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Sex Ratio at Birth:
An exploratory analysis of its determinants

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ABSTRACT OF PAPER:

In this paper an attempt is made to explore the determinants of the sex ratio at birth. The analysis of the available data suggest that there are some 'good' causes which could lead to a decline in the sex ratio at birth. The 'good' causes are identified to be increase in age at first birth, decline in reproductive burden and improvements in reproductive health care and maternal nutritional status. The results of this paper suggest that it may sometimes be misleading to employ the sex ratio as an index of relative female advantage.

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Sex Ratio at Birth: An Exploratory Analysis of Its Determinants

Introduction

Sex ratio at birth, though assumes independent importance, acquires lot more relevance in the context of explaining the trend in the overall sex ratio of a population. Sex ratio -- defined as the number of females per every one thousand males -- is a crucial demographic indicator. It is used as an index of relative well-being of females. In India, the sex ratio (SR, for short): (a) was found to be low at 972 at the turn of the century and (b) has been continuously declining over time and stands at 927 in 1991. The lowness and the declining trend of the ratio has attracted considerable attention of the researchers. Important contributions on the subject include Visaria (1961), Natarajan (1971), Mitra (1978), Miller (1981), Kynch and Sen (1983), Krishnaji (1987), Agnihotri (1993) Dreze and Sen (1995) and Sudha and Rajan (1998). There is considerable variation both in terms of the issues analysed and in terms of the relative importance accorded to different factors identified to cause the lowness and the declining trend of the SR. Incidentally, the sex ratio at birth and the overall sex ratio of a population are defined differently. The overall sex ratio, as indicated earlier, in India is defined as the number of females per every one thousand males. In short, sex ratio is an index of 'femaleness' of a population. On the other hand, the sex ratio at birth is defined as the number of male live births to every one hundred female live births. It is clear that the later index is an index of masculinity at birth. Definitionally, sex ratio at birth is inversely related to overall sex ratio. Given these differences in the definitions, I shall not attempt a detailed review of the extant literature as the purpose of this paper is to identify the determinants of the sex ratio at birth. To this end, I shall restrict the discussion on the literature to what has been said about the SR at birth. In particular, attention needs to drawn to a general inference on SR at birth as a determinant of the lowness and the declining trend in overall SR in India. SR at birth had been proposed but, subsequently, dismissed as an important determinant of either the lowness or the declining trend in overall SR in India (see, Visaria (1961), Natarajan (1971), Miller (1981) and Dreze and Sen (1995)). In what follows, the methods adopted to dismiss the importance of SR at birth are discussed.

Two methods are advocated to dismiss SR at birth as an explanation for the lowness and the declining trend in overall SR. In the first method SR at birth estimated[1] from the birth registr ..ion system or from the hospital records (see, for example, Visaria (1961) and Miller (1981)) are compared with the 'Standard' SR at birth. There are problems with the estimates of SR at birth arrived at based on the birth registration system and the hospital records. The birth registration system is incomplete and the estimates based on hospital records are likely to be biased. Even today only about 25 per cent of all births occur within medical institutions. Characteristics of women who give birth at the hospitals are likely to be different from those who do not have access to hospitals. Education, age at marriage, access to reproductive health care and nutritional level of mothers who give birth at the hospitals are likely to differ from that of the others. These are important determinants of foetal loss and hence SR at birth. For these reasons, SR at birth estimated based on both birth registration system and hospital records are likely to be imprecise. In the other method, expected SR at a particular age is estimated assuming a 'standard' SR at birth and utilising the mortality rates for males and females for the relevant period. The estimated SR for that particular age is compared with that obtained from the Population Census. If the estimated SR does not differ from that obtained from the Population Census, it is inferred that the SR at birth is *not* different from the standard SR at birth. For example, Dreze and Sen (1995), have computed the expected SR at age 5 in 1981. To estimate the SR at age 5, they have assumed an SR at birth of 950 (a SR at birth of 950 is close to 105 male births per every one hundred female births); and they have utilised the under five mortality rates of males and females from the Sample Registration System. The estimated SR of 921 at age five is very close to that at 920 obtained from the 1981 population Census at age 5. This result is taken to imply that SR at birth in India is not different from standard SR at birth. Since SR at birth in India do not differ from the standard SR at birth, it is dismissed as an important factor in explaining the lowness or the declining trend in the overall SR in India. This result, while implies that the lowness of the SR in India compared to that of the developed countries at any particular point of time is not due to lowness of SR at birth, does not automatically imply that SR at birth is not an important determinant of the declining trend. More importantly, these methods employed, suggest that there is an universally accepted 'normal' sex ratio at birth. The normal sex ratio at birth is assumed to be 105. In this connection, Miller (1981; reprinted in 1995; p40) observes, "The sex ratio at birth for the United States is 105.5

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[1] SR at birth estimated from birth registration data are likely to be defective (see, Visaria (1961)), as registration of birth in India is incomplete. I shall believe that the SR at birth estimated from the hospital records are likely to be biased. This issue is noted and will not be discussed in detail here.

(U.N., 1976). This figure is often taken as a "norm" against which other countries' sex ratios at birth are judged. The assumption that the overall sex ratios at birth for the U.S. is *the standard* (emphasis in original) is certainly more than ethnocentric; it may be inaccurate, too. Even the fact that the sex ratios at birth in other nations with highly developed census-keeping operations also tend to hover around 105 is still no reason to suppose that 105 is the "right" sex ratio". This observation raises two pertinent questions: (a) Is sex ratio at birth a variable or a biological constant? and (b) If sex ratio at birth is a variable, what are the determinants of the Sex Ratio at Birth? In this paper, I shall search for answers to these questions. To this end the rest of this paper is divided into three sections: Section II discusses the possibilities of altering the probability of the sex of a child at conception and attempts to identify the determinants of SR at birth. Section III the analyses the importance of: birth order; age at first birth; foetal wastage; and marriage between blood relatives in determining SR at birth. Section IV provides a summary of the paper.

