Persistent Daughter Disadvantage

What Do Estimated Sex Ratios at Birth and Sex Ratios of Child Mortality Risk Reveal?

This paper examines trends and estimated sex ratio at birth (SRB) for India and child mortality (q5) risk, 1981 and 1991, and discusses how the 2001 Census results are foreshadowed. Earlier state-level (rural vs urban) analyses are extended to present these data at the district level in the form of maps. Multivariate statistical analyses exploring social and economic covariates that affect the likelihood of gender bias in death (female disadvantage in child mortality risk) have been conducted. The female disadvantage is evident in birth and death spread over India in the decade 1981-1991. Though infant and child mortality levels fell for girls and boys, gender differences persisted, and penetrated the hitherto egalitarian south. Masculine SRB that were seen only in urban areas of the north-west in 1981 have spread to urban areas of many northern states in 1991. Multivariate analyses suggest that between 1981-1991, women's status variables become less associated with reduced gender bias. Modernisation variables suggest less association with gender bias, or that a substitution of pre-natal for post-natal elimination of unwanted daughters may be occurring. These findings are situated in the literature on gender, education, paid work participation, and marriage system changes in India.

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In this paper we examine levels and trends of estimated sex ratios at birth (SRB) and sex ratios of q5 mortality risk in India, and socio-economic correlates of the latter, using 1981 and 1991 Census data. The issue of India's 'missing women' has raised concern since the abnormal female-deficit population sex ratio was first noted in the 1871 census. Since then the ratio has grown almost steadily more masculine, despite small upswings in proportion to female in 1981 and 2001. Though India's 2001 Census shows a 6-point increase in the population sex ratio to 933 females per 1,000 males (vs 927 F/1000 M in 1991), this still shows a substantial female deficit. Alarmingly, the F/M sex ratio among children < 6 years decreased from 945 in 1991 to 927 in 2001 [Registrar General of India 2001]. Earlier research debated accuracy of census coverage as an explanation, e g, double counting migrant men or undercounting women [review in Krishnaji 2000]. Recent research however shows that the phenomenon is mostly due to persistent female mortality disadvantage in infancy and childhood, a view also supported by projections and simulations [Griffiths et al 2000].

Interpreted as a restriction of girl children's right to live, female disadvantage in child mortality is rightly taken as one of the most significant indicators of gender bias in India. This phenomenon is not due to greater natural frailty of girl children, but results from parents' practices discouraging the life chances of unwanted daughters through selective neglect or infanticide. Despite socio-economic development, fertility decline and falling mortality for both sexes, the male-female child mortality gap did not shrink during 1981-1991 [Das Gupta and Bhat 1997], but also spread into hitherto egalitarian parts of the country [Basu 1999; Rajan et al 2000]. Much research investigates socio-economic and cultural correlates of excess female child mortality in India up to 1981 [e g, Kishor 1993; Murthi et al 1996].

Related research enquires whether pre-natal sex selection techniques are spreading in India to weed out unwanted daughters before birth, rather than the age-old post-natal methods (infanticide and neglect) hitherto used. New technology and the spread of medical facilities in India since the early 1980s enable this possibility. Das Gupta and Bhat (1997) conclude that the juvenile sex ratio (ages 0 - 6) in India grew more masculine during 1981-1991 due to the rise of sex-selective abortion. Reliable data on period SRB, an indicator of sex-selective abortion are not available for all-India analyses. We attempt to fill this data gap by means of indirect estimation methods. Our previous paper on state and rural/urban patterns [Sudha and Rajan 1999] notes an increase in 'masculine' indirectly estimated SRBs 1981-1991 in urban north/north-west India suggesting increasing prenatal sex selection there. This interpretation is supported by small-scale, local level research and NGO reports.

We have two analytic aims. First, we map district level data on (1) estimated SRB and (2) observed child mortality (q5) risk sex ratios from the Indian censuses of 1981 and 1991. Most prior district-level studies of gender bias in India analysed 1981 data only; we include 1991. Second, we conduct multivariate statistical analyses of socio-economic correlates of female disadvantage in death (female dominant child mortality sex ratio), for 1981 and 1991 (similar analyses for 2001 are not possible at this time as the relevant data have not yet been released). Most prior analyses have examined correlates of gender bias in infant/child mortality

only up to 1981. Our discussion focuses on women's education and economic activity, as these important characteristics are emphasised in the literature as affecting gender bias, and are underscored in policy recommendations to promote women's empowerment.

Women's Education, Occupation and Gender Bias

Prior discussion of gender bias in India distinguishes between conventional markers of economic development (urbanisation, poverty, access to medical facilities, and male literacy and work); vs indicators of women's societal position, (female education, labour force participation, and measures of different marriage systems) [Kishor 1993; Murthi et al 1996]. The findings broadly suggest that conventional economic development does not automatically reduce gender bias. Conversely, many women's status indicators, conceptually associated with female empowerment, are related to improved life chances of girl children.

Literacy/Education

There is a difference between the impact of male and female education or literacy on gender bias in child survival. Education or literacy of men had no impact on gender bias according to Kishor (1993), but increased female disadvantage in Murthi et al's (1996) analyses. Female education has long been advocated to promote declines in fertility and child mortality [Dreze 1999; Dreze and Murthi 2001]. However the relationship between maternal education and gender bias can be positive or negative depending on region, parity or contextual details. A positive relationship may exist either because educated women more efficiently withhold high quality care from less desired children [Das Gupta 1987], or because they have lower fertility, which is accompanied by greater gender bias since parents have narrower latitude to ensure the desired number of sons [Das Gupta and Bhat 1997]. For a negative relationship, Murthi et al (1996) associate education with greater women's agency and decreased gender bias. More examination of trends over time is clearly needed.

The idea that women's education promotes female agency and reduces gender inequality is reasonable. Education is a fundamental human right and a necessary prerequisite for socio-economic development, particularly to improve the status of women. Nor are the findings that women's schooling is sometimes linked with increased gender bias to be interpreted as suggesting limiting female education as a solution. However, to understand the sometimes contradictory findings, we need to consider the content and context of literacy/education in India, which few prior studies have done. Regarding content, education may assist men and women to function as rational actors in a modernising economy, enabling them to understand and negotiate the system. However, it may not automatically lead them to transform the system. Longwe (1998) distinguishes between the concepts of education for empowerment vs schooling for subordination. Swaminathan (1991) states that Indian education in general is directed toward the privileged classes and reinforces rather than transforms traditional prejudices. This is as true of gender inequality as of any other social inequality.

Regarding context, literacy and education in India reflect not only schooling supply, but also familial decisions on distributing scarce resources among children; i e, whose education to prioritise over others'. That is, parents' educational investment in children reflects gender bias, and children schooled under these conditions may not be led to transform gender inequality. In India, even basic literacy for females lags behind males'. The all-India 2001 male literacy rate stood at about 75.9 per cent and the female rate at 54.2 per cent, a 22 percentage point gap [Government of India ND]. Though there is intra-gender variation by age, region, and class, Datta and Sinha (1997) describe women as the 'depressed class' where literacy is concerned.

