FERTILITY DECLINE AND GENDER BIAS IN NORTHERN INDIA*

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Although it is widely acknowledged that the preference for sons is a barrier to a decline in fertility, considerable disagreement exists as to what actually happens to this preference when fertility declines in a region of low female autonomy. By analyzing the data from the National Family Health Survey (NFHS), we present evidence from northern India to show that the preference for sons is reduced when the ideal family size becomes small, even though it does not completely disappear. This finding appears to contradict trends in the juvenile sex ratio and the incidence of female feticide that suggest the intensification of gender bias. We argue that the anomaly is the result of a diffusion of prenatal sex-diagnostic techniques in regions where there is a large unmet demand for such methods. Using the NFHS data, we estimate that in northern India, girls currently constitute about 60% of the unwanted births and that the elimination of unwanted fertility has the potential to raise the sex ratio at birth to 130 boys per 100 girls.

The existence of a strong preference for sons in India, particularly in northern India, has now been thoroughly established through a wide variety of data (Arnold, Choe, and Roy 1998; Miller 1981; Williamson 1976). At the same time, there is growing international concern about the issue of "missing" females and the increasing masculinity of India's population (Agnihotri 2000; Coale 1991; Das Gupta and Bhat 1997; Griffiths, Matthews, and Hinde 2000; Guillot 2002; Klasen 1994; Mayer 1999; Sen 1990; Sudha and Rajan 1999). A noteworthy aspect of the century-long trend of rising masculinity in India's population is that in recent years, this increase has been due mainly to the increase in the sex ratio at juvenile ages (for a review, see Bhat 2002a).[1] As the sex ratio in the age group 0–6 was increasing, the level of fertility was declining, as indicated by the downward trend in the proportion of the population in this age group. By showing a further increase in the juvenile sex ratio, the preliminary results of the latest Indian census (Registrar General, India 2001) have fueled the speculation that gender discrimination is intensifying in India.

The concomitant trends in fertility and the juvenile sex ratio suggest that the two could be related. Das Gupta and Bhat (1997) 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 are unwanted and are subject to higher mortality, as suggested by Das Gupta's (1987) classic study in Punjab. As fertility falls, the percentage of higher-order births would reduce, which ought to improve the survival chances of girls because a larger proportion of those who are born are wanted ones. In itself, this "parity effect" on child survival should have caused a decline in the juvenile sex ratio. But Das Gupta and Bhat suggested that as fertility decreases, sex discrimination could also spread to lower-order

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1. The Indian literature on the sex ratio uses, by convention, the ratio of females to males. In this article, we have adopted the international convention of the ratio of males to females.

female births if the drop in the desired family size is not accompanied by a proportionate decrease in the 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. For Das Gupta and Bhat, the upward trend in the juvenile sex ratio and the rising incidence of female feticide and infanticide in India suggest that the parity effect is overshadowed by the "intensification effect." The preliminary results of the 2001 Indian census appear to confirm their view.

Another body of research has suggested that the low autonomy of women and the strong preference for sons are major impediments to sustained declines in fertility and the rise in the use of contraception in countries like India (Basu 1992; Das 1987; Dreze and Murthi 2001; Jejeebhoy 2001; Kulkarni 1999; Malhotra, Vanneman, and Kishor 1995; Mason 1984, 1993; Murthi, Guio, and Dreze 1995; Mutharayappa et al. 1997). In part, it was the vigorous articulation of this view by women's groups at the International Conference on Population and Development at Cairo in 1994 that made gender equity the cornerstone of population policy worldwide (United Nations 1995). But if high fertility, low female autonomy, and the preference for sons are complimentary by nature, why does gender bias intensify when fertility declines? Is it because fertility has been declining independent of these factors? Or is the intensification of gender bias a myth? What truly happens to the preference for sons when fertility declines?

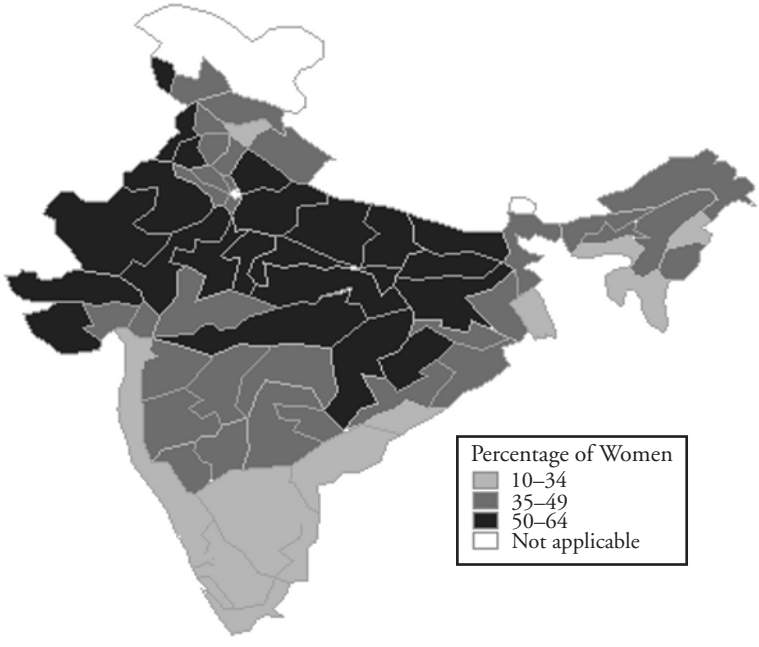
It is possible that the reduction in the preference for sons and the increase in the autonomy of women are not necessary conditions for a decline in fertility, for much of the evidence that relates the two to fertility level has come from cross-sectional data. From data that are based on a single cross section, it is difficult to establish whether the factors involved are catalytic or causal. There is a dearth of data on how much the preference for sons or, for that matter, the autonomy of women changes during the course of fertility transition. In the latter case, the paucity of information is understandable, to some extent, because the concept is vague and difficult to measure. But in spite of the huge literature on the effects of sex preference on demographic outcomes, there have been few studies on trends in and determinants of the preference for sons. We found only two studies—one that used district-level data on sex differences in child mortality for India (Kishor 1993) and another that obliquely touched on the issue of determinants of the preference for sons at the individual level (Clark 2000). Feminist writings have, of course, identified patriarchy inheritance laws and farming systems as the root causes, but they have not adequately addressed changes at the micro level.

In this article, we address the issue of what happens to the preference for sons as fertility falls and how the two are related to the trend in juvenile sex ratios in India. In doing so, we found that the usual measures of the preference for sons, which were derived from demographic outcomes, such as sex ratios, sex differences in mortality, or the use of services, are inadequate because these indices are contaminated by the changing ability of couples to put preferences into practice. In particular, we found it necessary to separate the effects of technological changes that could induce sex biases to manifest in new forms from those that influence the latent ones. To get to the repressed biases as far as possible, we used data on the sex composition of the ideal family size and wanted fertility by sex. Because these data could be contaminated by rationalization, we took steps to show that in spite of widely held skepticism, they indicate the expected pattern of variations (and thus appear to be reliable) and used statistical controls to minimize the effects of likely biases in the data.