II Sex Ratio at Birth: An Attempt to Identify Its' Determinants

II.1 Sex Selection at Conception

As indicated earlier, the first question that arises is: Is Sex Ratio at birth a biological constant? If SR at birth is a biological constant, then there exists a universally accepted normal SR at birth. Thus, this question assumes prime importance. As a prelude to an engagement with this question, the possibilities of sex selection at conception needs to be addressed. The sex of a child is determined at conception. When a ovum is fertilized by a androgenic spermatozoon a male offspring is produced. On the other hand if the ovum is fertilized by gynogenic spermatozoon a female fetus develops (see, Warren (1985). In this context the first question that arises is: Is it possible to select the sex of the fetus at conception? To this end, methods to increase the probability of fertilization of the ovum with androgenic spermatozoon are available in folklore (which offer less than scientific methods) to in modern scientific writings. These methods[2] and their reliability are discussed in detail in Warren (1985). I shall not attempt to review the various theories or methods of preconceptive sex selection. However, very briefly, the various theories on preconceptive sex selection will be indicated. Four methods, which are relatively easy to adopt and which do

[2] for a detailed review, see, Warren, M.A (1995). The book is on Gendercide: The Implications of Sex Selection and not on preconceptive sex selection. It must, also, be pointed out that the discussion in this paper on preconceptive sex selection draws heavily on this work.

not entail high costs, are suggested. They are: (1) timing of intercourse; (2) use of alkaline douches and deep penetration; (3) control of mothers diet in the weeks prior to conception; and (4) increasing the sperm count. The first suggest that intercourse close to the time of ovulation is more apt to produce male conceptions. The second proposes that while acidic environments favour fertilization of a ovum by a gynogenic spermatozoon, alkaline environments favour the fertilization of a ovum by a androgenic spermatozoon. Consequently, use of acidic douches are recommended to increase the odds of conceiving a girl and use of alkaline douches to increase the odds of conceiving a boy. Based on this theory couples wishing to have a boy baby are advised to use deep penetration, as the secretions of cervix are thought to be less acidic than those of vagina. The third recommends the diet which is high in sodium and potassium for mothers who wish to conceive a boy in the weeks prior to conception. Finally, the fourth theory or method, advocates that higher sperm counts are conducive to conception of males. This theory stresses the health of men and repeated intercourse on the same day. Warren (1985), however, states "None of these "home remedies" for the production of boys or girls have been shown to be effective". While none of these remedies may yield one hundred per cent result, it is not clear whether these measures significantly alter the odds of the sex of a child at conception. Even if the odds of conceiving a male child is tilted in favour of by one per cent, the SR at birth -- defined as the number of females born alive to every one thousand males born alive --, other things remaining the same, will decline by 10 points. However, I shall take it that the possibilities of preconceptive sex selection does *not* exist. This implies that the sex ratio at conception is a biological constant. This implies that the observed spatial and temporal variations in sex ratio at birth is due to what happens between conception and birth. Thus, it is important to identify the factors that affect the SR between conception and birth. This exercise is undertaken in what follows.

II.2 Determinants of Sex Ratio at Birth: A Discussion

II.2 (a) Variability in Sex Ratio at Birth

Selection of the sex of a fetus at conception, as indicated earlier, is near impossibility. Hence, if sex ratio is not affected between conception and birth, sex ratio at birth must also be a biological constant. However, the available evidence suggest to the existence of both: spatial and temporal variability in SR at birth. Visaria (1961) analyses the data, pertaining to the 1950's, on SR at birth from 76 countries. His data show that the SR at birth varies a great deal across countries. The male births per every one hundred female births varies from a low of 90.2 (an high SR at birth of 1109) in Montserrat to a high of 116.2 (a low SR at birth of 861) in Gambia. Available evidence suggest that even in developed countries masculinity at birth has increased over time. Raju and Premi (1992; cited from Anantharam (1989)) cites the cases of Sweden and United Kingdom. Data for United Kingdom Show that the masculinity at birth had increased from 104.3 (an SR at birth of about 959) in 1870 to 107.2 (an SR at birth of about 933) in 1980. In Sweden masculinity has increased from 103.5 (an SR at birth of around 966) in 1870 to 107.4 (an SR at birth of around 931) in 1980. Hull's (1990) analysis of data[3] on SR at birth for China show large inter regional variations. SR at birth (ratio of masculinity) varied from a low of 101.16 in Xinjing to 118.47 in Zhejiang. In India, too, the sex ratio at birth varies considerably both across space and over time. The data provided in Visaria (1961) help to identify the spatial and temporal variation in SR at birth. His data, based on birth registration system, indicate that masculinity at birth varied from a low 104.3 in Madras to 110.4 in Punjab in 1881-1890. The birth registration in India were, and even today is, incomplete and hence the absolute value of the masculinity at birth may not be reliable. However, I shall believe that the broad trend and regional variability indicated by the data cannot be questioned. The data over time suggest that masculinity at birth had increased from 107.3 in 1881-90 to 109.6 in 1940-46. More recent data, provided in National Family Health Survey (1995), prove the existence of considerable both inter-state and temporal variations in SR at birth in India. SR at birth estimated for different years between 1982 to 1993 varies between 868 in 1993 and 991 in 1990. SR at birth estimated from NFHS data (available on floppy diskette) for different states bears evidence to enormous inter-state (spatial) variability in India. SR at birth varies from 876 in Rajasthan to 973 in Kerala. Thus, the available evidences suggest that the SR at birth is a *variable* and *not* a biological *constant*. For reasons stated earlier, it appears that what happens between conception and birth determines the sex ratio at birth. To be precise, foetal loss appears to affect the sex ratio at birth.

II.2(b) Foetal Loss and Sex Ratio at Birth

Huxley (1926) indicated that 130[4] males are conceived to every 100 females; at birth it drops to little over 100. The natural advantage experienced (or the imbalance in the sex ratio at

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[3] Hull (1990) has analysed one per cent sample data obtained for various regions of China on SR at birth.

[4] see, also, Miller (1981). It appears that while the exact magnitude of SR at conception is a subject of dispute, the consensus seems to be that nature favours males at conception.

conception) by males at conception is, to a large extent, lost (or corrected) before birth. The reduction in masculinity that occurs in the duration of conception is due to miscarriages and abortions. Male embryo, being less hardy than that of females, more often aborts spontaneously (Miller, (1981). Apart from abortions -- to be precise, spontaneous abortions -- still births reduce masculinity among live births (UN (1954), Visaria (1961), and Mitra (1978)). These suggest that, in general, foetal wastage determines the sex ratio at birth. Thus, the problem of identification of the determinants of SR at birth reduces itself into identification of the determinants of foetal wastage. Other than foetal wastage, change in the weight of first order birth in total births, also, has been suggested as a factor influencing the SR at birth[5] (Mohanchandran Nair (1996)). Thus, I shall believe that foetal wastage determines the SR at birth. In what follows an attempt is made to discuss the determinants of foetal wastage.

Foetal wastage is a function of biological, environmental and economic factors. The studies[6] by Mitra (1978), Ruzicka and Kane (1985) and Visaria (1988) offer valuable insight into the determinants of foetal loss. From these studies it emerges that biological maturity is a crucial factor. Low age at conception, apart from being a crucial determinant of biological maturity, also determines haemoglobin levels (Ramachandran (1989)). Conception at an early age, when females are not biologically fully matured, rates of spontaneous abortion and still birth are high. The study by Pachuri and Jamshedji (1983), based on hospital data in Bombay, confirms higher rates of spontaneous abortion and still birth for adolescents compared to women in the age-group 20-29. The rates of spontaneous abortion and still birth among adolescents were, respectively, little over 205 per cent and 121 per cent compared to that for women in the age-group 20-29. The rates of abortion and still birth are expected to decline with the age of mothers up to a point and then increase with both the age of mothers and order of conception. To elaborate on, conception at an early age leads to higher rate of foetal wastage, higher rate of foetal loss induces bearing children in comparatively rapid succession which has a deleterious effect on the health of women (Karkal (1985)). To be more precise, bearing more children at rapid succession causes physical

5 Other reasons for high masculinity at birth have been suggested in Visaria (1961). They are race, climate, ABO blood group, and habits and customs of people. These factors were suggested on the assumption that the masculinity at birth in India was high. It has been shown that masculinity at birth is not high in India (see, Visaria (1961) and (Dreze and Sen (1995)).