Even when girls achieve literacy, their schooling attainment illustrates familial gender bias. For, e g, parents in rural Maharashtra educate daughters to help them be independent and provide support during economic hardship; but also limit girls' schooling to not conflict with rural life practices and the need for early marriage [Vlassof 1994]. Parents invest more in the education of children from whom they expect more returns: i e, sons are withdrawn from household labour and sent to school, while their sisters focus on housework. This holds for smaller families too, as fewer children mean more labour shortfalls [Jejeebhoy 1992]. In asset-poor rural Gujarat households, girls perform large amounts of housework, resulting in lower school attendance and higher dropout rates, particularly after puberty [Unni 1998].

Thus, though female literacy is rising in India, gender gaps in levels, content and context of education remain entrenched. Little is known whether girls educated under these conditions can achieve egalitarian aspirations for their own daughters and sons. Female education is necessary for women's advancement, but the content and context of schooling in India does not automatically enable this goal. Thus, the relationship between women's literacy/education and gender bias, including changes over time, need more exploration.

Economic Activity

Economic activity, specifically paid work participation, is another important factor considered by studies on gender bias. The literature again distinguishes between men's and women's economic activity. Although mortality in general may be higher among children of working mothers, women's paid work is associated with lower gender differences in child mortality. Explanations suggest that women in the paid workforce contribute economically to the household; raise their own value and that of their daughters; are less dependent on (male) family members for survival; and are able to make and implement decisions autonomously. Clearly, paid work is distinct from the household labour performed by girls kept home from school that the previous section mentioned.

However, reviews suggest gender biases in the Indian labour market. In the rural sector, women constitute about 26-34 per cent of the workforce. In the urban sector, women's share remained at 20-21 per cent from the late 1970s to the mid-1990s [Visaria 1996 cited in Gothoskar 2000]. The share of women in the total workforce peaked during the mid-1980s; dropped by about 1 percentage point in the late 1980s and remained there till the mid-1990s. The share of the service sector in urban employment has risen for both sexes, but especially women. Though women's share of employment in the organised sector increased in the 1980s; this was mainly in public owned enterprises, in a few traditionally female occupations. Outside agriculture, over 88 per cent of women were working

in the unorganised sector (a much greater proportion than that for men) [Gothoskar 2000]

Though opportunities for educated, skilled, urban women are growing, these are marked by wage, occupational, and 'pre-entry human capital discrimination' [Datta and Sinha 1997:57]. Deshpande and Deshpande (1992) note feminisation in the urban manufacturing sector. Employers prefer women workers because they earn at least 25 per cent less than men for similar jobs, are less easily unionised, hold semi-skilled occupations and are thought to have the patience and manual dexterity for repetitive work. In 1961-1981, even women in top tier professional and scientific occupations faced a 21 per cent male-female wage gap; 67-70 per cent of which was attributed to discrimination, i.e. gender differences in productivity were ruled out as an explanation [Duraisamy and Duraisamy 1998]. Women's work participation appears subordinated to the needs of the family, even among the uppermost classes [Desai 1996].

Thus women's economic contributions to the household are of great importance to their status, but societal gender inequality keeps them from being viewed or paid as equal participants. Working women's status may improve, but patriarchal societal ideology remains firmly in place [Varma 1993]. Nevertheless, economically active women are still in the best position to overcome bias against daughters. We examine this association for 1981-91.

Other Factors

Additional factors considered in the literature include socio-economic variables indicating the general level of development: urbanisation, infant mortality rate, male literacy rate and male work participation rate. Though development has been progressing in India since independence, the trajectory has been slow and uneven, and the population sex ratio has generally grown more masculine. We examine how the variables indicating development might affect gender bias (female excess in deaths). Until 1981, urbanisation and male literacy were associated with excess female deaths [Murthi et al 1996].

Gender bias also varies across socio-cultural groupings in Indian society. Although scheduled (lower) castes were often characterised by greater gender egalitarianism, they do not exhibit any less gender bias in child outcomes. Scheduled tribes on the other hand, whose cultures lie outside mainstream Hinduism, appear to have less gender-biased child outcomes, at least up to the 1980s. Although Hindu culture is plural and has certain traditions supporting respect for women, specific customs such as hypergamy, female seclusion, and dowry have been associated with gender bias. These customs seem to be spreading across all caste and religious groups and might be associated with the persistence of gender bias. While Islam in India is associated with greater conservatism regarding women's education, work participation and seclusion, there are also Koranic injunctions enjoining good treatment of daughters along with sons, and prohibiting female infanticide. We investigate how varying proportions of different cultural groups (Hindus, Muslims, scheduled castes and tribes) are associated with female excess deaths in 1981 and 1991.

We also examine the impact of region. While it has been long established that the south region is more gender egalitarian than the north in marriage systems, status of women, and child outcomes, evidence suggests that in the late 1980s and 1990s, gender bias has penetrated south India too [Basu 1999]. Social and economic changes in south India have produced many factors associated with gender bias, namely the spread of dowry and high female unemployment. We investigate how region is associated with gender bias in child deaths in 1981 and 1991.

We control for per cent couples using contraception, total fertility rate, F/M population sex ratio, and household size. Dreze and Murthi (2001) argue that fertility decline in India is retarded by son preference, and that gender bias in child mortality is related to higher rather than lower fertility.

Data and Methods

We use district-level data from the Indian censuses of 1981 and 1991. The data include social and economic indicators for districts of India released by the Office of the Registrar General of India. We supplement this with district-level q5 mortality risk estimates for 1981 and 1991 [Registrar General of India 1998]. We compiled district counts of male and female children aged 0-4 from various reports of the 1981 and 1991 censuses [Registrar General of India 1991 and 1998]. As a result, we have information for each district on the following:

(1) Demographic indicators:
(a) Per cent of couples using family planning methods
(b) Total fertility rate
(c) Population density
(d) Population sex ratio F/M
(e) Household size
(2) Socio-cultural indicators
(a) Per cent Hindu
(b) Per cent Muslim
(c) Per cent Christian[1]
(d) Per cent scheduled caste
(e) Per cent scheduled tribe
(3) Development Indicators
(a) Infant mortality rate
(b) Per cent urban
(c) Male literacy rate
(d) Male work participation rate
(4) Women's status indicators
(a) Female literacy rate
(b) Female work participation rate
(c) Women's average age at marriage
(5) Region
(a) Districts are grouped to indicate north/north-west India (including Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir 1981 only, Punjab, Rajasthan, and Uttar Pradesh); South (Andaman and Nicobar Islands, Andhra Pradesh, Karnataka, Kerala, Lakshadweep Islands, Pondicherry and Tamil Nadu); North East (Arunachal Pradesh, Assam 1991 only, Manipur, Meghalaya, Mizoram, Tripura, and West Bengal); Central and Western India (Bihar, Madhya Pradesh, Maharashtra, Orissa, Goa, Daman and Diu).
(6) Patterns of birth and death
(a) Numbers of male and female children aged 0-4, recorded by the censuses, which we use (along with the male and female child q5 mortality risk rates recorded in the censuses) to estimate the sex ratio at birth for 1981 and 1991 by reverse survival methods
(b) Male and female child q5 rates that we use to construct our measure of female disadvantage in infant/child mortality risk by district for 1981-91.