REGIONAL VARIATIONS IN THE PREFERENCE FOR SONS

The data we used came from the two National Family Health Surveys (NFHS-1 and NFHS-2), conducted on lines similar to the Demographic Health Surveys throughout the developing world (International Institute for Population Sciences, IIPS, 1995; IIPS and

Figure 1. The Percentage of Women Who Reported More Boys Than Girls in Their Ideal Family Size, 76 Natural Regions: 1992–1993



Source: Bhat and Zavier (1999).

ORC Macro 2000). In these surveys, ever-married women were asked to state the number of children they would like to have if they could start the process afresh. The question was intended to capture preferences regarding the ideal family size, rather than the desired family size that takes into consideration the socioeconomic constraints on fertility. But given the difficulty in answering such a hypothetical question, a slight conceptual difference between the two measures could be ignored. In NFHS-1, conducted in 1992–1993, 10% of the women gave nonnumeric answers (e.g., "it's up to God," "can't say") to the question on ideal family size, and in NFHS-2, conducted in 1998–1999, 7% did so. Those who gave numeric answers to the question 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. A simple index of the preference for sons 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 computed this index for 76 natural regions of India using the data from NFHS-1 (Bhat and Zavier 1999). Figure 1 presents a map showing the regional variation in this indicator of the preference for sons. The regions of this high and low preference are clearly demarcated in the map. The preference for sons, as measured by this index, is the highest in the northern plains and central uplands of India, where the proportion of women who want more sons than daughters ranges from 50% to 64%. But as one moves southward from the Vindhyas (central uplands), the preference for sons diminishes, and the proportion who want more boys than girls falls below 20% when one reaches the southernmost states of Tamil Nadu and Kerala. The regional variation in the preference for sons that is depicted by our index corresponds well with the regional variation in female autonomy first described by Karve (1965) and elaborated and introduced to

demographers by Dyson and Moore (1983). The data from the NFHS-2 also show similar geographic variations (not shown).

The utility of the data on ideal family size and its sex composition are often questioned because they could be affected by the tendency of respondents to rationalize what has already happened or to give responses that they think would please the interviewer. Although the presence of such biases in the data cannot be ruled out, as Figure 1 shows, they do not seriously affect the systematic variations in the preference for sons. For most statistical analyses, what matters is the reliability of the patterns of variations and covariations, not the preciseness of population averages. In theory, it can be contended that the map in Figure 1 depicts the true variation because as a consequence of rationalization, the composition of the ideal family size closely resembles the composition of the actual number of surviving children. But in practice, this could hold true only for a minority of cases. The ideal family size and its sex composition was the same as the realized size and composition for only 16% of the women in NFHS-1 and 17% of the women in NFHS-2. In addition, not all these responses reflect rationalization because some of the women may have realized their desired goals through deliberate planning. Even if it is granted that rationalization affected the responses to a substantial degree, for us what is required is only for the index to capture the true variations in the preference for sons, not how it managed to do so.

THE PREFERENCE FOR SONS AND FAMILY SIZE

Using the NFHS data, we can easily show that the total fertility rate is higher in states in which there is a greater preference for sons. But such an analysis does not indicate whether fertility declines because of a reduction in the preference for sons or whether regions with a weak preference for sons provide the enabling environment for fertility to fall. One way to gain insight into these issues is to examine what happens to the preference for sons when the ideal family size changes. Because one would be particularly interested in knowing about this relationship in a region that is characterized by a strong preference for sons, we analyzed the data for northern India, which consists of the states of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab, and Haryana.[2] Table 1 presents some relevant data on this topic from NFHS-2 (for similar data from NFHS-1, see Bhat and Zavier 2001). In this region, 47% of the women reported a preference for more boys than girls in their ideal number of children, and only 2% reported a preference for more girls than boys. The table also shows that the proportion of women who wanted more boys than girls was substantially higher among those who reported their ideal family size in odd numbers, rather than in even numbers. Such a pattern is observed because an even number can be divided into two equal integers, whereas an odd number cannot. Consequently, the proportion of women who wanted more boys than girls shows a zigzag pattern of change with ideal family size (see Figure 2). But when the odd and even numbers are considered independently, there is a clear indication that the preference for sons falls with declines in the ideal family size. A similar pattern also emerges when the reported ideal family sizes are grouped as 1–2, 3–4, and 5 or more (shown by the dotted line in Figure 2). The proportion of women who wanted more boys than girls is 75% when the ideal family size is 5 or more, 67% when it is 3 or 4, and 12% when it is 1 or 2. Thus, it appears that the decline in the preference for sons is initially slow but gains momentum once the ideal family size becomes really small.

The observation that the preference for sons falls with declines in the ideal family size is contrary to what Das Gupta and Bhat (1997) assumed. To clarify further how this relationship evolves, Table 1 shows the sex composition of the ideal number of children

2. Also included in the region are three new states, Jharkhand, Uttaranchal, and Chattisgarh, formed from the states of Bihar, Uttar Pradesh, and Madhya Pradesh, respectively.

Table 1. The Mean Ideal Number of Sons, Daughters, and Children of Either Sex; the Percentage of Women Who Wanted More Sons Than Daughters; and the Percentage of Women Who Wanted More Daughters Than Sons, by the Ideal Family Size, Northern India: 1998–1999

Ideal Number of Children	Mean Ideal Number of			Proportion of Sons in the Ideal Family Size	% Who Wanted More Boys Than Girls	% Who Wanted More Girls Than Boys	Number of Women
	Sons	Daughters	Either Sex				
1	0.50	0.07	0.43	0.50	49.7	6.9	799
2	0.98	0.81	0.23	0.49	9.3	0.2	12,361
3	1.89	0.97	0.15	0.63	92.1	2.4	12,487
4	2.19	1.68	0.16	0.55	26.2	0.4	7,526
5	3.04	1.75	0.21	0.61	84.4	10.1	1,549
6+	4.01	2.41	0.74	0.59	60.3	5.6	950
Total	1.71	1.12	0.20	0.56	47.4	1.7	35,672

of 1, 2, 3, 4, 5, and 6 or more. Women who reported an ideal family size of 3 children wanted, on average, 1.9 boys, 1 girl, and 0.1 child of either sex. Women who reported an ideal family size of 2 children wanted 1 boy, 0.8 girl, and 0.2 child of either sex. As Figure 3 shows, although both the ideal number of boys and the ideal number of girls increase when women want more children, it is the former that rises more than the latter. But is the change in the ideal number of sons proportionately more than the change in the

Figure 2. The Percentage of Women Who Wanted More Boys Than Girls in Their Ideal Family Size, by the Ideal Number of Children, Northern India: 1998–1999