6 It should be indicated that none of these studies is directly concerned with foetal loss. The study by Mitra is on India's Population. Ruzicka and Kane's study is on Nutrition and Child survival in South Asia which throws considerable light on the issue of foetal loss. Visaria is primarily concerned with infant mortality.

exhaustion and nutritional depletion or leads to 'maternal depletion syndrome'(Jeliffe, (1966)). Nutritional level of mothers is an important determinant of foetal wastage (Venkatachalam (1962)). Nutrition level of mothers, apart from being a function of reproductive burden, is a function of economic factors[7]. The poor nutritional status of the mother reflects her own growth as a foetus, new born, child and adolescent (Jejeebhoy and Rao (1995) and Mathai (1989)). Mothers own growth depends on the economic position of the family. Apart from general prosperity of the family, intra-family allocation of resources, determined by gender discrimination[8], affects the allocation of food to women and hence the growth and health status of women. The nutritional inadequacy is compounded, as indicated earlier, by the number of conceptions by a woman.

Work participation and nature of work assumes importance in determining the pregnancy outcomes. Domestic work (Patrizia and Francoise (1987)) and work in agriculture (Swaminathan (1997) affect pregnant women and pregnancy outcomes. Domestic drudgery particularly cooking appears to have adverse health effects. Biomass smoke levels and poor ventilation lead to respiratory infections in young children, adverse pregnancy outcomes for women exposed during pregnancy, chronic lung disease and associated heart disease in adults and cancer (Tata Energy Research Institute (1994)). Adverse pregnancy outcomes is perceived to be the result of carbonmonoxide emitted in the process of biomass combustion (Banerjee (1996)). Air pollution indoors, apart from causing adverse pregnancy outcomes, affects the survival chances of infants. Polluted air indoors causes acute respiratory infection which is a major cause of infant mortality (Banerjee (1996)). Thus, domestic drudgery, particularly cooking food with open stoves, both directly and indirectly affects pregnancy outcomes. Carbonmonoxide emitted directly affects pregnancy outcomes. Infant mortality, which is an important cause of increase in reproductive burden of women, affects pregnancy outcomes through depletion of maternal nutrition.

Work in agriculture is another important cause of adverse pregnancy outcomes. Women perform the task of transplanting saplings in rice cultivation and weeding. Batliwala (1988) points out that "This means [performing the task of transplanting] that every woman --

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7 see, in this connection, Ruzicka and Kane (1985). These authors, while dealing with Nutrition and Child Survival in South Asia, discuss how family size; frequent child bearing; early marriage of girls; inadequate housing and irregular income affect nutritional level of the population.

8 see, for example, Gupta (1987).

heavily pregnant or otherwise -- is squatting on her haunches for hours together. Obstetricians confirm that such physical strain and pressure on the uterus could well trigger off premature labour in the last trimester of pregnancy, not to mention increasing chances of still birth". For the male fetus, generally being larger in size (Stern (1960); cited in Miller; (1981)) than the female fetus, the chances of dying appears to be higher compared to that for female fetus. For these reasons, one would expect, in a situation where women perform the tasks of transplanting and weeding the foetal wastage, particularly of male fetuses, are likely to be higher compared to that where women are not engaged in these tasks. This calls into question the conclusion that high SR in South Indian States, particularly among juvenile population, is a reflection of greater female autonomy compared to that experienced by women in North Indian States (Dyson and Moore (1983)). Simply put, high sex ratio, particularly juvenile sex ratio, in the south Indian states could be a reflection of differences in the nature of work done by women in these states. While this issue is noted, will not be pursued in any great detail here. However, what is important is that the nature of work by women affects the pregnancy outcomes and hence the SR at birth.

Access to reproductive health care, to be specific access to antenatal care, improves the maternal well-being. Maternal anaemia is an important determinant of infant survival. Perinatal mortality rates are ten times higher among severely anaemic women compared to normal women (Ramachandran (1989)). Antenatal care, if provided, is likely to reduce the problem of maternal anaemia. The maternal and child health programme seeks to address this period of neglect (Jejeebhoy and Rao (1995)). They review the available evidence on the utilization of the services provided under the maternal and child health programme and conclude that the utilization of the services is extremely poor. This paper is not on antenatal care; and hence, I shall not attempt a detailed review of either the access to or the impact of antenatal care. However, the discussion on antenatal care sheds interesting side lights on the issue addressed in this paper. The discussion reveal that maternal anaemia, since is an important determinant of child survival, determines the number of conceptions by a woman to achieve a certain number of surviving children. Maternal anaemia increases with birth order\conception parity. Thus, health of the mother at first conception emerges as a crucial determinant of the pregnancy outcomes. The discussion, further, suggests that mothers whose nutritional status is poor at the start of their reproductive span are pushed into a vicious circle.

Environmental factors, particularly the availability of protected drinking water, have a bearing on the nutritional level of women. Amoebiasis is water borne. Availability of protected drinking water helps to control the incidence of amoebiasis. It spreads faster during rainy season when water gets contaminated. Amoebiasis affects the nutritional intake of the body. Provision of adequate and safe drinking water also leads to saving of energy. Which improves nutritional status of the mother, the fetus and the nursling (Burger and Esrey (1995)). The discussion here indicates that SR at birth is not only a function of biological, economic, and social factors but also depends, to a large extent, on the development of infrastructural facilities, particularly provision of protected drinking water.

The engagement with the issue of foetal loss, so far, serves to highlight the complex interplay of economic, social, environmental and biological factors in determining the pregnancy outcomes and hence SR at birth. It is unfortunate, in this connection, that the requisite data are not available to analyse the impact of these various factors on pregnancy outcomes and hence on the sex ratio at birth. However, one could identify certain proxies for the health and reproductive behaviour of women. Reproductive wastage could be used as a proxy for health of women. Age at marriage or age at first conception could be used as a proxy for biological maturity of women. Birth order could be used as a proxy for frequent child bearing or reproductive burden. Thus, I shall restrict the analysis to these crucial factors: birth order, foetal wastage and age at first birth. An attempt is also made to analyse the impact of marriage between relatives on SR at birth. In what follows the sex ratio at birth by birth order is analysed.