Figure 1 (a): Estimated M/F Sex Ratio at Birth for Indian Districts in 1981

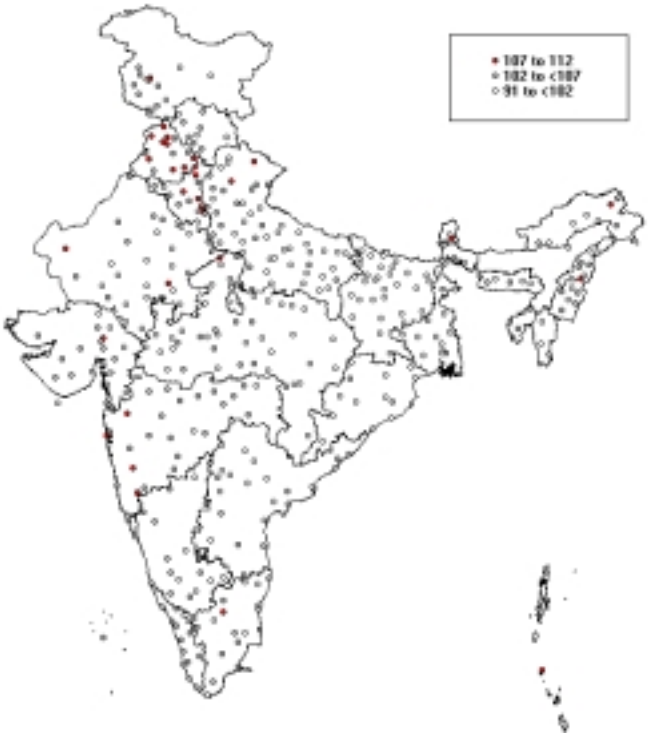
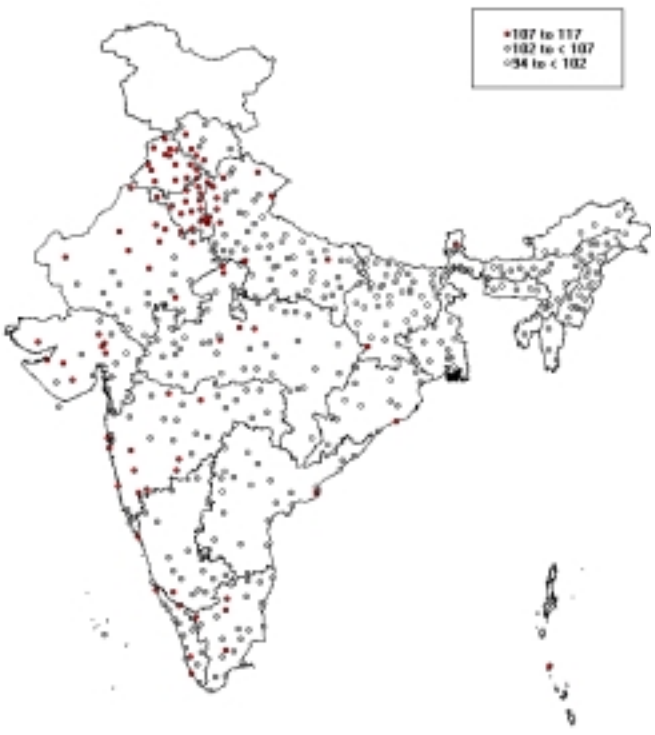


Figure 1 (b): Estimated M/F Sex Ratio at Birth for Indian Districts in 1991



Estimating the Sex Ratio at Birth

Though the period SRB is a strong indicator of prenatal sex selection and is thus emerging as a significant data need for India, there is no systematic national-level data releasing efforts in this regard that enable direct analysis. We therefore attempt to fill this gap by applying the reverse survival technique [UN 1983: Chapter VIII], as also in our earlier paper [Sudha and Rajan 1999]. This technique is based on the notion that children aged *x* are the survivors of births that occurred *x* years ago. Therefore, we can take the numbers of children recorded at age *x* and observed mortality risk for children in that population, and, using a suitable model life table for the population in question, 'resurrect' the numbers who had died.[2] From the result we take the ratio of male to female children, and estimate SRB that we present in maps. Because this measure is estimated, and constructed on the district level (and is thus based on smaller numbers than the state level and consequently less robust) we only present this in the form of maps and do not conduct multivariate analysis.

SRB values more masculine than 107 M/F are treated as an indicator of 'weeding out' of girls, either through prenatal sex selection, or under-reporting female births, both mechanisms are varying forms of bias against girls, denying them physical or social existence. In our maps we draw attention to regions of India where the SRB is greater than the 'normal' range (SRB>=107 M/F).

Calculating q5 Sex Ratios

Infant/child q5 mortality risk sex ratios are straightforward, based on the recorded q5 mortality risk for males and females reported in the Censuses of 1981 and 1991. Again, the global norm in societies where gender bias is not marked shows that male infants and children are more likely to die. We therefore present q5 sex ratios, drawing specific attention to areas where female deaths outnumber males (q5SR <100 F/M).

Analytic Strategies

First, we present district level maps showing the pattern of estimated M/F SRB and M/F q5SR for 1981 and 1991. In an associated descriptive table we present the range of values in 1981 and 1991.

Second, we conduct multivariate analyses with F/M q5sr 1981 and 1991 as dependent variables. To correct for spatial correlation in district level analyses of India, we use the statistical package SAS (PROC MIXED). This package/procedure uses information on the geographical x and y coordinates for the centroid of each district of India in 1981 and 1991 to take spatial correlation into account and compute unbiased estimates.

For the multivariate analyses, we appropriately transform the q5SR to highlight female disadvantage. We performed a logarithmic transformation of the q5f/q5m ratio, thus, higher values indicate female disadvantage. We conduct separate analyses for 1981 and 1991.

We also note that the number of districts in India increased between 1981 and 1991. Based on areas where the census was successfully completed, we have data from 398 districts in 1981 and 452 in 1991. We do not discard any extra districts in 1991, and note that there is thus more variability in the data in 1991.

