-9.0	3.1	2.9	-0.2	58.1	51.7	-6.3
Maharashtra	35.9	27.1	-8.8	2.5	2.3	-0.2	52.0	52.2	0.2
Orissa	45.1	37.6	-7.5	3.0	2.7	-0.3	56.7	55.6	-1.1
Punjab	48.0	29.1	-18.9	2.6	2.3	-0.3	57.7	52.2	-5.5
Rajasthan	57.6	47.5	-10.1	3.0	2.8	-0.2	63.3	57.1	-6.2
Tamil Nadu	11.5	9.6	-1.9	2.1	2.0	-0.1	42.9	40.0	-2.9
Uttar Pradesh	56.6	53.3	-3.3	3.4	3.1	-0.3	58.8	58.1	-0.8
West Bengal	31.9	20.7	-11.2	2.6	2.4	-0.2	53.8	45.8	-8.0
All India	41.5	33.2	-8.3	2.9	2.7	-0.2	55.2	51.9	-3.3

Source: International Institute for Population Sciences (1995); International Institute for Population Sciences and ORC Macro (2000); Bhat and Zavier (1999).

Thus, over time too, as ideal family sizes fall, son preference tends to fall rather than rise. This seriously questions the possibility of an intensification of sex bias as postulated by Das Gupta and Bhat. At least in the Indian context, their thesis requires a fresh look.

A Revised Proposal

If son preference declines with forces of modernization and fall in desired family size, why is the juvenile sex ratio rising in India? An answer is to be found in the sex composition of unwanted fertility and increasing availability of technologies to eliminate unwanted births of a given sex. Although son preference falls with the drop in desired family size, at any point in time, number of unwanted daughters is more than unwanted sons (see Figure 5). As shown earlier, in northern India, even when ideal family size drops to 1 or 2 children, one-third of women want more boys than girls. In such a situation, there could be increased manifestation of sex bias if the rise in the proportion of women adopting the new technologies of female feticide or traditional practice of female infanticide is higher than the fall in the proportion of women wanting more boys than girls.

Figure 5. A model of fertility transition in societies with strong son preference

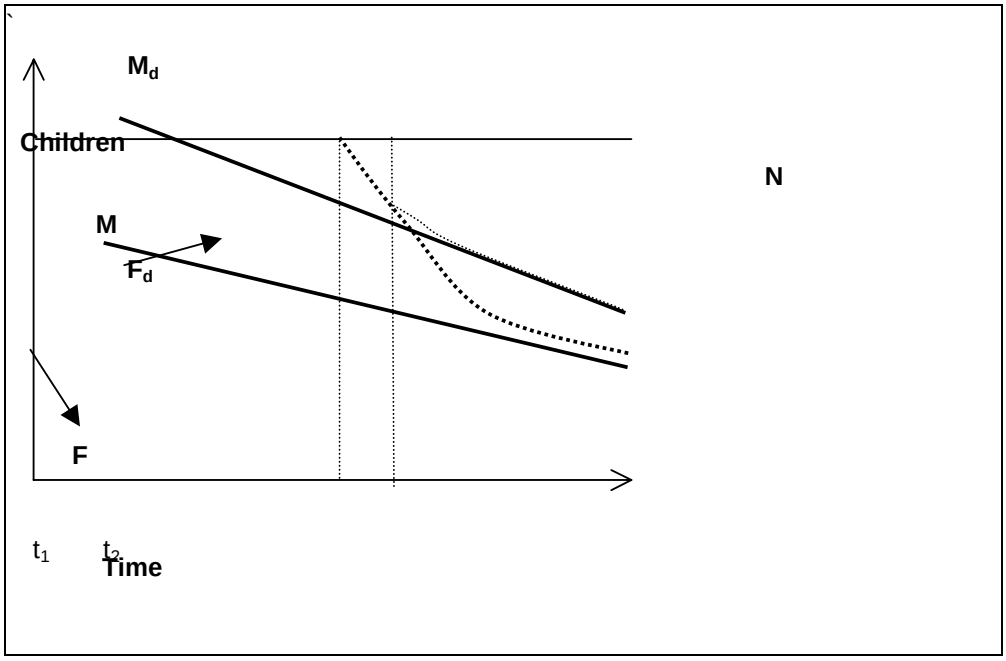


Figure 5 illustrates how such changes can occur in a society with a strong son preference. The lines M_d and F_d show the trends in desired number of sons and daughters during fertility transition. Because there is son preference, M_d is shown to be higher than F_d, but M_d is assumed to decline faster than F_d, as implied by our data on northern India. The line N shows the 'natural' constraint for the supply of both sons and daughters. At time before t_1, few deliberately attempt to control fertility, and many female children born are

unwanted while most of the male children born are wanted. Practice of female infanticide, either directly or indirectly through prolonged neglect, could be prevalent.