III. Determinants of Sex Ratio at Birth: An Empirical Evaluation

The discussion, so far, suggests that the foetal wastage determines the sex ratio at birth. Apart from foetal loss, contribution of first order birth to total birth has been suggested as an important determinant of SR at birth (Mohanchandran Nair (1996)) and Dsouza (1993)). The rationale for the first order birth to be an important determinant of SR at birth is not clear. However, I shall believe for reasons provided earlier, birth order could be construed as a proxy for 'maternal depletion syndrome'. One expects that health of women at first birth is better than at subsequent births and hence the foetal loss among first conception is expected to be low. Consequently, I shall expect to find that the SR among first order birth to be lower than that among other order births. This a priori expectation is evaluated in what follows.

III.1 Sex Ratio at Birth by Birth Order

The relationship between birth order and SR at birth is examined with the help of data available from two sources. These data sources are constituted by the National Sample Survey (NSS, for short), (1955) rounds 2 and 4 and the National Family Health Survey:1992-93 (NFHS, for short). The NSS survey had been conducted in the beginning of the 1950's and the NFHS data are of more recent origin. These sources of data, while being useful to identify the importance of variations in SR at birth by birth order, renders a historical perspective on the issue. First, the NSS data are presented and discussed. Data on SR at birth by birth order, up to 4th order birth, and period of marriage of mothers are provided in Table 1 for rural areas of India. As a prelude, it is important to look at the data problem. The NSS survey had been conducted in 1951-52. Couples alive at the time of survey had been classified by the period of marriage of the couples. One could observe from Table 1 that the marriage period covered extends to more than 40 years. Which indicates that the survey had attempted to collect data on births over a period of little more than 40 years. The accuracy of the information on SR at birth obtained in this survey crucially depends on the memory of couples to recall all their children born alive by birth order. It is plausible, given the levels of literacy of couples at that time, the data are seriously affected by recall error. To be precise, it is likely that children, particularly female children, who were not alive at the time of interview but were born alive were not counted properly. It is, also, quite plausible that some girls who had got married and left the household were not counted. These types of errors are likely to be higher the older the couples are. Simply put, recent births would have been recalled better than the past ones. This proposition is evaluated in what follows.

The last column in Table 1 provide aggregate data, aggregated over first to fourth order births, on SR at birth. The data, combined for both the NSS rounds: 2 and 4, show that SR at birth for women whose marriage period was before 1910 was unusually low at 794. This figure had been increasing with period of marriage and stood at 943 for those women whose marriage period was 1946-51. The monotonic increase in SR at birth with period of marriage implies that memory lapse or recall error had declined with narrowing of the time gap between marriage period and the time of survey. This result suggest that it is difficult to infer on the time trend in SR at birth from survey data which covers the reproductive history of women. Similar problem has been noted in NFHS too. NFHS (1995) observes "The sex ratio at birth [defined as the number of males born alive to every one hundred females born alive] is particularly high (112.0) for births occurring before 1972, indicating that there is underenumeration of female births that occurred more than 20 years before survey. Since 1972, however, the sex ratio at birth has been almost constant at an average level of 106.3-106.6 for five year periods". The concern in this context is not the trend in SR at birth. The concern is variability in SR at birth across birth orders. I shall believe that the recall error does very little damage to the assessment of variability in SR at birth across birth orders.

The data provided in Table 1 indicate that in five of the of the six marriage periods, for which data are available, the SR at birth among first born babies are the lowest compared to that for all other birth orders up to 4. The last period 1946-51 being very close to the survey year, all women who got married in this period might not have experienced more than one or two births. To be more precise, the number of births in the higher order births to women married between 1946-51, particularly third and fourth order births, would have been negligible. Thus, SR at birth among higher order births for these women becomes extremely unreliable. Once the data for the last marriage period are left out, there emerges a clear pattern. SR for the first order births compared to other order births to women in the respective marriage period is observed to be the lowest. Thus, the numbers presented, to a large extent, confirm that the share of first order births in total birth is an important determinant of overall SR at birth.

Having looked at data of 1952 vintage, I shall analyse the data for the most recent past made available by the NFHS. Information on birth order for a total of 275172 live births are available in NFHS. For each birth order, data on (a) number of births classified by sex of the live born child and (b) the estimated SR at birth are presented in Table 2 for all India. As the last row of Table 2 suggest, information on SR at birth for birth orders equal to and above six are aggregated. This aggregation is effected as the number of births in the higher orders are few. A quick glance at the data show that the SR among first live born infants are the lowest at 911. This result confirms that birth order is an important determinant of overall SR at birth. To be more precise, the composition of the total births according to birth order does influence the overall SR at birth. This is confirmed by a simple calculation. While the overall SR at birth estimated excluding the first order births could be placed at 936, inclusion of first order births brings down the overall SR at birth to 929. A reduction of 7 points brought about by the inclusion of the first order births in the overall SR at birth, I shall believe, is significant. The data also show that the SR at birth, in general, increases with birth order: from 911 in the first order births to 943 in six and above order births. This result has implications to the observed time trend in over all SR in the country. Simply put, as the weight of the first order births in total births increase overtime the overall SR at birth is likely to decline, which affects the trend in over all SR. The available data on composition of births by birth order suggest that the first order births which accounted for about 20 per cent in 1972 had gone up to about 32 per cent in 1993. It is also important to note that an increase in the weight of the first order birth implies a reduction in the reproductive burden of women. This will affect SR that obtains among the higher order births too. This issue is noted and will not be addressed here as the requisite time series data on SR at birth by birth orders are not available. However, the fact that SR increases with parity confirms that the 'maternal depletion syndrome' affects the SR at birth.

State wise data on SR at birth by birth order have been tabulated to verify if the results obtained for the country as a whole holds for individual states. These results are presented in Table 3. For each state information on SR for: (a) first order births; (b) estimated for all births excluding the first order births; and (c) total births (inclusive of first order births) are presented in Table 3. Since number of births in the higher orders are too few in each state, detailed tabulation of SR at birth by birth orders is not presented here. However, detailed information, for each of the 24 states and for an union territory, on SR at birth by birth orders are available with the author. The numbers are largely self-explanatory to warrant a detailed discussion. Thus, the discussion is restricted to pointing out some of the salient features of the numbers presented in Table 3. A quick glance at the numbers in this table reveal that in 20 states the SR among first live born is lower than the overall SR at birth. More importantly, in 10 states the overall SR at birth is in excess of 20 points compared to that for the first order births. In another five states: Gujarat, Orissa, Karnataka, Tamilnadu and West Bengal, the overall SR at birth exceeds that of the first order births by more than 10 points. The observed results at the level of states are in conformity with that obtained at the national level. Surprisingly, both the overall SR at birth and the SR at birth for the first order births varies considerably across states. The overall SR at birth varies from a low of 876 in Rajasthan to 979 in Kerala, while that for the first order birth varies from 812 in Tripura to 973 in Kerala. In this connection, for reasons which will be provided later, it is important to note that SR for the first order births is <u>not</u> affected by human intervention. This implies that variation in SR at birth, particularly for the first order births, reflect the differences in the complex inter play of various factors identified to be important determinants of foetal wastage across states and hence SR at birth.