Results

Figure 1 (a) and 1(b) show district level maps of M/F estimated SRB for 1981 and 1991 respectively. Each dot on the map represents one district. For all maps, darker dots indicate female

Figure 2 (a): Estimated Sex Ratio of M/F Child Mortality Risk (q5) for Indian Districts in 1981

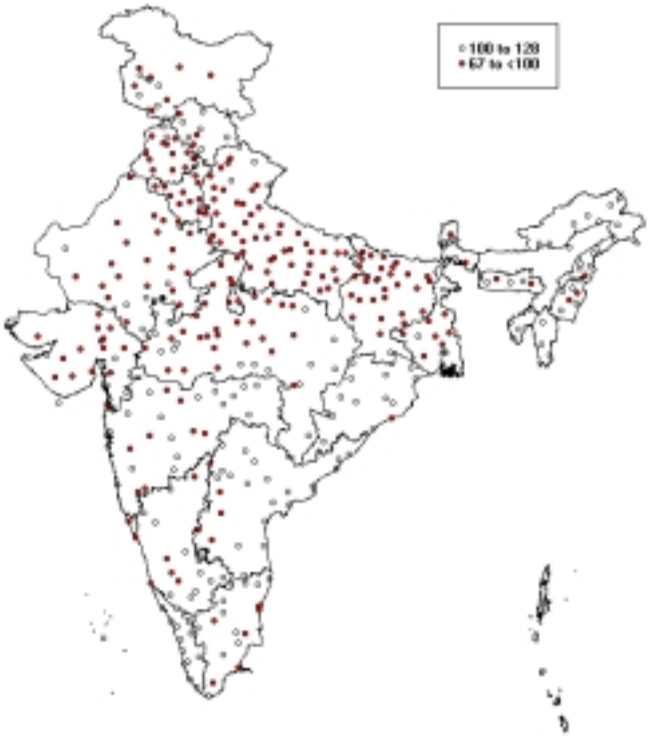
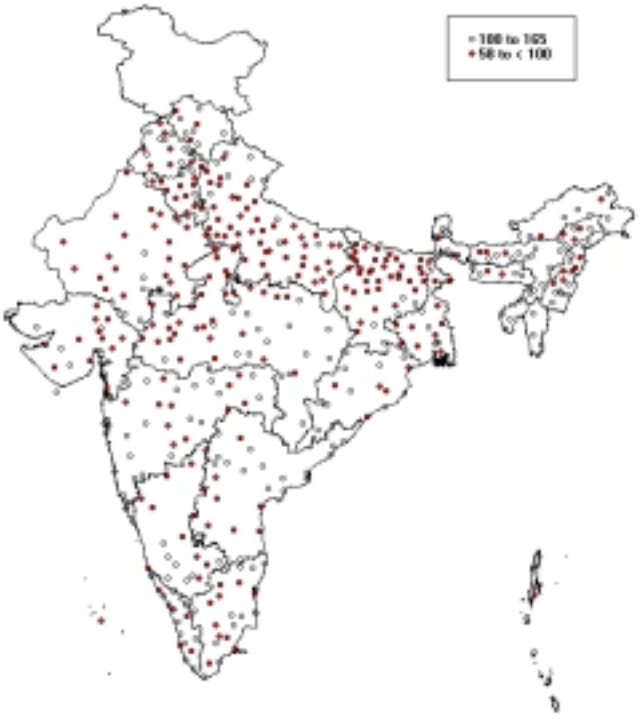


Figure 2 (b): Estimated Sex Ratio of M/F Child Mortality Risk (q5) for Indian Districts in 1991



disadvantage. For 1981, in Figure 1(a), the estimated SRB ranges from 91 to 112 males for 100 females. The underlying data show that 29 districts have a value of estimated SRB >= 107. Ten of these are clustered in Punjab alone and another five in adjacent Haryana state. These are areas with among the greatest historical gender bias, and the most evidence of prenatal sex selection technology by 1981. We also see many districts with a SRB less than 102 M per 100 F. Figure 1(b) shows in 1991 that there are many more districts with estimated SRB >= 107, with values now as high as 117, blanketing most of Punjab and Haryana, and also more than before in Rajasthan and Gujarat; western UP, MP, Himachal Pradesh and Maharashtra. We also see traces of this phenomenon in southern India.

Figure 2(a) and 2(b) show district figures for M/F q5sr. In 1981 (Figure 2a), the values ranges from 67 to 128 M per 100 F. Female disadvantage, i e, values <100, are mostly concentrated in north India, stretching from the western boundary states through UP, MP, Bihar, to West Bengal (with traces in the north-east and the peninsula). In 1991 (Figure 2b), the values range wider than in 1981, as low as 58 and as high as 165. Female disadvantage remains strong in the northern belt and also deeply penetrates all four major southern states. We also see more such points in the north-east. For values >100, Agnihotri (2000:Chapter 3) relates high male infant/child mortality to harsh health environment, low levels of health infrastructure, and general malnutrition. High male child mortality is worthy of future analyses, but is beyond our current scope.

The maps show that by 1991, the same areas in north northwest India show masculine estimated SRB concurrent with excess female child mortality. That is gender bias in birth and death patterns appear to operate simultaneously in these areas. These foreshadow the findings of the 2001 Census of India where especially the states of Punjab, Haryana, and the Delhi UT have the least proportion of females to males age 0-6. We elaborate this point further below.

Table 1 describes the underlying data on estimated M/F SRB and F/M q5SR. The average all-India estimated M/F SRB grew a little more male-dominant (within the normal range) over the decade, and the F/M q5sr barely changed. The proportion of districts with masculine estimated SRB tripled from 1981 (about 6 per cent) to 1991 (about 18 per cent). The proportion of districts with female disadvantage q5sr remained at around 58 per cent and grew more dispersed in location and range. Thus, gender gap in child mortality did not diminish in this decade.

Table 2 describes the socio-economic covariates, indicating general changes 1981-91. We see a decline in fertility and child mortality, rise of 1 year in female mean age at marriage, growth in male and female literacy and labour force participation, and increasing urbanisation and population density of the country. We note the well-known decline in the 1991 F/M population sex ratio after the small upswing seen in 1981 after a century's decline.

Table 1: Patterns in Estimated Sex Ratios at Birth (m/f) and q5 Sex Ratios (f/m) in India, 1981-91

	Estimated SRB M/F			Q5SR F/M		
	1981		1991	1981		1991
N districts	398		452	398		452
Mean	101.5		104.0	105.1		104.3
(SD)	(3.6)		(3.9)	(13.2)		(13.6)
Median	101.4		103.4	98.2		98.1
N districts	225	< 102	136	167	< 100	192
in Range (per cent)	(56.5)		(30.1)	(42)		(42)
	147	102-107	231	231	100 +	260
	(36.9)		(51.1)	(58)		(58)
	26	> 107	85			
	(6.5)		(18.8)			

We now turn to the multivariate statistical analysis. Because higher values of the dependent variables indicate female disadvantage, positive coefficients suggest covariates associated with more gender bias. Table 3 presents the parameter estimates for the impact of social and economic variables on the likelihood of female disadvantage q5sr, corrected for spatial correlation, for 1981 and 1991. We discard the variables on population density in the district, and per cent Christian, as exploratory analyses showed them to have no significant effect. Model statistics (not presented) indicate adequate fit to the data.