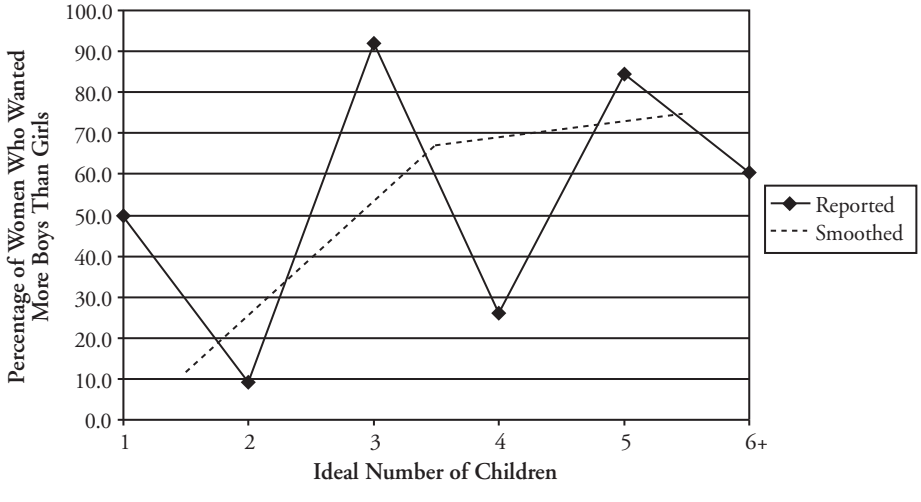
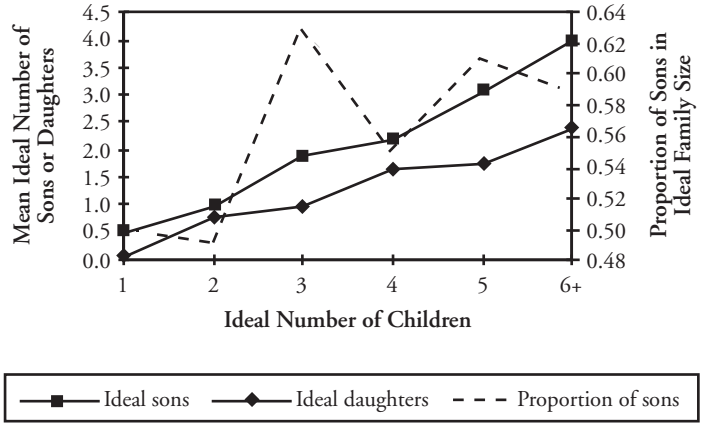


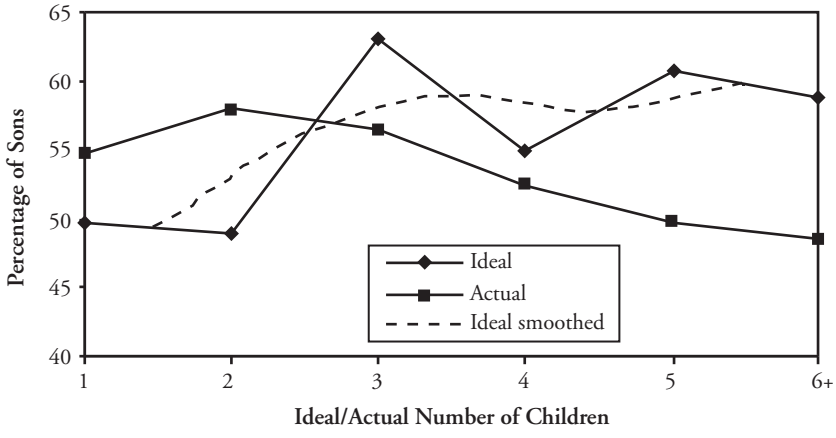
Figure 3. The Mean Ideal Number of Sons and Daughters and the Proportion of Sons in the Ideal Family Size, by the Ideal Number of Children, Northern India: 1998–1999



ideal number of children? Suppose the ideal number of sons increases from 2 to 4 while the ideal number of daughters increases from 1 to 2. It would imply a larger increase in the ideal number of sons than in the ideal number of daughters, but it would have no impact on the sex ratio of the ideal number of children. Therefore, Figure 3 also shows the proportion of sons in the ideal number of children by the ideal family size. It depicts a zigzag pattern of change associated with the odd and even numbers of children in the ideal-size family. But there is an unmistakable suggestion that the ideal number of sons increases more rapidly than the total ideal family size when odd and even family sizes are considered separately. For example, the proportion of sons in the ideal family size increases from .50 to .63 when the ideal family size increases from 1 to 3, and it rises from .49 to .55 when the ideal family size increases from 2 to 4 (see Table 1).

Is it possible that we observed this trend in the sex composition of the ideal family size because of rationalization? As a matter of fact, rather than having caused the ideal number of sons to decrease more rapidly than the total ideal family size, the rationalization bias may have caused it to fall less rapidly with the ideal family size. Such a conclusion emerged from an analysis of the sex composition of living children according to the total number of living children. As Figure 4 shows, in northern India, the percentage of sons among living children falls as the total number of children increase beyond two. It occurs because of the tendency to stop bearing children once the desired number of sons is born. As a result, smaller families are composed more of sons, whereas large families are composed more of daughters. If there were a strong tendency to report the actual number of children as the ideal number of children, the proportion of sons in the ideal family size would have declined with the increase in the ideal family size. Instead, it sharply rises when the ideal family size increases from two to four and tends to level off thereafter (see Figure 4). Because women with many children are likely to adjust their ideals upward, the nonlinearity at higher ideal family sizes could be due to rationalization. Therefore, the biases in the reports of the ideal family size cannot explain why the decrease in the ideal number of sons is proportionately more than the decrease in the total ideal number of children.

Figure 4. The Percentage of Sons in the Ideal and Actual Family Size, by the Ideal and Actual Family Size, Northern India: 1998–1999



Thus, the simple bivariate analysis indicates that the ideal number of sons is more elastic to changes in the ideal family size than is the ideal number of daughters. A more robust test will be reported later. But it is not difficult to understand why this should be the case. Among Hindus, there is a general desire to have one daughter because it is considered sacramental to give away one daughter in marriage. But more than one daughter is seen as adding to the family's costs, rather than to its benefits. In contrast, sons are viewed as productive assets, who are required to provide support in old age, to perform religious rites after death, and to continue the family line. Thus, when women want large families, their primary desire is to have many sons. A customary wish extended to a young Hindu woman is to be a mother of eight sons. As a logical corollary, it follows that when family sizes diminish, the desired number of sons would fall faster than the total number of desired children.

TRENDS IN THE PREFERENCE FOR SONS

A shortcoming of the foregoing analysis is that it was based on cross-sectional data. At times, the results of a cross-sectional analysis could be misleading. Data from the NFHS-1 and NFHS-2 can be used to study the changes diachronically. Table 2 shows the ideal number of children, the proportion of sons in the ideal family size, and the percentage of women who reported a desire for more 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 declined from 2.9 to 2.7 during the six-year interval (1992–1993 to 1998–1999) between the NFHS-1 and NFHS-2. During the same period, the percentage of women who reported a greater number of boys than girls in their ideal family size decreased from 42% to 33%, and the proportion of sons in the ideal family size declined from 55% to 52%. In addition, the table shows that the ideal number of children and the percentage of women who reported more boys than girls in the ideal family size declined in every state, including the states in the northern region. The proportion of sons in the ideal family size also declined in every state, except Assam. Thus, over time, as the ideal family sizes fall, the preference for sons tends to fall, rather than rise.