At time t_1, contraceptive technology becomes accessible to a sizeable proportion of the population, and fertility begins to fall. As this technology is gender-neutral in its effects on unwanted fertility, both male and female births follow the same trajectory of fall, as shown by the dotted line in Figure 5. But their paths would begin to diverge at time t_2 when pre-natal sex selection technologies become available. Male births (M) would move to meet the line M_d while female births (F) would proceed towards the line F_d. Even though the difference between M_d and F_d would be falling, the difference between M and F would increase, suggesting an increase in sex bias. As the moral burden of an abortion is lower than killing or neglecting a living child, even those who would not have resorted to the latter would tend to opt for the former. Consequently, increased manifestation of sex bias would be reflected in juvenile sex ratios.

We therefore suggest a simple modification to Das Gupta and Bhat's proposals regarding the effects of fertility decline on sex bias. While retaining their concept of parity effect, we propose to split the intensification effect into two parts: son-preference effect and technological effect. The son preference-effect refers to the fact that as family size desires fall son preference falls. Thus, like the parity effect, this effect has a favourable impact on sex bias. The technological effect refers to the result of greater access to technologies that help to eliminate unwanted births of a given sex. During fertility decline, its negative effect on sex bias can outweigh the positive effects of the other two if female births account for a large share of unwanted fertility. But if parents were to be denied of the access to such technologies, fertility decline will have a favourable effect on the sex ratio.

Impact on Sex Ratio at Birth

It would be useful to know how many male and female births are unwanted in northern India, and what will be the sex ratio at birth if all unwanted fertility is eliminated. Such a computation can be made from the NFHS data, following the approach used in estimating wanted fertility rates. A male birth is considered unwanted if the number of sons before its birth was greater or equal to the ideal number of sons, and a female birth is considered unwanted if the number of daughters before its birth was greater or equal to the ideal number of daughters. Women who gave non-numeric response to the question on ideal family size are assumed to want all their births.

To simplify computation, a reference period of one year before the NFHS-1 has been adopted for measuring fertility. By using data on birth history and ideal family size by sex, all women were classified as belonging to one of the following four categories of 'sex-preference-status' at the beginning of the reference period: (i) wanted only boys, (ii) wanted only girls, (iii) wanted children of either sex (iv) did not want any birth. Implicitly it is assumed that attitudes regarding ideal family size did not change during the year period preceding the survey. According to the NFHS-1 data for northern India, at one-year before the survey, 23 percent of women wanted only a boy, 10 percent wanted only a girl, 39 percent wanted a child of either sex and 28 percent wanted no more children. Table 4 shows

the live births during the year preceding the survey by sex according to women's wanted status. The data show an overall sex ratio at birth of 105 males per 100 females, a value that hardly suggests widespread practice of female feticide in northern India at the beginning of 1990s.

Table 4. Number of live births during the year preceding the survey by sex and according to sex-preference status of women, northern India, 1992-93

Preference status one year before the survey	Number of sample women *	Births during the year preceding the survey		Sex ratio at birth
		Males	Females	
Wanted only a boy	9072	1236	843	147
Wanted only a girl	4037	259	358	72
Wanted boy or girl	15426	1894	2049	92
Did not want any	11251	325	295	110
Total	39785	3714	3544	105
Sex ratio of wanted births =				130
Females in total unwanted births =				66%

* As per the weighted sample.

However, sex ratio at birth by sex-preference status shows quite an interesting pattern. Among those who wanted a boy, the sex ratio at birth was 147 while it was 72 for those who wanted a girl. In other words, those who wanted boys gave birth to more boys, and those wanted girls gave birth to more girls during the year. While female feticide can explain the higher sex ratio in former group, it is highly unlikely that male feticide are equally common in north India as suggested the sex ratio of the latter group. Sampling errors in the sex ratio at birth cannot explain this since the pattern of variation is similar in all the six states of northern India (see Table 5). But such a pattern could result if reports on ideal family size were affected by rationalization. If those who had a boy during the last year had upwardly adjusted their ideal number of sons, they would tend be classified in the first category. Similarly, if those who had a girl had upwardly adjusted their ideal number of daughters, they would disproportionately fall in the second category. Our multivariate analysis of determinants of son preference had indicated the presence of such a bias in the data on ideal number of children.