Findings for 1981 suggest that women's literacy, and work participation are associated with less female child mortality disadvantage. Per cent urban also is associated with lower risk. As found in prior studies, male work participation rate is associated with heightened risk. Socio-cultural variables such as per cent scheduled tribe and scheduled caste have negative coefficients, in line with prior studies. Per cent Muslim also has a negative sign. The north-west region shows higher female disadvantage. The southern region has no significant net negative effect (though it did so in bivariate associations). Male literacy, as prior studies found, is marginally associated with increased female child mortality disadvantage. The total fertility rate is associated with increased but F/M population sex ratio with decreased, female disadvantage. In 1991, proportion scheduled tribe is still associated with decreased female disadvantage but proportion scheduled caste is no longer so. Female literacy also no longer has an impact. But male and female work participation are both associated with lower female disadvantage. Proportion urban still is associated with less female disadvantage. South region has no significant effect (which had been found in a bivariate analysis). North-west region is now associated with significantly less female mortality disadvantage, though bivariate associations had shown no significant difference from the rest of India, and the maps suggested that female disadvantage in q5 mortality ratio. The population sex ratio is still associated with less female disadvantage.

Female literacy appears to have lessened in its negative association with death disadvantage for daughters. Women's work participation lowers female mortality disadvantage.

The changing impact of modernisation factors, specifically per cent urban and male literacy, that are associated with decreased female mortality risk in 1991, suggest that modernisation is associated with a change in strategies, families might be turning to prenatal elimination of unwanted daughters rather than post-natal. This point is elaborated below.

Discussion

The levels and trends of female disadvantage in birth and death suggest that development in India is not accompanied by declining gender bias. Despite declines in fertility and overall child mortality female disadvantage in q5 mortality risk has persisted, spread to more areas, and shows more negative values in 1991 than in 1981. Also, over the same time, the values of masculine estimated SRB and the number and proportion of districts showing very masculine values has gone up.

Is Elimination of Unwanted Daughters Occurring Before or After Birth?

In countries such as China and South Korea, with diverse development trajectories and standards of living compared to India, but nevertheless sharing a strong cultural son – preference, prenatal sex selection techniques seem to be replacing post-natal methods [Yi et al 1999; Goodkind 1996]. That is, SRB are growing abnormally masculine while sex ratios of infant/child mortality are growing more egalitarian. Fewer girls are being born, but those born are more wanted and tend to survive.

Is India experiencing this kind of substitution, or are girls in India facing a 'double jeopardy' of increasing prenatal elimination concurrent with persistent post-natal risk? On the one hand, the average estimated SRB in India grew 3 percentage points more masculine between 1981 and 1991. At the same time, the average gender gap in child mortality still shows female disadvantage. That is, in the aggregate, in India pre- and post-natal risk to daughters may run concurrently, a scenario that suggests intensifying gender bias (though we caution that our suggestion is based on estimated SRB and needs further verification).

Some evidence hints that both risks may be concentrated in the same social groups. Sureender et al (1997) show that in Punjab, daughters of women who approve of female foeticide survive at half the rate of daughters of women who do not, though

Table 2: Descriptive Statistics of the Social and Economic Information for Each District of India, 1981-91

	1981				1991			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Demographic factors								
Per cent couples using FP	30.2	03.9	2.0	67.6	41.4	12.8	15.4	82.7
Total fertility rate	5.2	0.9	2.5	9.1	4.4	0.9	1.8	7.1
Population density	487.2	204.9	0.8	31779	570.3	1874	2	23783
Population sex ratio (F/M)	932.1	67.3	661.4	1238.0	928.3	60.5	788	12.0.0
Household size	5.6	0.6	4.1	7.2	5.8	0.8	0.0	9.1
Socio-cultural indicators								
Per cent Hindu	76.7	25.8	2.0	99.6	77.6	23.1	1.8	99.5
Per cent Muslim	10.9	15.6	0.04	97.5	10.6	11.9	0.04	94.3
Per cent scheduled caste	13.4	8.9	0	49.9	14.7	8.4	0	51.8
Per cent scheduled tribe	14.8	24.9	0	97.2	15.0	24.7	0	51.8
Development indicators								
Infant mortality rate	114.5	37.8	12.0	257.0	77.8	29.0	22.0	204.0
Per cent urban	19.6	16.0	0	100	21.7	17.5	0	100
Male literacy rate	44.9	12.5	12.3	83.9	63.2	13.8	26.3	97.5
Male work participation rate	51.8	4.8	33.6	66.1	51.3	3.9	39.3	68.9
Women's status indicators								
Female literacy rate	22.9	14.2	2.9	79.3	38.2	17.9	7.7	94.0
Female work particip. rate	16.4	12.8	0.6	53.9	24.9	13.3	1.8	60.1
Women's mean age at marr	18.1	1.8	14.2	23.3	19.4	2.1	16.0	27.9

data on actual abortions were not analysed. Moreover, 31 per cent of daughters of the former are not immunised, compared to 23 per cent of those of the latter. Further, the 2001 Census also showed that the sex ratio (number of F per 1,000 M) in the age group 0-6 has fallen greatly from 945 in 1991 to 927 in 2001. In Punjab specifically the provisional 2001 Census results show only 793 girls per 1,000 boys age 0-6. Our 1991 data showed estimated M/F SRB of 117 and 118 for rural and urban Punjab respectively, and M/F q5 sex ratio of 92 for both locations [Sudha and Rajan 1999:Appendix Table 1 and 2]. The steep fall in the age 0-6 sex ratio in the 2001 Census for Punjab, Haryana and Delhi may be an extension of the 'double jeopardy' pattern noted 10 years prior. This idea is further supported by the Haryana state report of NFHS-2 (1998-99) that notes (p xvii) that prenatal selection and female disadvantage in child mortality are both responsible for the very low 0-6 sex ratio of the state. NFHS-2 Reports from Punjab, Delhi and other north Indian states also make this point.

The bivariate correlation between estimated SRB and q5 sex ratio (higher values of both indicating female disadvantage) in 1981 was .38 ($p < .0001$) and in 1991 was .25 ($p < .0001$). This suggests that districts with higher female deficit in births also have greater female excess in deaths, though the strength of the association seems to diminish over time. We repeat that our SRB statistics are based on estimates, thus the conclusions need additional confirmation.

On the other hand, local area or household level substitution patterns may be obscured in the aggregate; i e, the same communities are not eliminating unwanted daughters both pre- and post-natally. One study shows that urbanising jat families in the outskirts of Delhi form the clientele of flourishing sex determination/abortion facilities in the area [Khanna 1997]. These clinics are widely used to realise jat families' reproductive goals of about three children, with at least two sons. However, a gender gap in infant/child mortality is no longer seen, suggesting substitution of pre- for post-natal methods where facilities for the former exist. Moreover, our multivariate analysis showed that NW region now was associated with lower gender bias in child mortality. Thus, at the district level, a situation of substituting prenatal methods may be occurring.