Table 2. The Percentage of Women Who Wanted More Boys Than Girls, the Ideal Number of Children, and the Percentage of Sons in the Ideal Family Size, by State: NFHS 1992–1993 and 1998–1999

	Percentage of Women Who Wanted More Boys Than Girls			Ideal Number of Children			Percentage of Sons in the Ideal Family Size		
State	NFHS-1	NFHS-2	Change	NFHS-1	NFHS-2	Change	NFHS-1	NFHS-2	Change
Andhra Pradesh	33.0	19.8	–13.2	2.75	2.41	–0.34	49.2	43.5	–5.7
Assam	43.6	38.2	–5.4	3.17	2.91	–0.26	54.3	54.5	0.2
Bihar	55.8	47.9	–7.9	3.40	3.26	–0.15	58.6	57.8	–0.7
Gujarat	42.4	33.1	–9.3	2.60	2.48	–0.11	52.4	47.7	–4.7
Haryana	45.1	37.5	–7.6	2.56	2.54	–0.02	55.1	54.3	–0.8
Himachal Pradesh	36.7	25.9	–10.8	2.36	2.17	–0.19	54.0	50.7	–3.3
Karnataka	27.0	13.0	–14.0	2.54	2.19	–0.35	50.3	40.6	–9.7
Kerala	18.3	14.0	–4.3	2.62	2.53	–0.09	40.3	37.8	–2.5
Madhya Pradesh	51.5	42.5	–9.0	3.12	2.90	–0.22	58.5	53.0	–5.5
Maharashtra	35.9	27.1	–8.8	2.55	2.31	–0.24	51.9	50.2	–1.7
Orissa	45.1	37.6	–7.5	3.01	2.67	–0.34	57.0	55.5	–1.5
Punjab	48.0	29.1	–18.9	2.57	2.27	–0.30	57.8	51.2	–6.6
Rajasthan	57.6	47.5	–10.1	3.02	2.80	–0.22	61.5	58.4	–3.1
Tamil Nadu	11.5	9.6	–1.9	2.08	2.04	–0.04	41.4	37.2	–4.2
Uttar Pradesh	56.6	53.3	–3.3	3.37	3.15	–0.22	59.3	58.5	–0.8
West Bengal	31.9	20.7	–11.2	2.58	2.37	–0.21	53.3	45.9	–7.3
All India	41.5	33.2	–8.3	2.86	2.65	–0.21	54.5	51.3	–3.2

Sources: Bhat and Zavier (1999); IIPS (1995); IIPS and ORC Macro (2000).

DETERMINANTS OF THE PREFERENCE FOR SONS

As we pointed out earlier, although there is a vast literature on the effects of sex preference on demographic outcomes, rigorous, quantitative analyses of factors that influence sex preference have been surprisingly scanty. Our data on India suggest that the preference for sons has been decreasing along with fertility. What factors could be influencing this decline? To gain insights into this issue, we analyzed the determinants of the preference for sons in northern India, as implied by the data on the sex composition of the ideal family size. Such an analysis also allowed us to test whether the positive relationship between the preference for sons and the ideal family size that was observed in the bivariate analysis also holds true in the multivariate context. In particular, it would be interesting to see what happens to this relationship when the main source of rationalization bias is eliminated in the regression analysis by controlling for the actual family size and its sex composition.

This analysis used data from both NFHS-1 and NFHS-2. Our sample consisted of ever-married women aged 50 and younger in the six states of northern India who supplied a nonzero, numeric value for their ideal family size. There were, respectively, 29,720 and

33,133 such women in the unweighted samples of NFHS-1 and NFHS-2. As in the bivariate analysis, we measured the preference for sons in two slightly different forms. In one form, if a woman reported more sons than daughters in her ideal family size, she was assigned a value of 1, and 0 otherwise. Because this version of the dependent variable is binary, we analyzed it using logistic regression. In another form, the dependent variable was the proportion of sons in the ideal family size of each respondent. Although this variable is not strictly continuous, there would be no serious violation of the normal assumptions of linear regression if the model was estimated through the ordinary least-squares (OLS) method. The regression in this case was designed to test whether the explanatory variables of the analysis affect the sex ratio of ideal family size.

As explanatory variables, the following variables were selected from the NFHS data set: the women's age, residence, educational level, exposure to the mass media, religion and caste, work status, and standard of living. Through women's age, we intended to capture the cohort effect on the preference for sons, that is, whether younger women have a weaker preference for sons than do older women. We expected urban residence, educational level, and exposure to the mass media to reduce the preference for sons because they are associated with the inculcation of modern, egalitarian values in a traditional society. Religion and caste could have an influence on the preference for sons because they help to delineate sex roles and the position of women among their people. For example, marriage customs could influence sex preference. If the majority of higher-caste Hindus give dowries at the marriages of their daughters, Muslims and lower-caste Hindus have a tradition of bride price or dower. The preference for sons could also be higher among higher-caste Hindus because only sons could perform religious rites for parents after their death. But the practice of veiling women (*paradha*), which epitomizes the seclusion of women, was essentially a Muslim custom adopted by the Hindus of northern India. It is also known that women of various aboriginal groups of India (scheduled tribes) are economically more active and enjoy great autonomy than do Hindus whose agricultural practices require hard labor.

Economic considerations can also play an important part in the preference for sons. In regions and households where women are economically active, daughters may be more valued, and thus the preference for sons could be weak. Normally, the preference for sons and economic prosperity should be inversely related because in the patriarchal, agrarian cultures of south Asia, sons are viewed as an insurance against risk (Cain 1983). An increase in wealth should lower the preference for sons by reducing concerns about security, particularly in old age. But some social anthropologists (e.g., Srinivas 1989) in India have suggested that an increase in wealth and upward social mobility are associated with the adoption of customs of higher castes, such as the immurement of women and the practice of dowry (a phenomenon known as Sanskritization, as opposed to Westernization). The 2001 Indian census registered a substantial decline in the juvenile sex ratio in regions that are more prosperous (Registrar General, India 2001), which caused the Indian mass media to speculate that prosperity has been leading to the marginalization of women. Therefore, to ascertain which effect really dominates, we included an index of wealth, constructed from household assets and ownership of consumer durables, in the regression. The NFHS-2 data set provides a preconstructed index of the standard of living in the categorical scale (IIPS and ORC Macro 2000). For NFHS-1, we constructed a similar index but from a slightly shorter list of household assets.

Because our main objective was to examine what happens to the preference for sons when fertility falls, we included the ideal family size in the analysis as an explanatory variable. But it is not disputed that ideal family size and its sex composition are jointly determined. The inclusion of the ideal family size as an explanatory variable is justified on the grounds that other socioeconomic variables included in the analysis are unlikely to capture all the factors responsible for the decline in fertility. The ideal family size could

serve as a useful proxy for ideational changes and program interventions that could reduce fertility independent of socioeconomic development. The possibility that these factors have played an important role in the decline in Indian fertility has been discussed elsewhere (see Bhat 1998, 2002b; Guilmoto and Rajan 2001; Srinivasan 1995). Because the earlier bivariate analysis suggested that the relationship between the preference for sons and the ideal family size is nonlinear, we used the square of the ideal family size to capture its impact.