A closer scrutiny of the variability in SR at birth across birth orders for each state brings out an exceedingly important point. While there is considerable variation in SR at birth (a) within each state across birth orders and (b) across states for each birth order, the data do not seem to support, with an exception of Punjab, active human intervention to distort the SR at birth. If active human intervention affects the SR at birth, one should expect to find the SR at birth to decline with birth order (see, in this connection, George and Dahiya (1998)). The numbers on SR at birth by birth orders at the state level show neither a consistently declining nor an increasing relationship with parity, except in Punjab. In Punjab, the SR at birth declines with birth orders up to fourth order births -- from 934 in the first order to 821 in the fourth order. One observes an increase in SR between 4th and 5th order births: from 821 to 902. However, after 5th order births, once again the SR at birth declines as the birth order increases. This result suggests that in Punjab active human intervention is significant enough to distort the SR at birth. In none of the other states, the distribution of SR across birth order confirms the relationship consistent with the 'a priori' expectation regarding active human intervention to select the sex of the child at birth. From these results, it could safely be said, in general, human intervention does not distort the SR at birth in India. I shall hasten to add here that this result should not be taken to mean absence of human intervention to select the sex of the child at birth. Indeed, I shall believe that probably the human intervention to select the sex of the child at birth is increasing and spreads across space (see, in this connection, Miller (1981) and (George and Dahiya (1998)). This result shows that such intervention is not sufficiently large enough to alter the observed sex ratio at birth. The variability in SR at birth across birth orders in each state and across states in each birth order appears to be determined, to a large extent, by a complex interplay of various factors. In this connection, an examination of the relation between age at first conception and SR among first order births is relevant. There is also an advantage, which will be indicated later, in confining attention to the first order births.

III.2 Age at First Birth and Sex Ratio among First Order Births

As a prelude to an assessment of the relationship between SR among first order births and age at first conception, briefly the variability in SR at birth in the first order births and the advantages in confining attention to first order births are discussed. It has already been indicated that there exists considerable variation in the level of SR among first live born across states, say, from 812 in Tripura to 973 in Kerala. This variability in SR at birth for the first order births: (a) suggest that the state specific factors are important in determining the SR at birth and (b) helps to explore the importance of, at least, one of the determinants of SR at birth. More importantly, there is an advantage in confining attention to first order births. SR for the first order births is least affected by human intervention. There appears to be some evidence to support this notion. George, Miller, and Abel (1992) observe, while dealing with female infanticide in Rural South India, that, "Notably, only one female infanticide (by a married mother) involved first born daughter. All other victims had birth orders greater than one, and each of these families had at least one surviving female at the time, and usually they had two. This pattern corresponds to the well known parity-specific practice of female child neglect in north-west India which seems to protect and preserve first-born daughters but discriminate against higher parity daughters". This observation suggest that parents are not worried about the sex of the first born child. This in itself may be an outcome of the patriarchal value system. To a man, being a parent than being seen as an impotent outweigh all other considerations. Thus, I shall believe, it is safe to assume that SR for the first order birth is not affected by human intervention. Since human intervention does very little to distort the SR at birth in the first order births, the observed variability across states in SR among first live born could be assumed to be, largely, accounted by variation in the levels of natural and biological determinants of SR at birth across states.

Age at first conception is the prime candidate to explain the variability in SR at first births across states. Availability of data restricts the selection to median age at first birth which is used as a proxy for age at first conception. Data on median age at first birth and SR at first birth, for each of the 24 states and an union territory, Delhi, are presented in Table 4. For reasons stated earlier, foetal wastage and age at first conception is expected to be inversely related, particularly when child bearing by adolescents is high. The data show that in 13 states the median age at first birth is less than 20 years. To put it differently, more than 50 per cent of the first order births occur to adolescent mothers in a large number of states in India. Surprisingly, in three of the four states: Andhra Pradesh, Karnataka and Tamilnadu, in south India the median age at first birth is below 20 years. To measure the extent of the association, correlation co-efficient between median age at first birth and the SR among first order births has been computed. The computed correlation co-efficient at -0.335 is low and is statistically significant only at 10 per cent level. The correlation co-efficient, though low, bears expected sign. This result is important for two reasons. As indicated earlier, the complex interplay of various factors determine the SR at birth. Data availability do not permit an analysis of the relationship between age at first birth and SR for the first order births controlling for other factors such as extent of work participation by women, nature of employment of women and nutrition level of mothers at first birth. I shall believe, given the simplicity of this exercise and extent of complexity in the interplay of various factors, the result obtained which is theoretically consistent is important. Indeed, once the two extreme observations, pertaining to Kerala and Tripura are left out, the value of the correlation co-efficient improves to -0.596; which is moderately high; and is statistically significant at 1 per cent level. The sign and magnitude of the correlation co-efficient confirm that as median age at first birth increases, SR among first live born declines. These results signify (a) the importance of age at first birth as a determinant of SR among first live born and (b) indicate the importance of other local\state specific factors at work. This completes the discussion on the relationship between first order birth and age at first birth. In what follows the relationship between foetal wastage and the SR at birth is explored.

III.2 Sex Ratio at Birth and Foetal Wastage

Foetal wastage, as indicated earlier, is the source of variability in SR at birth. In this connection, it is expected that as foetal loss increases SR at birth too increases. This positive relationship is explored here. NFHS provide data on number of spontaneous abortions and still births experienced by a woman. Number of spontaneous abortions and the number of still births together constitute the total number of foetal wastage experienced by a woman. It should be added here that, for the purposes of this paper, induced abortions are left out from the count of foetal wastage. It should, also, be emphasised that the estimate of foetal wastage is likely to be an under estimate. In any survey, it is more difficult to obtain retrospective information on conceptions than on live births (NFHS, (1995)). Data on abortions, particularly spontaneous abortions in the early months of pregnancy, are difficult to get. Given this limitation on the data, the results are presented in what follows.

The maximum number of total foetal wastage experienced by a woman works out to 9 in India. Accordingly, the selected women are classified into 10 categories. While the first group consists of women who report no foetal loss, the last group includes women who report the maximum number of foetal wastage, i.e. 9. The other 8 categories in between are constituted by women who are arranged in ascending order of the total number of foetal wastage reported by them. For each group of women, data on total number of female live births, total number of male live births, and SR at birth are furnished in Table 5. The numbers presented in column 4 confirms, in general, that SR at birth increases as the number of foetal wastage experienced by women increases. SR at birth increases from 917, for women who had experienced no foetal loss, to 1375 for those who report the maximum number of foetal wastage at 9. To confirm the strength of the relationship between foetal loss and the SR at birth, simple correlation co-efficient between number of foetal loss and SR at birth has been computed. Estimated correlation co-efficient is fairly high at 0.810 and is statistically significant at 1 per cent level. This confirms the positive relationship between foetal loss and SR at birth.