However, in India, distinguishing between pre- and post- natal methods of eliminating unwanted daughters is not the central issue. Although some scholars suggest that abortion is psychologically easier to bear than neglecting a living child [Das Gupta and Bhat 1997], and others examine the ethical issues surrounding restriction of prenatal sex selection [Goodkind 1999], in India gender bias against daughters seems so firmly entrenched, that parents' choice of methods depends on availability and convenience rather than conscience. The central issue is therefore persistence of bias against daughters in modern India.

Modernisation and Persistent Gender Bias

Scholars [e g, Harriss-White 1998; Wadley 1993] link the persistence of gender bias, including older or newer methods of eliminating unwanted daughters, to modernisation processes in India. This link suggests the continuation of familial strategies noted in 19th century India [Clark 1983], of parents' manipulating family size and sex composition and children's marriage arrangements to maximise their families' social and economic status. These strategies lead to disfavour against daughters because of the deeply gendered and interlinked nature of productive and reproductive processes. In modernising India too, efforts for socio-economic advancement are still strategised by families along kinship network ties, of which children's marriage form a part. Despite increasing female education and work participation, familial socio-economic advancement is still viewed as largely achieved through males, and families value sons accordingly. Sons also increasingly bring in dowry. Daughters' participation in modernisation is still subordinated to family and marriage needs and seen as benefiting marital rather than natal families.

The interlinkage of productive and reproductive domains (represented by work and marriage) lead to women's work and education being subject to the dictates of marriage necessities. India is still a society of early and near universal marriage for women. Kinship networks and social identity define, and are largely defined by, marriage and motherhood for adult women. Unmarried women (including widows, divorcees, separated, etc) face greater social and economic vulnerability than married women, particularly if they have no male kin willing and able to support them. This adds further to the pressure to bear sons. Khanna (1997) and Gold (2001) describe how education and work decisions for females are always made with an eye to guarding female sexuality and the inevitability of marriage, in urbanising Delhi and rural Rajasthan respectively. Our findings suggest that female education does not entirely transform this scenario for women and lead them to eradicate gender bias for their daughters, though female work participation has some protective effects in this regard.

Our study has no measure of marriage systems other than female age at marriage, which showed limited association with female disadvantage. However, the general lack of association of women's education and the partial lack of association of women's work participation with reduced gender bias; the increased association of per cent Hindu with female disadvantage and decreased protective effect of per cent scheduled caste, can also be partly understood in the light of changing marriage systems in India.

Table 3: Parameter Estimates of Social and Economic Indicators Affecting Masculine Estimated Sex Ratio at Birth and Female Disadvantage in Child Mortality Risk, 1981-1991

	Sex Ratio of Child Mortality Risk			
	1981		1991	
	Estimate	t-Ratio	Estimate	t-Ratio
Demographic factors				
Per cent couples using FP	0.0002	0.35	-0.000	-0.10
Total fertility rate	0.023**	2.27	0.023*	1.78
Population sex ratio (F/M)	-0.001**	-6.09	-0.001**	-2.90
Household size	0.0156	1.41	0.008	0.69
Socio-cultural indicators				
Per cent Hindu	-0.0005	-1.36	0.0002	0.44
Per cent Muslim	-0.002**	-4.22	-0.002**	-2.18
Per cent scheduled caste	-0.002**	-2.53	-0.001	-1.09
Per cent scheduled tribe	-0.002**	-4.70	-0.001**	-2.86
Development indicators				
Infant mortality rate	-0.0001	-0.59	-0.0003	-1.30
Per cent urban	-0.001*	-1.91	-0.001**	-3.15
Male literacy rate	0.002*	1.64	-0.0000	-0.06
Male work participatn. rate	0.006**	-3.05	-0.006**	-2.05
Women's status indicators				
Female literacy rate	-0.004**	-3.67	-0.001	-1.18
Female work participn. rate	-0.002**	-3.10	-0.002**	-2.15
Women's mean age at marr	-0.002	-0.35	0.002	0.36
Region indicators				
North-west	0.021*	1.65	-0.006**	-2.08
South	-0.005	-0.30	0.015	0.78

* significant at the .10 level. ** significant at the .05 level or better.

Across the Indian caste and regional spectrum, marriage arrangements are fundamentally transforming: dowry and nuclear family customs have deeply penetrated communities where they were never the norm, including formerly matrilineal/matrilocal communities in peninsular/southern India. Though Caldwell et al (1982) noted the beginning of the societal shift toward dowry in peninsular India, little research on this topic considers its reciprocal links with the changing status of women.[3] Economic analyses view the dowry trend as demographically determined by a young age structure, such that marriage-age women are competing for a smaller pool of men in an older age group [Rao 1993a, 1993b], or that the supply of widower grooms has declined due to improvements in female mortality [Bhat and Halli 1999]. However, these studies do not address the critical question of why the response to demographic pressure is spread of the dowry custom, despite the unaffordable sums demanded and the deadly violence that often enforces payment. Options such as women marrying men younger than themselves or remaining unmarried and independent are considered unthinkable for most Indian women.[4]

Thus, in modernising India where efforts to advance socio-economically still depend on family/kinship ties and males are seen as the main vehicles of the efforts, the multiple intersecting domains which permit only limited educational and occupational avenues for most women, and make marriage and dowry transactions inevitable for them, coalesce to make sons valuable and multiple daughters unaffordable for many parents.

One point bears repetition. It is sometimes suggested that growing masculine sex ratios will ultimately lead to a shortage in the 'supply' of women and since 'demand' for marriageable women remains, the 'value' of women will rise. This argument is not tenable. The sex ratio of India has been growing more masculine since 1871, but girls continue to be eliminated. Wives are universally desired, but few want to raise daughters. Shortfalls in the 'supply' of women will lead to their being subject to greater restrictions, control and violence, as in China, where shortage of marriageable women in some areas has led to kidnapping and sale of women from other regions [Das Gupta and Shuzhuo 1999].

Conclusion

This paper presented evidence from the census of India to show that abnormally masculine estimated SRB grew more prevalent between 1981 and 1991; and female disadvantage in child mortality risks persisted. Statistical analyses suggested that women's status indicators are associated with partial protection to daughters; women's work participation more so than female literacy. Male work participation and urbanisation over the decade are associated with decreasing female disadvantage in child mortality, suggesting that modernisation may be associated with substitution of pre- for post-natal sex selection. Changes in cultural factors also suggest links to growing female disadvantage. That is, gender bias remains firm.