An advantage of the multivariate analysis is that it allowed us to use several control variables to account for the possible biases in the measures of the preference for sons. The earlier analysis showed that our indices of the preference for sons indicate systematic variations, depending on odd and even numbers of ideal family size. Therefore, a dummy variable for the odd numbers was included in the regression. To minimize the effect of rationalization bias, we included male and female living children as additional explanatory variables. If the rationalization bias is strong, we would expect women to show a greater preference for sons when there were more male children in the family and a lesser preference for sons when there were more daughters. It is also possible that women who wanted more sons had more of them because they stopped bearing children at an appropriate time in the family-building process. If so, it would not be necessary to control for the effects of the actual number of sons and daughters. But we still did so to remove all traces of rationalization in the reports of ideal family size.

Furthermore, it is possible that the reporting of more sons in ideal family size is related to the deaths of boys in the family and the reporting of more daughters in the ideal family size is related to the deaths of girls in the family. Therefore, the number of dead sons and the number of dead daughters were included as additional controls. The capabilities of interviewers and the data-collecting agency could also influence responses on the ideal family size and its sex composition. In the NFHS, different agencies were in charge of data collection in different states. Therefore, state dummy variables were included in the regression to control for biases resulting from this source. These dummy variables may also capture real regional variations in the preference for sons that are not accounted by other explanatory variables.

Table 3 presents the results of the logistic regression using the qualitative preference-for-sons variable and the results of the OLS regression using the proportion of sons in the ideal family size, derived from the data in both NFHS-1 and NFHS-2. In the case of the logistic regression, the estimated odds ratios are shown; values greater than 1 indicate a positive relationship with the preference, and values less than 1 indicate a negative relationship. The results of the two types of regressions are similar. The results obtained from using the data from NFHS-1 and NFHS-2 also differ only marginally. Consider first the control variables that were used to minimize the possible biases in the measures of the preference for sons. The number of sons in a family has a strong positive effect on the reported preference for sons in all regressions. The data from both NFHS-1 and NFHS-2 indicate that having an additional son increases the odds of preferring more boys than girls by 39% and the proportion of sons in the ideal family size by 2%. An additional daughter is shown to reduce the reported preference for sons, but its effect is not as strong or significant as the positive impact of having a son. There are two alternate interpretations of this result. On the one hand, the finding may indicate that parents may rationalize the birth of boys more than the birth of girls, and, consequently, measures of the preference for sons that are derived from the ideal family size may have an upward bias. On the other hand, it may indicate that those who had a strong preference for sons stopped bearing children after they had more sons. Perhaps both tendencies are present in the data.

The past mortality of sons is shown to increase the stated preference for sons, but its effect is statistically significant only in the models estimated from the NFHS-2 data. The results indicate that the death of daughters has no effect on the stated preference for sons.

Table 3. Results of the Logistic and OLS Regressions of the Determinants of the Preference for Sons, Northern India: NFHS-1 and NFHS-2

	Logistic Regression[a]: Ideal Number of Boys Greater Than Ideal Number of Girls		OLS Regression: Proportion of Sons in the Ideal Family Size	
Explanatory Variables	NFHS-1	NFHS-2	NFHS-1	NFHS-2
Age of Woman	0.9581**	0.9527**	–0.0021*	–0.0010
Age of Woman, Squared	1.0005*	1.0005*	0.0000	0.0000
Ideal Family Size	2.6814***	2.0201***	0.0142***	0.0132***
Ideal Family Size, Squared	0.9318***	0.9658***	–0.0014***	–0.0007*
Odd Ideal Family Size (Even = 0)	34.6915***	50.6077***	0.0853***	0.0956***
Urban Residence (Rural = 0)	0.7474***	0.7840***	–0.0219***	–0.0256***
Regular Exposure to Media (No = 0)	0.9021*	0.8571***	–0.0115***	–0.0113***
Religion (Hindu = 0)				
Muslims	0.8886	0.7863***	–0.0189***	–0.0205***
Sikhs	1.2086*	1.3731**	0.0085	0.0176**
Christians	0.3914	0.4947**	0.0193	–0.0508**
Others	1.2005	0.4660**	–0.0152	–0.0302*
Caste (Other castes = 0)				
Scheduled caste	0.9561	0.9255	–0.0021	–0.0061*
Scheduled tribe	0.7838***	0.7270**	–0.0120***	–0.0146**
Education (Husband and wife illiterate = 0)				
Wife illiterate but husband literate	0.8938**	0.9302	–0.0065*	–0.0031
Wife literate	0.7513***	0.7992***	–0.0215***	–0.0164***
Wife middle school complete	0.7136***	0.6686***	–0.0310***	–0.0274***
Wife high school complete and above	0.5464***	0.4314***	–0.0577***	–0.0601***
Standard-of-Living Index (Low = 0)				
Medium	1.0034	0.9369	–0.0005	–0.0048
High	0.9245	0.8363**	–0.0099**	–0.0091*
Work Status (Not working = 0)				
Working for wages	1.0384	0.9123	–0.0070	–0.0116***
Other workers	1.0884	1.1799**	0.0026	0.0036

(continued)

Several state dummy variables are significant in the regressions, but there is no systematic pattern in their significance to suggest that they capture the regional-cultural differences in the preference for sons. The random pattern in their significance, especially the inconsistency between the NFHS-1 and NFHS-2 results, suggests that the state differences arise largely from variations in data quality, as we hypothesized earlier.

Even after other covariate effects were controlled, the ideal family size has a strong positive effect on the preference for sons when it is measured either in the binary form or in terms of proportions. This finding suggests that not all the variations in ideal family size are captured by the covariates included in the model, and the residual effects are such

(Table 3, continued)

Explanatory Variables	Logistic Regression[a]: Ideal Number of Boys Greater Than Ideal Number of Girls		OLS Regression: Proportion of Sons in the Ideal Family Size	
	NFHS-1	NFHS-2	NFHS-1	NFHS-2
Number of Living Children				
Males	1.3869***	1.3883***	0.0187***	0.0162***
Females	0.8046***	0.8369***	–0.0045***	–0.0003
Number of Children Dead				
Males	1.0422	1.0829**	0.0005	0.0046*
Females	1.0515	1.0033	0.0013	0.0026
State of Residence (Uttar Pradesh = 0)				
Bihar	0.9273	0.8002***	0.0007	–0.0059
Madhya Pradesh	0.8513**	0.6488***	0.0013	–0.0406***
Rajasthan	1.3600***	0.9166	0.0302***	0.0019
Punjab	1.1643	0.7230**	–0.0038	–0.0343***
Haryana	0.9517	0.9551	–0.0338***	–0.0124**
Constant	0.0670***	0.1074***	0.5584***	0.5333***
–2 Log-Likelihood	23,450	23,636	NA	NA
Adjusted R^2	NA	NA	0.129	0.129
Number of Women	29,720	33,133	29,720	33,133

Note: NA = not applicable.