State wise data on SR at birth and foetal wastage have been tabulated to confirm the relationship between foetal loss and SR at birth at the state level. The results are presented in Table 6. The detailed data on foetal wastage and SR at birth are not presented here. For the sake of simplicity, also the number of births for women who report more than 2 or 3 foetal loss are two few to examine the relationship in any great detail for each state, only information on SR at birth: (a) for all births; (b) for all births to women who report no foetal loss; and (c) for all births to women who report at least one foetal loss are provided in this table. It could be verified, comparing the numbers in Columns 3 and 4, that in 19 of the 23 states the SR at birth for all births to women who report at least 1 foetal loss exceed that for women who report no foetal loss in the respective state. It is important to note that in 13 of the 19 states the excess is more than 50 points. The opposite holds true only in 5 small states and in one union territory, Delhi. Of the 5 states where the opposite holds good four states, namely, Manipur, Mizoram, Nagaland and Tripura are located in north eastern part of India. This result indicates the importance of region specific factors at work. This issue while is noted, will not be pursued here. To sum up the discussion, the evidence provided for the country as a whole and for each of the individual states in Indian union prove the importance of foetal wastage in determining SR at birth. Next, I shall very briefly, analyse the impact of marriage between blood relatives on SR at birth.

III.3 Marriage between Blood Relatives and Sex Ratio at Birth

Marriage between relatives account for more than 25 per cent of all marriages in 4 states: Tamilnadu, Andhra Pradesh, Karnataka and Maharast... For the purpose of evaluating the importance of marriage between relatives in determining the SR at birth, attention is confined to only these four states. Attention is confined to these four states to ensure sufficient number of births for women who are married to blood relatives and those who are married to non-blood relatives. The total number of births analysed for each of the state of Andhra Pradesh, Tamilnadu, Karnataka and Maharastra, respectively, are 11517, 10693, 13512, and 11941. The total number of births in each state, at the first instance have been classified by sex of the live born children. In the next step, the total births of male and female children are classified into four categories. The first category consists of births to women married to first cousins or uncles. Thus, the first group consists of births between the closest blood relatives. The next three categories include births, respectively, to women married to second cousins, other blood relatives and to non-blood relatives. The relevant data for each of the four states are furnished Table 7.

It is anticipated, since SR in general is high in the south Indian states where the incidence of consanguineous marriages is high, that the SR among births to women married to blood relatives will be higher than that for women who are married to non-blood relatives. This 'a priori' expectation is evaluated here. The numbers presented in Table 7 are largely self-explanatory, and hence, I shall discuss (a) only some of the salient features of the numbers presented in this Table; and (b) concentrate on some of the related issues that arise in this context. The numbers do suggest that in three of the four states: Andhra Pradesh, Karnataka and Maharastra, SR among births to women married to relatives, irrespective of the nature of relationship, is higher compared to that among women married to non-blood relatives in the respective states. The difference in SR at birth to women married to relatives and non-relatives is fairly high at 24 and 13 points, respectively, in Karnataka and Maharastra. The hypothesised relationship does not hold good in Tamilnadu. The share of marriages among blood relatives in the total marriages in Tamilnadu at 46.5 per cent is the highest in the country. This prompted an examination of other factors: variability in age at first cohabitation and weight of first order birth in overall birth. First, the case of Karnataka is discussed. In Karnataka: (a) the contribution of first order birth to all births is the lowest at 28.47 and 29.71 per cent, respectively, for women married to blood relatives and non-blood relatives; and (b) the difference in the share of first order births in all births between women married to blood relatives and non-blood relatives at 1.24 percentage point is negligible in Karnataka. Based on these results, one could assume that the reproductive burden for women in both categories is the same in this state. Which in turn implies that the level of foetal wastage induced by 'maternal depletion syndrome' is the same for both categories of women. Thus, it could be inferred that the observed higher SR at birth for women married to close relatives compared to that for women married to non-relatives is, largely, true.

An examination of the data on mean age at first cohabitation, however, dispels this notion. Mean age at first cohabitation at 15.7 years for women married to blood relatives is lower by 1.2 years compared to that for women married to non-blood relatives in Karnataka. This result, it appears, highlight the importance of biological maturity at first cohabitation and hence age at first conception. This sort of reasoning is strengthened by the results obtained for Andhra Pradesh. In Andhra Pradesh, the share of first order birth in all births at 30.72 and 32.43 per cent, respectively, for women married to close relatives and non-relatives is do not vary much. Similarly, the mean age at first cohabitation at 14.9 and 15.4 years for the two categories of women is apart by just 0.5 year. The SR at birth for the two categories of women at 970 and 967 is not quite different from each other. A comparison of the results for Andhra Pradesh and Karnataka brings out, clearly, that these two states differ only in terms of the difference in age at first cohabitation between women married to close relatives and non-relatives. Thus, the higher SR at birth that obtains for women married to close relatives compared to that for women married to non-relatives in Karnataka is largely attributable to lower mean age at first cohabitation for women married to relatives. In this connection, it could be verified, that the results for Maharastra closely resemble that for Karnataka. For these reasons, one could safely infer, that the higher sex ratio observed among births to women married to blood relatives is caused by lower mean age at first cohabitation and hence lower age at first conception for them. To put it differently, the results suggest that biological maturity, and not relation at marriage, is a crucial determinant of SR at birth.

The case of Tamilnadu, however, seems to defy the sorts of reasoning advanced. The age at first cohabitation is lower for women married to blood relatives. Difference in the share of first order births in total births is highest at 4.05 in favour of women married to non-blood relatives. However, the SR at birth for women married to non-relatives is higher at 963 compared to that for women married to relatives at 949. Thus, neither the 'reproductive burden' nor the age at first cohabitation/biological maturity appear to be important determinants of SR at birth in Tamilnadu. The results appear to suggest the following. In situations where the age at first cohabitation is low, note that in all states except Tamilnadu the age at first cohabitation is below 17 years, the difference in age at first cohabitation/conception appears to decide the differential in SR at birth between the two categories of women. On the other hand, in a situation where the age at first cohabitation is fairly high, the other factors such as differences in reproductive health care provided, nature of work participation and intra-family allocation of food seem to exert a great deal of influence on pregnancy outcomes and hence on SR at birth. In this connection, I shall believe, the women married to close relatives enjoy (a) relatively better access to reproductive health care, (b) better nutrition, as discrimination in the intra-family allocation of food in such families where women are married to close relatives is less sharp, and (c) less burden of domestic drudgery which is an important determinant of pregnancy outcomes. For these reasons, I shall believe, if the effect of biological maturity is controlled, the influence of other factors come to the fore. The available data do not permit an analysis of these factors and hence is left as an hypothesis here. To complete the discussion on the impact of marriage between close relatives the results are very briefly summarised. The results do not support the 'a priori' expectation that SR at birth for women married to close relatives is higher compared to that for women married to non-blood relatives. To be precise, relation at marriage perse does not affect the SR at birth. The observed differences in SR at birth between women married to relatives and non-relatives, it appears, to be largely explained by the differences in biological maturity at first cohabitation/conception.