Our literature review illustrated how gender inequality operates in the domains of education, employment, and marriage, allowing advancement for a small section of Indian women, but not transforming gender bias for the majority. In the short run therefore, while these biases remain, development does not promise to transform patriarchy or lessen female demographic disadvantage in India. As Banerjee (1998:261) puts it: "in the Indian patriarchal ideology, women are regarded more as a highly flexible resource of the household rather than fully-fledged members of it". The evidence in this paper may be best understood in this light.

Maithreyi Krishnaraj (2000) states 52+ years since Indian independence is not a small period for realising progress. The progressive provisions of the Indian Constitution promising much for women have largely not been realised. Dreze and Sen (1995) assert that persistent gender inequality and deprivation of females are among India's most serious social failures. Though women's groups in India work toward progressive change, more efforts from public and private sectors are needed to bring about fundamental social change to reduce gender inequality. EPW

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Notes

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1 These religious categories are not exhaustive and mutually exclusive. That is, they do not sum to 100 per cent. Each religion variable stands alone, i e, in contrast to all other religions in the district.

2 We take district-level counts of boys and girls aged 0-4 and male and female q5 mortality probabilities recorded in the 1981 and 1991 Censuses, fitting to a South Model Coale and Demeny Life Table [Coale and Demeny 1966]. We thus 'resurrect' the numbers of boys and girls under age five who died prior to the census enumeration, add them to the numbers of reported males and females aged under five, and take the ratio of male to female children in the resulting total, to estimate the sex ratio at birth. Clearly, no indirect estimation technique can produce results as good as accurate direct records. Additionally, it may be argued that reverse survival methods would not pick up daughters eliminated through infanticide, where neither the birth nor death is ever reported or recorded. This type of omission would in turn bias the estimated sex ratio at birth toward masculinity. However, female infanticide is mostly a localised practice, in rural pockets of some states such as Bihar, Madhya Pradesh and Tamil Nadu. This practice may not swamp the aggregate numbers. We also note the most masculine estimated SRB in urban areas of north-west India, where infanticide practices (though historically recorded) have not been recently reported, medical facilities are widely available, and prenatal sex selection centres have been reported to flourish. Also, our estimated SRB's at the state, rural and urban level do not vary substantially from the observed sex ratio among infants aged 0+1 [Sudha and Rajan 1999:Appendix Table 1]. Finally, our estimated SRB is almost identical with that estimated by the SRS, e g, 117 for Punjab (SRS, RGI 1999). This gives us confidence in our estimate.
We also acknowledge that the district-level estimations, based on smaller numbers than the state-level estimates, are less robust. But, in the absence of reliable records on period SRB, we argue that the estimated SRB can illustrate the impact of continuing son preference in India, during social change, economic development, declining fertility and mortality, and spread of new medical technologies. We therefore cautiously proceed with reporting of estimated SRB, and draw conclusions with these cautions in mind.

3 The authors are currently conducting research in Kerala of socio-economic change, marriage system change, dowry penetration, women's status, and consequent valuation of sons vs daughters. We hope our findings will illustrate some of these issues.

4 Indian activists points out the nexus between dowry customs and daughter disadvantage. However, there are multiple opinions regarding the dowry issue within the Indian women's movement. One view argues that dowry provides women with the only feasible avenue to claiming their share of parental property in a social climate that makes it difficult for daughters to enforce legal claims to other forms of inheritance [e g, Kishwar 1999]. Therefore, until other avenues to inheritance are ensured, dowry should not be entirely discouraged, but familial support structures that limit exorbitant demands and provide some security for women should be put into place. At the same time, families should begin to view daughters as capable of providing as effective old age support as sons, and value them accordingly.

References

Agnihotri, Satish Balram (2000): *Sex Ratio Patterns in the Indian Population: A Fresh Exploration*, New Delhi; Thousand Oaks, Sage Publications, Calif.

Banerjee, N (1998): 'Household Dynamics and Women in a Changing Economy' in Maithreyi Krishnaraj, Ratna M Sudarshan and Abusaleh Shariff (eds), *Gender, Population and Development*, OUP, Delhi.

Bhat, P N and S S Halli (1999): 'Demography of Brideprice and Dowry: Causes and Consequences of the Indian Marriage Squeeze', *Population Studies*, July;53(2):129-48.

Caldwell, Caldwell and Reddy (1982) 'The Causes of Demographic Change in Rural South India: A Micro Approach' *Population and Development Review*, Vol 8, No 4, pp 689-728.

Census of India (1981): 'Child Mortality Estimates of India', Occasional Paper No 5 of 1988, Demography Division, Office of the Registrar General of India, Ministry of Home Affairs, New Delhi.

Clark, Alice W (1983): 'Limitations on Female Life Chances in Rural Central Gujarat', *The Indian Economic and Social History Review*, Vol 20, pp 1-25.

Coale, Ansley and Paul Demeny (1966): *Model Life Tables and Stable Populations*, Princeton University Press, New Jersey.

Das Gupta, Monica (1987): 'Selective Discrimination against Female Children in Rural Punjab, North India', *Population and Development Review*, Vol 13, pp 77-100.

Das Gupta and Li Shuzhuo (1999): 'Gender Bias in China, South Korea and India 1920-1990: Effects of War, Famine and Fertility Decline' in *Development and Change Special Issue on Gender, Poverty and Well-Being*, Vol 30, No 3, July, pp 619-52.

Das Gupta and P N Mari Bhat (1997): 'Fertility Decline and Increased Manifestation of Sex Bias in India', *Population Studies*, Vol 51, pp 307-15.

Datta, Anindita and Sachidanand Sinha (1997) 'Gender Disparities in Well-Being, An Overview', *Indian Journal of Gender Studies*, Vol 4, No 1, pp 51-65.

Desai, Neera (1996): 'Women's Employment and Their Familial Role in India', pp 98-112 in A M Shah, E A Ramaswamy and B S Baviskar (eds), *Social Structure and Change: Vol 2 Women in Indian Society*, Sage Publications, New Delhi.

Deshpande, Sudha and L K Deshpande (1992): 'New Economic Policy and Female Employment', *Economic and Political Weekly*, Vol 27, No 41, pp 2248-52.

Dreze, Jean (1999): 'A Surprising Exception: Himachal's Success in Promoting Female Education', *Manushi: A Journal about Indian women and Society*, No 112, May-June, Available on-line at: http://free.freespeech.org/manushi/112/jean.html Accessed September 28, 1999.

Dreze, Jean and Manta Murthi (2001): 'Fertility, Education and Development: Evidence from India', *Population and Development Review*, Vol 27, No 1, pp 33-64.

Dreze,-Jean and Amartya Sen (1995): *India: Economic Development and Social Opportunity*, Oxford, Delhi and Oxford University Press, Clarendon Press, New York.

Duraisamy Malathi and P Duraisamy (1998): 'Sex Segregation and Discrimination among Scientific Personnel' in Maithreyi Krishnaraj, Ratna M Sudarshan and Abusaleh Shariff (eds), *Gender, Population and Development*, OUP, Delhi.