[a]Coefficients shown are odds ratios.

*$p < .05$, **$p < .01$; ***$p < .001$

that they reduce (or increase) both the preference for sons and the ideal family size. Because the square of this variable shows a negative relationship, the decline in the preference for sons is greater when the ideal family size is small than when it is large. The regression results indicate that the dummy variable for an odd-numbered ideal family size has a strong positive effect on the preference for sons. The proportion of sons in ideal family size is 9%–10% higher among those who report an odd ideal number than among those who report an even ideal number. These results confirm the findings of the bivariate analysis presented earlier. The fact that the effect of the ideal family size on the preference for sons is strong and statistically significant in the regressions, even after the actual numbers of sons and daughters were controlled, indicates that this effect could not have arisen from rationalization.

With respect to the effects of other covariates, in all the regressions, urban residence, educational level, and regular exposure to the mass media have strong negative effects on the preference for sons. Urban residence reduces the proportion of sons in the ideal family size by about 2%; regular exposure to the mass media, by 1%; and high school education of women, by 6%. Husband's education also appears to have some effect because the odds of reporting more sons than daughters in the ideal family size are about 7%–11% lower among illiterate women with literate husbands than among illiterate women with illiterate husbands. However, this effect is statistically significant only in the data from NFHS-1.

The regression results indicate that the preference for sons is lower among wealthy women than among poor women. The analysis of NFHS-2 data shows that the proportion

of sons in the ideal family size is lower by 1%, and the odds of reporting more boys than girls in ideal family size are lower by 16%, among women who score high, rather than low, on the standard-of-living index. The data from NFHS-1 show similar differences, but they are statistically significant only in the OLS regression. The possibility that the employment of women for wages reduces the preference for sons receives support from the analysis of NFHS-2 but not from the analysis of NFHS-1. Thus, the pure effect of wealth on the preference for sons is negative, but its favorable effect on gender equity could be nullified if it is accompanied by the withdrawal of women from the labor force.

It is not surprising that religion emerges as an important determinant of the preference for sons. The results suggest that Christians and Muslims have a lower preference for sons than do Hindus, whereas Sikhs have a stronger preference than Hindus. The analysis of the NFHS-2 data indicates that in comparison with Hindus, the proportion of sons in the ideal family size is 5% lower among Christians, 2% lower among Muslims, but 2% higher among Sikhs. The estimated odds ratios also show similar differences. But the analysis of the NFHS-1 data, while confirming the lower preference for sons among Muslims and the higher preference among Sikhs, does not support the possibility of a lower preference for sons among Christians. The results for Christians are variable probably because Christians made up less than 1% of the sample for northern India. It should be noted that Sikhs predominate in northwestern India, a region that is known for its well-entrenched gender bias (Bhat 2002a; Das Gupta 1987; Miller 1981).

As expected, scheduled tribes have a lower preference for sons than do caste Hindus. According to the NFHS-2 data, the proportion of sons in the ideal family size among scheduled tribes is lower by 1.5%, and the odds ratio of the preference for sons is lower by 27%. The results from the analysis of NFHS-1 corroborate this finding. All the regressions indicate a lower preference for sons among scheduled castes than among other castes, but the difference is statistically significant only in the OLS regression using the NFHS-2 data.

In Table 3, several regressions suggest that the age of women has a nonlinear effect on the preference for sons. As age increases, the preference for sons is found to decline initially and to increase subsequently (as suggested by the positive, and statistically significant square term). But before one concludes that there has been a rise in the preference for sons among recent cohorts, we should note that this effect is observed after other covariates, such as education, regular exposure to the media, and ideal family size, are controlled. Because younger cohorts are more favorably placed on these variables, the net effect could still be a reduction in the preference for sons among the recent cohorts. Also, a lower preference for sons among older women could have been observed because to keep with the changing times, older women may have revised their preference for sons downward. That is, when they were younger, they may have had a higher preference for sons than they did later.

Thus, our analysis suggests that the preference for sons is likely to decline in northern India with the modernizing influence of education, urbanization, and regular exposure to the mass media. There is also weak support for the possibility that the preference for sons will decline with the increase in wealth and rising wage employment of women. The declines in ideal family size occurring independent of these factors are also shown to reduce the preference for sons. By directly controlling for the actual number of sons and daughters in the regressions, we have shown that these effects cannot be attributed to rationalization.

SEX COMPOSITION OF WANTED FERTILITY

If the preference for sons declines with the forces of modernization and a decrease in the desired family size, why is the juvenile sex ratio rising in northern India? This paradox may be resolved by examining the sex composition of unwanted births and the sex ratio

Table 4. The Number of Live Births During the Year Preceding the Survey, by Sex and According to the Sex-Preference Status of Women, Northern India: 1997–1998

Preference Status One Year Before the Survey	Number of Women[a]	Births During the Year Preceding the Survey[b]		Sex Ratio at Birth
		Males	Females	
Wanted Only a Boy	8,661	*1,165*	784	149
Wanted Only a Girl	4,638	300	*360*	83
Wanted a Boy or a Girl	11,598	*1,325*	*1,428*	93
Did Not Want Any Children	13,604	413	336	123
Total	38,503	3,203	2,907	110
Sex Ratio of Wanted Births				139
Females in Total Unwanted Births (%)				61

[a]As per the weighted sample.

[b]Wanted births are shown in italic type.

of wanted births. Such an analysis is possible by following the approach used in estimating wanted fertility rates from data on ideal family size (see Lightbourne 1985). The birth of a son is considered unwanted if the number of sons preceding it was greater or equal to the ideal number of sons, and the birth of a daughter is considered unwanted if the number of daughters preceding it was greater or equal to the ideal number of daughters. Women who gave a nonnumeric response to the question on the ideal family size are assumed to have wanted all their children.

To simplify the computations, we adopted a reference period of one year before the NFHS-2 for measuring fertility. Using data on birth history and ideal family size by sex, we classified all women as belonging to one of the following four categories of "sex-preference status" at the beginning of the reference period: (1) wanted only boys, (2) wanted only girls, (3) wanted children of either sex, and (4) did not want any birth. Implicitly, it is assumed that attitudes regarding the ideal family size did not change during the one-year period preceding the survey. According to the NFHS-2 data for northern India, at one year before the survey, 23% of the women wanted only a boy, 12% wanted only a girl, 30% wanted a child of either sex, and 35% wanted no more children. Table 4 shows the live births during the year preceding the survey by sex according to the women's wanted status. The data indicate an overall sex ratio at birth of 110 males per 100 females, a value that is consistent with the reported practice of female feticide in some parts of northern India.