From these data we should still able to arrive at an unbiased estimate of the effect of removing unwanted fertility on the sex ratio at birth if rationalization had affected the reporting of ideal number of sons and daughters by an equal measure. Considering only male births of women who wanted boys, female births of women who wanted girls, and male and female births of women who wanted children of either sex, the sex ratio at birth in wanted fertility is estimated as 130 as against 105 in all births. Thus when all unwanted fertility is removed, the sex ratio at birth is expected to increase by 25 percentage points in northern India. The reason for this rise is that two-thirds of the unwanted births are females.

It may be noted that the estimated effect on the sex ratio at birth is significantly lower than what would be implied by the sex ratio of ideal family size of 162 (1.9 sons and 1.2 daughters). This must be because quite a few women have stopped childbearing before attaining their ideal sex composition.

By carrying out an age-specific analysis, we have also estimated wanted and unwanted total fertility rates by sex. These are shown in Table 6. The table also provides similar estimates for all the six states of northern India. The computations show that among 4.3 births born per woman in northern India, 3.2 are wanted. Of the 1.1 unwanted births born per woman, 0.4 are boys and 0.7 are girls. Neither the size of the unwanted fertility nor its sex composition varies significantly among the states. It is to be noted that state-specific estimates could have large sampling errors, as suggested by the wide variation in the sex ratio at birth. But the pattern observed in the expected rise in the sex ratio at birth as a result of eliminating all unwanted births seems quite plausible. The impact of removing the unwanted births on the sex ratio at birth is estimated to be significantly higher in Punjab and Haryana (a rise of nearly 50 percentage points) than in Uttar Pradesh or Bihar (a rise of about 20 percentage points). That is because among the wanted births, the sex ratio is highly skewed in favour of males in Punjab and Haryana.

Table 5. Wanted and unwanted total fertility rates by sex, and sex ratio at birth by sex-preference status, northern India 1992-93

	Northern India	Uttar Pradesh	Bihar	Madhya Pradesh	Rajasthan	Punjab	Haryana
Wanted total fertility rate							
Total	3.15	3.63	3.02	3.19	2.63	1.96	2.72
Male	1.79	1.98	1.68	1.93	1.56	1.21	1.76
Female	1.36	1.66	1.34	1.26	1.06	0.75	0.95
Unwanted total fertility rate*							
Total	1.11	1.17	1.17	0.98	1.10	0.98	1.15
Male	0.39	0.39	0.47	0.33	0.33	0.31	0.46
Female	0.72	0.77	0.70	0.65	0.77	0.67	0.69
Sex ratio at birth by sex-preference status							
Wanted only a boy	147	154	139	140	135	147	179
Wanted only a girl	72	51	94	109	86	61	67
Wanted boy or girl	92	86	87	112	96	93	112
Did not want any	110	95	145	107	94	100	148
All births	105	97	105	119	106	107	131
Wanted births	130	116	126	151	145	155	177
Expected rise in sex ratio at birth	25	19	21	33	39	48	47

* Difference between actual and wanted TFR.

Conclusion

Our analysis clearly shows that as desired family size falls, son preference also falls in northern India. Evidence is presented to show that son preference also declines with the modernizing influence of education, urbanization and exposure to mass media. This seems to contradict the observed rise in juvenile sex ratios with the declines in fertility. We propose that the two trends could be reconciled by splitting the hypothesized intensification effect of fertility decline into two parts: son-preference effect and technological effect. While the parity and son-preference effects of fertility decline would reduce the sex bias, the increasing ability of parents to eliminate children of unwanted sex would intensify the sex bias. It is estimated that in northern India the unwanted fertility is about one birth per woman, and two-thirds of such births are girls. The complete elimination of unwanted births would increase the sex ratio at birth from 105 to 130 boys per 100 girls. But by denying the access to technologies that aid in choosing children's sex, it should be possible to augment the favourable effects of fertility decline on sex bias.

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