Dyson and M Moore (1983): 'On Kinship Structure, Female Autonomy, and Demographic Behavior in India', *Population and Development Review*, March, 9(1):35-60.

Gold, Ann M (2001): 'Education: New Light in New Times Women's Songs on Schooling Girls in Rural Rajasthan', *Manushi: a Journal about Women and Society*, No 123, March-April 2001 available on line at: http://free.freespeech.org/manushi/123/newlight.html, Accessed June 26, 2001.

Goodkind, Daniel (1999): 'Should Prenatal Sex Selection be Restricted? Ethical Questions and Their Implications for Research and Policy', *Population Studies*, March, 53(1):49-61.

– (1996): 'On Substituting Sex Preference Strategies in East Asia: Does Prenatal Sex Selection Reduce Postnatal Determination', *Population and Development Review*, Vol 22, No 1, pp 111-26.

Gothoskar, Sujata (2000): 'Teleworking and Gender', *Economic and Political Weekly*, June 24. Special Issue on Teleworking and Teletrade in India, pp 2293-98.

Government of India (ND): 'Comprehensive Information on Indian Education on the Occasion of the Celebrations of the 50th Year of Indian Independence' Overview statistics on sexwise rural-urban literacy. Ministry of Human Resource Development, with National Informatics Centre (NIC). Available on-line at: http://shikshanic.nic.in/cd50years/g/Z/7H/0Z7h0101.htm, Accessed July 2, 2001.

Griffiths, Paula, Zoe Matthews and Andrew Hinde (2000): 'Understanding the Sex Ratio in India: A Simulation Approach', *Demography*, Vol 37, No 4, pp 477-88.

Harriss-White, Barbara (1998): 'Gender-Cleansing: The Paradox of Development and Deteriorating Female Life Chances in Tamil Nadu' (pages unknown) in R Sundar Rajan and U Butalia (eds), *Signposts: Gender Issues in Post-Independence India*, Kali for Women, New Delhi.

Jejeebhoy, Shireen J (1992): 'Family Size Outcomes for Children and Gender Disparities: The Case of Rural Maharashtra' in Cynthia Lloyd (ed), *Fertility, Family Size and Structure: Consequences for Families and Children*, Proceedings of a Population Council Seminar, June 9-10, 1992, New York, Population Council, New York.

Khanna, Sunil K (1997): 'Traditions and Reproductive Technology in An Urbanising North Indian Village', *Social Science and Medicine*, Vol 44, No 2, pp 171:180.

Kishor, Sunita (1993): 'May God Give Sons to All': Gender and Child Mortality in India', *American Sociological Review*, April, 58(2):247-65.

Kishwar, Madhu (1999): *Off the Beaten Track: Rethinking Gender Justice for Indian Women*, Oxford University Press, New Delhi.

Krishnaji, N (2000): 'Trends in Sex Ratio: A Review in Tribute to Asok Mitra' in *Economic and Political Weekly*, April 1, pp 1161-63.

Krishnaraj, M (2000): 'Women's Perspectives on Public Policy in India: A Half-Century Incomplete or Lost Agenda?', *Gender, Technology and Development*, Vol 4, No 2, pp 161-200.

Littell, R C, G A Milliken, W W Stroup, R D Wolfinger (1996): *SAS System for Mixed Models*, Chapter 9, SAS Institute, Cary NC.

Longwe, S H (1998): 'Education for Women's Empowerment or Schooling for Women's Subordination?', *Gender and Development*, July, Vol 6 # 2, pp 19-26.

Murthi, Mamta, Anne-Catherine Guio, Jean Dreze (1996): 'Mortality, Fertility and Gender Bias in India: A District-Level Analysis', *Population and Development Review*, Vol 21, No 4, pp 745-82.

Registrar General of India (1991): *Socio-Cultural Tables*, various volumes.

– (1998): 'District Level Estimates of Fertility and Child Mortality for 1991 and Their Inter-Relations with Other Variables', Occasional Paper No 1, Ministry of Home Affairs, New Delhi.

– (1999): 'Sex Ratio at Birth at State Level 1980-1998', Sample Registration System, New Delhi.

– (2001): *Census of India 2001: Provisional Population Totals*, Series 1, Paper 1 of 2001, Controller of Publications, New Delhi.

Rajan, S I, S Sudha and P Mohanachandran (2000): 'Fertility Decline and Worsening Gender Bias in India: Is Kerala no Longer an Exception?', *Development and Change*, Volume 31, No 4, pp 1085-92.

Rao, V (1993a): 'Dowry 'Inflation' in Rural India: A Statistical Investigation', *Population Studies*, July, 47(2):283-93.

– (1993b): 'The Rising Price of Husbands: A Hedonic Analysis of Dowry Increases in Rural India', *Journal of Political Economy*, August, 101(4):666-77.

Sudha, S and S Irudaya Rajan (1999): 'Female Demographic Disadvantage in India 1981-1991: Sex-Selective Abortion and Female Infanticide', *Development and Change Special Issue on Gender, Poverty and Well-Being*, Vol 30, No 3, July, pp 585-618.

Sureender, S, Rama Rao, S Niranjan (1997): 'Attitude Towards Female Foeticide: Does it Influence the Survival Status of Female Children', *IASSI Quarterly*, Vol 16 (3 and 4), 1997, pp 106-114. Available on line at: http://www.hsph.harvard.edu/grhf/SAsia/suchana/0617/sureender_etc.html , Accessed September 15, 2000.

Swaminathan, P (1991): 'Gender in Indian Planning: A Critique' in Sebasti L Raj (ed), *Quest for Gender Justice: A Critique of the Status of Women in India*, T R Publications, Madras, India.

UN (1983): *Manual X: Indirect Techniques for Demographic Estimation*, Department of International Economic and Social Affairs, Population Studies, No 81, New York.

Varma, R (1993) 'Assessing Rural Development Programmes from a Gender Perspective' in J H Momsen and V Kinaird (eds), *Different Places, Different Voices: Gender and Development in Africa, Asia and Latin America*, Routledge, London.

Unni, Jeemol (1998): 'Gender Differentials in Schooling', pp 141-58 in Maithreyi Krishnaraj; Ratna M Sudarshan; Abusaleh Shariff (eds), *Gender, Population and Development*, Oxford Delhi and Oxford University Press, New York.

Vlasoff, C (1994): 'From Rags to Riches: The Impact of Rural Development on Women's Status in an Indian Village', *World Development*, Vol 22, No 5, pp 707-19.

Wadley, Susan (1993): 'Family Composition Strategies in Rural North India', *Social Science and Medicine*, Vol 37, No 11 pp 1367-76.

Yi, Zeng, et al (1993): 'Causes and Implications of the Recent Increase in the Reported Sex Ratio at Birth in China', *Population and Development Review*, Vol 19, No 2, pp 283-302.