The sex ratio at birth by sex-preference status reveals an interesting pattern: the sex ratio at birth was 149 among those who wanted a boy and 83 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 the former group, it is highly unlikely that male feticide is equally common in north India, as the sex ratio of the latter group suggests. Sampling errors in the sex ratio at birth cannot explain this finding, given that the pattern of variation is similar in NFHS-1 and NFHS-2 (see Table 5). But such a pattern could result if reports on the ideal family size were affected by rationalization. If those who had a boy during the previous year had upwardly adjusted their ideal number of sons, they would tend to 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.

From these data, it is still possible 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 the ideal number of sons and daughters by an equal measure. Considering only the births of sons to women who wanted boys, the births of daughters to women who wanted girls, and the births of sons and daughters to women who wanted children of either sex, the sex ratio at birth in wanted fertility is estimated as 139 as against 110 in all births. Thus, when all unwanted fertility is removed, the sex ratio at birth is expected to increase by 29 percentage points in northern India. The reason for this rise is that girls constitute about 60% of the unwanted births. 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 the ideal family size of 153 (1.7 sons and 1.1 daughters), perhaps because some women cease bearing children before they achieve their ideal family sex composition.

The sex ratio of wanted births was derived on the assumption that rationalization bias was sex neutral. But our earlier multivariate analysis suggested that women rationalized the births of boys more than of girls. The reporting bias by sex would exaggerate the sex ratio of wanted births. A rough correction can be made for this bias. In Table 4, the sex-specific rationalization would primarily affect the reported number of births of sons to women who wanted only boys and the number of births of daughters to women who wanted only girls. If we assumed that for the latter group, the sex ratio at birth would have been 105 in the absence of rationalization, the number of girls born would have been 286 instead of 360. The reported excess of 74 girls could be attributed to rationalization. The comparison of the coefficients for living sons and daughters in the regressions presented in Table 3 suggests that the propensity to rationalize boys' births is two to three times higher than the propensity to rationalize girls' births. If the upper limit of three times is assumed, those who wanted boys would have rationalized the birth of 222 boys. Thus, in the absence of rationalization, sons born to women who wanted boys would have been 943 instead of 1,165. The revised number of wanted boys and girls implies a sex ratio of 132 (= 2,268 / 1,714 × 100) in total wanted births. Hence, the rationalization bias would have caused only a slight overestimation of the sex ratio of wanted births.

By conducting a similar analysis by age, we also estimated wanted and unwanted total fertility rates (TFRs) by sex for northern India (see Table 5). Table 5 also provides similar estimates from NFHS-1. The two rounds of the NFHS suggest a decline in the wanted TFR from 3.2 to 2.4 during the six-year period from 1992 to 1998. During the same period, the male component of this rate declined from 1.8 to 1.4, and the female component declined from 1.4 to 1.0. Thus, there have been declines in both male and female wanted fertility rates. The difference between the actual and the wanted TFR rose marginally from 1.1 births in NFHS-1 to 1.2 births in NFHS-2. The examination of the unwanted TFR by sex shows that its female component remained constant at 0.7 birth, while its male component increased marginally from 0.4 to 0.5. Given the large sampling errors in TFR estimates derived from the one-year reference period, the registered increases may well have been spurious. The sex ratio of wanted births, computed from the NFHS-1 without correcting for rationalization bias, is 130. After the rough correction suggested earlier was incorporated, it is reduced to 122. Hence, there is close agreement between the NFHS-1 and NFHS-2 on the sex composition of wanted and unwanted fertility. The findings suggest that the sex ratio at birth has the potential to rise up to 125–130 if all the unwanted fertility is eliminated.

A REVISED PROPOSAL

The anomaly of rising juvenile sex ratios can be understood from the sex composition of unwanted children and the increasing availability of prenatal sex-selection technologies. Although the preference for sons falls with the decline in the desired family size, at any point in time, the number of unwanted daughters is more than the number of unwanted

Table 5. Wanted and Unwanted Total Fertility Rates by Sex, and Sex Ratio at Birth by Sex-Preference Status, Northern India: 1991–1992 and 1997–1998

Indicator/Category	NFHS-1	NFHS-2
Wanted Total Fertility Rate		
Total	3.15	2.37
Male	1.79	1.39
Female	1.36	0.98
Unwanted Total Fertility Rate[a]		
Total	1.11	1.19
Male	0.39	0.47
Female	0.72	0.72
Sex Ratio at Birth, by Sex-Preference Status		
Wanted only a boy	147	149
Wanted only a girl	72	83
Wanted a boy or a girl	92	93
Did not want any children	110	123
All births	105	110
Wanted births	130	139
Expected rise in the sex ratio at birth	25	29

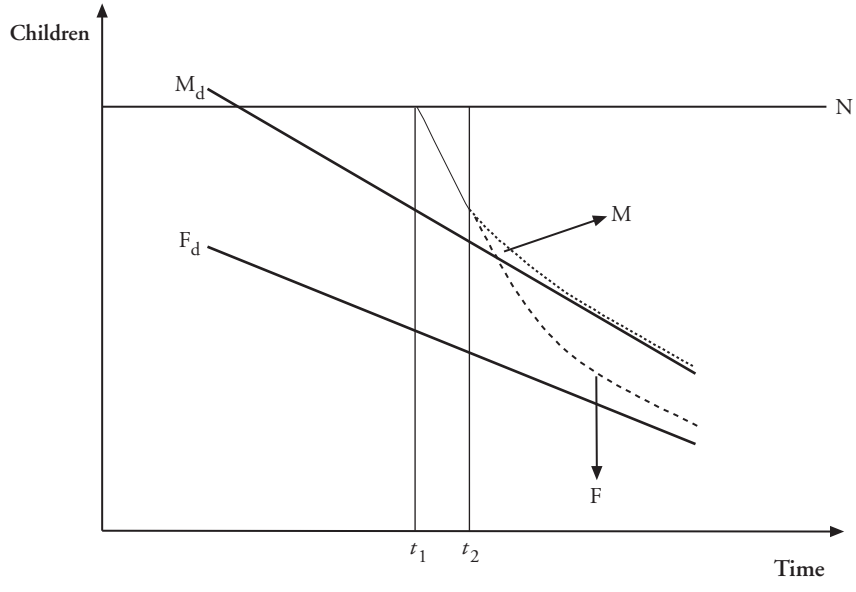
[a]Difference between the actual and the wanted total fertility rates.

sons. As we showed earlier, in northern India, even when the ideal family size drops to one or two children, about 12% of the women want more boys than girls. In such a situation, there could be a greater manifestation of sex bias in the sex ratios if the rise in the proportion of women who adopted the new technologies of female feticide or the traditional practice of female infanticide was higher than the decrease in the proportion of women who wanted more boys than girls.

Figure 5 illustrates how such changes could occur in a society with a strong preference for sons. The lines M_d and F_d show the likely trends in the desired number of sons and daughters during fertility transition. Because there is a preference for sons, 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 for northern India. The line N shows the "natural" constraint for the supply of both sons and daughters. At time before t_1, there is hardly any deliberate attempt to control fertility, and many of the girls who are born are unwanted, but most of the sons who are born are wanted. The practice of female infanticide, either directly or indirectly through prolonged neglect, could be prevalent.