A quick summary of the results presented in this section, I shall believe, is in order before the concluding observations are offered. The importance of the following factors: reproductive burden; foetal wastage; age at first conception; and relationship at marriage in determining the SR at birth has evaluated in this section. It has been pointed out earlier that it has not been possible to get data on all the relevant variables. In tune with normal practice in empirical research certain proxies have been employed. While median age at first birth has been used as proxy for age at first conception, birth order has been used as a proxy for maternal depletion syndrome or reproductive burden. Spontaneous abortions and still birth constituted the count of foetal wastage. The analyses in this section broadly confirm the relevance of the chosen factors, except the relationship at marriage, in determining the SR at birth. SR which is, in general, lower among births to women married to relatives is explained by lower age at first cohabitation and higher reproductive burden experienced by them compared to the other group of women. These results indicate that the SR at birth could decline for some 'good causes'. The 'good causes' being: increase in age at first conception or reduction in child bearing by adolescents; reduction in reproductive burden of women or increase in the share of first order births; and reduction in foetal wastage which may be caused by complex inter play of economic, social, cultural, biological and environmental factors. These results caution against the use of sex ratio as a comprehensive index of well-being of women in India. Indeed, these results suggest that a high value of SR in the lower end of the age-spectrum could be the result of extreme poverty, high reproductive burden for women, high maternal malnutrition and extremely poor access to reproductive health care facilities. For these reasons, the distribution of SR across age-group assumes importance in assessing the well-being of women[9]. Thus, these results on the one hand signify the importance of 'good' causes to affect the SR at birth and on the other brings out the inadequacy of the overall SR to capture the well-being of women.

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9 see, in this connection, Jayaraj and Subramanian (forthcoming), for an explicit reckoning of the distribution of SR across age-group in the measurement of the 'femaleness' of a population.

IV Concluding Observations

This paper is motivated by the quest for identifying the determinants of SR at birth. In this connection, the observation made by a well known demographer, Pathak (1998), is worth quoting. He observes, while reviewing the Status and Perspective of Demographic Research in India, that " Not a single study has, however, come out with a conclusive explanation for the imbalanced sex-ratio in India, and for its peculiar trend. Also, there is no theoretical study available to explain the rising trend in sex ratio at birth over time". In this context, this paper does not claim to offer a comprehensive theory on increasing masculinity at birth in India. This paper is in the nature of a first cut at the problem. The attempt, as indicated earlier in this paper, is to identify the determinants of SR at birth which, I shall presume, is the first step to proposing a comprehensive theory on determinants of SR at birth. The analyses in this paper appear to prove that the chosen determinants of SR at birth: foetal wastage, maternal depletion syndrome, and age at first conception are important. While it should be emphasized that there are some 'good' causes which affect the SR at birth, the results of this paper should not be interpreted to mean that gender based discrimination is on the decline in India. In this context it needs to be stated that this paper does not address the issues of either gender based discrimination or well-being of women in India.

While this paper is not directly concerned with the issue of 'gender based' discrimination in India, sheds interesting side lights on the issue. It brings out the inadequacy of an index such as the sex ratio: either the overall sex ratio or the juvenile sex ratio, to infer on the trend or the regional variation in 'gender based' discrimination. To be more precise, the high juvenile sex ratio observed in the south Indian states is often (see, in this connection, Bardhan (1974), Miller (1981), Dyson and More (1983)) taken to reflect the relatively better female autonomy enjoyed by women in the south than women in the north Indian states. The better position of women in the south is also thought to be mediated by, apart from cultural factors, economic value of women: female labour is relatively intense in paddy cultivation in the south compared to that in wheat cultivation in the north. Nature of work, particularly tasks such as transplanting and weeding in paddy cultivation, is an important determinant of foetal wastage and hence the SR at birth. This raises the question: How much of the observed differences in SR, particularly in the juvenile SR, is explained by the higher foetal wastage experienced by women who work in paddy cultivation compared to others? Unless this question is answered, it is difficult to infer on the relationship between female autonomy and

SR. This issue has not been analysed in detail in this paper, but could serve as an useful research agenda in the future.

This paper, also, dispels the notion that there exists a 'normal' sex ratio at birth. The analysis in this paper, clearly, shows that SR at birth is a function of level of foetal wastage. Foetal wastage is not only a function of biological factors, but is determined by the complex interplay of social, cultural, economic, biological and environmental factors. I shall believe that the extent and nature of the inter paly of these various factors change over time. For example, the beginning of this century (i.e. the twentieth century) was marked by wide spread famines and prevalence of epidemics in India (Mitra (1978) and Visaria and Visaria (1982)). The nutritional level of the population was extremely poor in India. To add to this, infrastructural development too was poor. Even the rudimentary sanitation and public health care services and facilities that India possessed were heavily concentrated in the urban areas (McAlpin (1985)). For these reasons it is expected that at the beginning of this century foetal wastage was very high in India. It is nearly impossible to ascertain the level of foetal wastage experienced by women in India at the beginning of this century. Even today it is difficult to construct a picture of time trend in foetal wastage in this country. The indirect evidence, which is deduced based on data provided on SR at birth, available suggest that it was very high in India. The calculated SR at birth, calculated employing the reverse survival method and the enumerated population figures at age-group 0-4 from census records, are presented in the NSS survey report, Number 7 on: Couple Fertility (page 66). These figures for the years 1901, 1931 and 1951 at 990 and 1020 for 1911 suggest that SR at birth was very high in India. The figure for the year 1911 is suggestive. The effect of several localised famines and a severe one in Uttar Pradesh depleted the nutritional level of the population (Mitra (1978)). The impact of which is reflected in the SR at birth[10] estimated for the year 1911. Estimates provided, estimated based on reverse survival method and population enumerated for the age 0+1 in the population censuses 1981 and 1991, in Sudha and Rajan (1998) for the recent years 1981 and 1991, could be placed, respectively, at 971 and 935. The decline in SR at birth is associated with certain positive changes. Mean age at marriage which was observed to be below 13 years at the beginning of this century had gone up to 19.5 years in 1991. The increase was marked after 1961 and it is only after 1981 the mean age at marriage is observed to be higher than the present minimum legal age at marriage at 18 years. Medical

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10 The NSS (1955) and Sudha and Rajan (1998) define SR at birth as the number of males born live per every one hundred females born live. These estimates are converted into number of females born live to every one hundred males born live.

attention provided at birth had increased from around 28 per cent in 1971-73 to 46.2 per cent in 1991. Reproductive burden too had declined. Fourth and higher order births which accounted for about 46 per cent of all births in India in the beginning of the 70's had declined to 24.2 per cent in 1991. These positive changes, as the results of this paper suggest, might have led to the decline in SR at birth in India. While the importance of the positive factors or that of the 'good' causes underlying the observed downward trend in SR at birth in India is stressed, it needs to be emphasized that these results do not indicate that the 'gender-based discrimination' in India is on the decline. The results presented neither deny the existence of such barbaric practices as female infanticide and foeticide nor their increase over time and across space in India. Simply put, the results of the paper demonstrate that improvements in the well-being of women, particularly in the reproductive sphere, could cause a decline in their share at birth.