At time t_1, contraceptive technology becomes accessible to a sizable proportion of the population, and fertility begins to fall. Because this technology is gender neutral in its effects on unwanted fertility, the births of both boys and girls follow the same trajectory of decline, as is shown by the dotted line in Figure 5. But their paths would begin to diverge at time t_2, when prenatal sex-selection technologies become available. Male births (M) would move to meet the line M_d while female births (F) would proceed toward the line F_d. Even though the difference between M_d and F_d would be reduced, the difference between M and F would increase, suggesting an increase in sex bias. Because the moral burden of an abortion is lower than that of killing or neglecting a living child, even those

Figure 5. A Model of Fertility Transition in Societies With a Strong Preference for Sons



who would not have resorted to the latter would tend to opt for the former. Consequently, a greater manifestation of sex bias would be seen in the juvenile sex ratios.

We therefore suggest a simple modification to Das Gupta and Bhat's (1997) proposals regarding the effects of a decline in fertility on sex bias. Although we retain their concept of a parity effect, we propose to replace their intensification effect with son-preference effect and a technological effect. The son-preference effect refers to the change in the preference for sons when the desire for a certain-size family falls. As our analysis for north India suggests, and contrary to what Das Gupta and Bhat assumed, like the parity effect, this effect also tends to reduce sex bias. But it differs from the parity effect because the latter was the effect of the change in the birth-order distribution with the decline of fertility and did not presuppose a change in the pattern of the preference for sons.

The technological effect refers to the result of greater access to technologies that help to eliminate unwanted births of a given sex. Its effect is on the revealed preferences (such as in the sex ratio, sex differences in mortality, or fertility-stopping rules), rather than on latent preferences. During a decline in fertility, its negative effect on the revealed bias outweigh the positive effects of the other two if the births of girls account for a larger share of unwanted fertility. Our model also predicts that the effect on the sex ratio at birth would be larger if prenatal sex-diagnostic technologies become available at an earlier, rather than a later, stage in the transition. But if parents were to be denied access to such technologies, a decline in fertility, through the other two routes, should make the population less masculine.

SUMMARY AND CONCLUSION

A vast literature has indicated that the preference for sons exerts a negative influence on the use of contraception and that the autonomy of women is inversely related to the fertil-

ity level. Yet it is not clear what happens to the preference for sons and female autonomy when fertility is falling. In India, the rising juvenile sex ratio and the growing incidence of female feticide during a period of sustained declines in fertility have given rise to the speculation that the desire for smaller families is leading to an increase in the preference for sons and the further marginalization of women. Such apprehensions threaten to derail the Indian effort to stabilize the population as early as possible.

In this context, we have examined the effect of changing fertility on the preference for sons using data on the sex composition of the ideal family size, reported by women in the two NFHSs conducted in 1992–1993 and 1998–1999. We used two indices of the preference for sons that were derived from these data: the percentage of women who reported more boys than girls in their ideal family size and the proportion of sons in the reported ideal family size. Because many view data on retrospectively reported fertility preferences with skepticism, we first showed that the pattern of sex preference revealed by such data corresponds closely to what is already known about the regional variation in the autonomy of and discrimination against women. Subsequently, we zeroed in on the relationship between the ideal number of sons and the ideal family size in northern India, the region where the preference for sons is well entrenched. First, from a bivariate analysis of the microdata from NFHS-2, we found that even in this region, the ideal number of sons falls more rapidly than the ideal number of children. We showed that such a pattern in the data on fertility preferences could not have been observed because of the tendency to rationalize the actual outcomes, since in the actual family size, the number of sons declines less rapidly than the total number of children. However, the sex pattern in the actual number of children is also due to the preference for sons because women who go on to have many children are those who were "unlucky" to have given birth initially to more daughters. We then broadened the analysis to include the data from NFHS-1 and showed that there was a decline in the ideal number of children and the preference for sons in the six years between the two surveys.

We then subjected the data on the sex composition of the ideal family size from NFHS-1 and NFHS-2 separately to a multivariate analysis with the objective of answering two specific questions: (1) what factors could be causing a decline in the preference for sons when fertility is falling? and (2) does the preference for sons decline with a decrease in the ideal family size even when the main source of rationalization bias is eliminated by controlling the actual number of girls and boys in the regressions? Regarding the first, we found that the preference for sons decreases with the modernizing influence of education, urbanization, and regular exposure to the mass media. We also found weak confirmation for the possibility that the preference for sons declines with the rise in wealth and wage employment of women. Regarding the second, we found that the decline in the preference for sons accelerates with the decrease in the ideal family size, even after the effects of other covariates, including the actual number of girls and boys, are controlled. This finding indicates that the positive relationship between the ideal family size and the preference for sons cannot be attributed to rationalization bias. It further implies that factors that are not directly controlled in the regressions precipitate a decline in the preference for sons by causing a decrease in the ideal family size.

Next, we tried to resolve the paradox of the rising juvenile sex ratio during a period of a falling preference for sons. The data from NFHS-1 and NFHS-2 suggest that although the preference for sons decreases with the ideal family size, it does not completely disappear. We showed that girls constitute about 60% of the unwanted fertility in northern India, and the total elimination of unwanted births has the potential to raise the sex ratio at birth to 130 boys per 100 girls. In such an environment, new prenatal sex-selection technologies are thriving, and because the moral burden of abortion is less than is the killing of a live birth by infanticide or prolonged neglect, couples are increasingly satisfying their repressed demand for sons by using this method. Currently, this technological

effect outweighs the effect of a reduced preference for sons that is caused by the decline in the ideal family size.

By way of conclusion, we suggest a modification to Das Gupta and Bhat's (1997) proposals on the effects of the decline in fertility on sex bias. While we retained their concept of the parity effect, we replaced the hypothesized intensification effect of a decline in fertility with the son-preference effect and the technological effect. As the Indian data that we reviewed suggested, the son-preference effect, like the parity effect, would generally reduce sex bias when fertility is falling. But the increasing ability of parents to eliminate children of an unwanted sex during the course of fertility transition (i.e., the technological effect) would intensify the sex bias revealed in actual behavior. As the Indian experience suggests, the technological effect could outweigh the influence of the other two effects when the sex-detection techniques are newly introduced in societies with a strong preference for sons. Its adverse effect on the sex ratio would be larger if the technology becomes available earlier in the transition when the preference for sons is stronger.

However, it should be possible to augment the favorable effects of the decline in fertility on sex bias by prohibiting the use of new technologies for the purpose of having children of a desired sex. In 1994, the Indian Parliament enacted a law aimed at preventing the misuse of prenatal diagnostic technologies. Although so far there has been no conviction under the law, recent data from the Sample Registration System indicate that the rise in the sex ratio at birth has been arrested (see Bhat 2002a). Public-interest litigation in the Indian Supreme Court and the release of the provisional results of the 2001 census showing a further rise in the juvenile sex ratio have led to an amendment to the previous act, to allow for broader-based action against offenders. Some religious bodies have also passed strictures against the practice in their communities. These developments give rise to the hope that the worst phase of this social epidemic is past.

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