Table 1: **Sex Ratio At Birth by Order of Birth; All-India Rural**

Marriage Period	NSS Round	Order of Birth				1-4
		1	2	3	4	
Before 1910	2nd	685	840	719	820	758
	4th	840	763	826	971	840
	Combined	758	800	769	893	794
1910-19	2nd	662	877	909	909	820
	4th	800	800	917	775	820
	Combined	725	833	909	833	820
1920-29	2nd	680	800	885	943	806
	4th	781	826	971	962	870
	Combined	725	813	926	952	833
1930-39	2nd	877	909	990	855	909
	4th	877	1000	971	909	935
	Combined	877	952	980	877	926
1940-45	2nd	901	901	1063	885	926
	4th	847	1010	1111	1111	943
	Combined	870	952	1087	980	935
1946-51	2nd	893	1235	592	360	935
	4th	990	943	400	1333	962
	Combined	943	1064	455	568	943

Source: National Sample Survey, Report No 7: Couple Fertility

Table 2: Live Births of Males and Females and Sex Ratio at Birth Classified by Birth Order (INDIA)

(Rural and Urban)

Birth Order	Number of		Sex Ratio
	Male Births	Female Births	
1	41513	37837	911
2	34213	31920	933
3	25391	23815	938
4	17081	15937	933
5	10711	10062	939
6+	13735	12957	943
Total	142644	132528	929

Source: National Family Health Survey: 1992-93 (Available on Floppy Diskette)

Table 3: **Sex Ratio at Birth for: First Order Births, All Excluding First Order Births and All Including First Order Births (Rural and Urban)**

States	Sex Ratio at Birth for:		
	First Order Births	All Births Excluding First Order	All Births Including First Order
Andhra Pradesh	962	971	968
Arunachal Pradesh	922	906	910
Assam	915	968	954
Bihar	911	960	947
Delhi	868	912	898
Goa	867	985	945
Gujarat	910	937	929
Haryana	922	918	919
Himachal Pradesh	898	954	936
Jammu and Kashmir	861	912	896
Karnataka	933	959	951
Kerala	974	983	979
Madhya Pradesh	880	916	906
Maharastra	959	937	944
Manipur	889	923	913
Meghalaya	916	885	894
Mizoram	821	979	929
Nagaland	860	970	936
Orissa	924	946	940
Punjab	934	882	898
Rajasthan	866	880	876
Tamilnadu	946	962	956
Tripura	812	928	894
Uttar Pradesh	913	923	920
West Bengal	946	963	958
India	911	936	929

Source: Same as in Table 2

Table 4: Sex Ratio Among First Live Borns and the Median Age at First Birth

(Rural and Urban)

States	Sex Ratio Among First Live Borns	Median Age At First Birth
Andhra Pradesh	962	18.1
Arunachal Pradesh	922	20.8
Assam	915	18.4
Bihar	911	18.8
Delhi	868	20.1
Goa	867	22.0
Gujarat	910	20.0
Haryana	923	20.2
Himachal Pradesh	898	19.6
Jammu and Kashmir	861	19.6
Karnataka	933	18.8
Kerala	974	20.9
Madhya Pradesh	880	18.9
Maharastra	959	18.9
Manipur	889	21.6
Meghalaya	916	20.8
Mizoram	821	22.0
Nagaland	860	21.1
Orissa	924	18.8
Punjab	934	21.4
Rajasthan	866	20.3
Tamilnadu	946	19.3
Tripura	812	18.8
Uttar Pradesh	913	19.6
West Bengal	946	18.2

Source: Same as in Table 2.

Table 5: **Male and Female Live Births and Sex Ratio at Birth Classified by the Number of Foetal Waste Experienced by Women (INDIA, Rural and Urban).**

FOETAL WASTE	MALES	FEMALES	SEX RATIO
0	116593	106962	917
1	18042	17549	973
2	5546	5335	962
3	1648	1731	1050
4	488	537	1100
5	183	216	1180
6	86	77	895
7	31	40	1290
8	17	22	1294
9	8	11	1375

Table 6: **Sex Ratio at Birth Classified by the Level of Foetal Waste Experienced by Women**

State	Sex Ratio at Birth for Women Who Experienced:		All Births
	No Foetal Loss	At Least One Foetal Loss	
Andhra Pradesh	966	981	968
Arunachal Pradesh	910	913	910
Assam	949	969	954
Bihar	930	1024	947
Delhi	900	893	898
Goa	955	908	945
Gujarat	911	1028	929
Haryana	897	991	919
Himachal Pradesh	911	1037	936
Jammu and Kashmir	883	950	896
Karnataka	937	1020	951
Kerala	978	984	979
Madhya Pradesh	894	989	906
Maharastra	934	999	944
Manipur	937	838	913
Meghalaya	893	898	894
Mizoram	937	887	929
Nagaland	944	847	895
Orissa	907	1093	940
Punjab	884	979	898
Rajasthan	868	927	876
Tamilnadu	932	1052	956
Tripura	906	854	894
Uttar Pradesh	904	976	920
West Bengal	952	989	958

Source: Same as in Table 2.

Table 7: **Male and Female Live Births, Sex Ratio, Mean Age at First Cohabitation and Contribution of First Order Births to Total Births Classified by Relationship at Marriage**

State/ Relation at Marriage	Total Births		Sex Ratio	Mean Age at First Cohabitation	Contribution of First Order Births to Total Births
	Male	Female			
Andhra Pradesh					
First Cousins\Uncles	1798	1751	974	14.9	NC
Second Cousin	96	74	771	14.8	NC
Other Blood Relation	236	241	1021	15.2	NC
All Relation	2130	2066	970	14.9	30.72
Not Related	3722	3599	967	15.4	32.43
Total	5852	5665	968	15.2	NC
Tamilnadu					
First Cousins\Uncles	1844	1761	955	17.0	NC
Second Cousin	387	368	951	17.3	NC
Other Blood Relation	476	441	926	17.5	NC
All Relation	2707	2570	949	17.1	30.77
Not Related	2759	2657	963	18.3	34.82
Total	5466	5227	956	17.7	NC
Karnataka					
First Cousins\Uncles	1923	1855	965	15.6	NC
Second Cousin	138	150	1087	15.5	NC
Other Blood Relation	417	391	938	16.3	NC
All Relation	2478	2396	967	15.7	28.47
Not Related	4446	4192	943	16.9	29.71
Total	6924	6588	951	16.5	NC
Maharastra					
First Cousins\Uncles	1359	1285	946	15.3	NC
Second Cousin	12	16	1333	14.7	NC
Other Blood Relation	290	282	972	15.5	NC
All Relation	1661	1583	953	15.3	28.86
Not Related	4482	4215	940	16.5	31.58
Total	6143	5798	944	16.2	NC

Source: Same as in Table 2

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