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# Sex Ratio at Birth

## The Role of Gender, Class and Education

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This paper is part of a technical paper series covering interconnections between sex ratio and marriage squeeze; class and education; and crime rates

April 2016



United Nations Population Fund

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technical report

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## The Role of Gender, Class and Education

Paper Two of a Three-Paper Series

Prepared for  
United Nations Population Fund

By  
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The causes of Gender Biased Sex Selection (GBSS) are well known. However, the unfolding consequences of this harmful practice are still being studied. We are thankful to the UNFPA India Country Office for having agreed to our proposal to research three themes focusing on the correlates and consequences of GBSS. These themes focus on: the role of class and education in explaining India's gender imbalance trajectory, the present and future contours of the marriage squeeze, and the relationship between crime rates and sex ratio imbalances. Bringing together quantitative and qualitative data, the three papers shed light on hitherto unexplored dimensions of the GBSS phenomenon.

We would like to thank Ena Singh, Dhanashri Brahme and Sanjay Kumar of the India Country Office for having supported the work through its various phases. We also thank Sanjay and Dhanashri for having provided peer-review of the papers. Support provided by UNFPA colleagues Vidya Krishnamurthy and Manpreet Kaur is also acknowledged in design and printing of the papers.

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# Abstract

The paper uses a class and education based approach to investigate the trends in the sex ratio at birth (SRB) in India. While the definition of the middle class is a purely economic one, it incorporates both social and economic understanding of its behaviour. The paper introduces the concept of the “emerging middle class”—a class that lies between the poor and the “stable” middle class. It argues that the social mobility strategies of the emerging class have much to do with the rise of the SRB; and the increasing share of the stable middle class has much to do with the improvement in SRB post the peak in 2004. Further, it is contended that the mobility strategies have gendered effects accounting for a lower value of girls in upwardly mobile emerging middle class families. The decline of the SRB post 2004 is coincident with a reduction in the size of the emerging middle class and an increase in the size of the stable middle class that depicts less gender bias.

The results for the states of India, 1998 to 2012, are robust and point to three conclusions. First, that changes in the class structure account for a large proportion of both the increases in the SRB, and the equivalent declines in the SRB in the fourteen year period, 1998–2012. Each 10 percentage point (ppt) increase in the size of the middle class improves the sex ratio by 0.7 percentage points. Second, that male and female education affect SRB in opposite ways—an increase in male education increases gender discrimination while an increase in female education improves the sex ratio at birth. The third conclusion is that if the middle class and the narrowing of the female-male education gap increase at observed historical rates, the average SRB in India will achieve natural levels of 105 by the mid-2020s, with the female deficit regions taking longer at normalization.

# 1

## Section

# Introduction

*In the contemporary era, there has been a general expectation that gender inequalities would decrease with economic development. Western countries made great strides in narrowing various gender gaps as they became richer. In India, the gender gap has been decreasing on various socio-economic indicators—literacy, education, life expectancy, health—even though the picture has continued to vary across regions, states and districts. Hence, the popular expectation was that the historically unfavorable gender imbalance, especially in India’s north and north-western regions, would improve with development, greater modernization and growing prosperity.*

A critical indicator of gender equality is the sex ratio at birth (SRB).<sup>1</sup> Nature (biology) suggests that without intervention, the SRB approximates to a universal constant of 105, i.e. that for each 100 girls born, 105 boys are born.<sup>2</sup> However, despite rapid economic growth in the last thirty years, the sex ratio at birth in India has

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1 All sex ratios are expressed in the international format of number of boys for every 100 girls.

2 This unusual “factoid” is extensively documented by Brian-Jaisson (2007). The authors’ exhaustive review of historical studies documents that estimates of the sex ratio at birth have captivated some of the greatest statistical and mathematical minds over the last 300 years. What each study found, and re-established, was that the probability of a child being a boy was close to 51.3 percent—yes, more boys are born than girls. A male probability of birth of 51.3 percent translates into a sex ratio at birth of 105.3. To date, only one factor causing a deviation from the 105.3 constant has been identified—blacks tend to have approximately 1 to 1.5 percent lower sex ratio at birth. This has been found to be true for the blacks in the United States, (see Chahnazarian (1990) as well as residents of sub-Saharan Africa 1950–2010 (see Bhalla et. al., 2013).

not evolved as per “normal” expectations. Before the late-1990s, the SRB<sup>3</sup> was close to 111. But this rose to a peak of 113.6 in 2004. Fertility declines and availability of new sex determination technologies were felt to be at the heart of the increases in the sex ratio imbalance. Post 2004, a fast decline has been seen with SRB reducing to 110 in 2012—a significant improvement but well above the “norm” of 105.

Co-incidentally, 2004 is also the peak year of the SRB in the other son-preference country, China. A casual perusal of the relevant literature reveals that there was a considerable outpouring of pessimistic research about the future evolution of the sex ratio at birth and its consequences. One study that got considerable attention (Hudson-den Boer (2004) argued that because of the presence of significant excess males in China and India, the countries were likely to enter into wars to alleviate the “stress”.

SRB data for both China and India, and several other son-preference countries, has continued to show surprising improvement post 2004. The improvement in India post 2004 is opposite and *higher* in magnitude as opposed to the worsening change from 1998 to 2004 (see Figure 1). Thus, while there is still some time to go before the SRB stabilizes at a normal 105 level, a consistent explanation is required which explains *both* the rise, and the fall in the SRB, in India over the past two decades.

This is what this paper attempts to achieve. Apart from the accelerating role of new sex determination technologies, we find that there is a critical, and heretofore relatively unexamined, determinant of the sex ratio at birth, i.e. class behavior. We separate the conventional middle class into two groups—the “emerging middle class” and the “stable middle class”. We identify the “emerging middle class” as being responsible for a considerable proportion of the rise in SRBs and argue that as the size of this section of the middle class increased, so did SRBs. We also predict that as its size shrinks in the future and as it transitions into the “stable middle class”, the SRBs are likely to continue their downward trend.

In addition, we find that the expansion of female education (relative to male) has a significant effect in *improving* the sex ratio at birth. Both these factors argue for the SRB in India to *reduce* to 105 by 2025. This is only true for the aggregate of states—traditional son-preference states like Haryana and Punjab reduce to 111 in 2025 from their peaks of 118 in 2004.

The paper is organized as follows. Section 2 discusses the data used in our analysis and Section 3 explores the relationship between sex ratio patterns and socio-economic class. Section 4 documents the definition of middle class used (as well as the corresponding definitions of the poor, the emerging middle class and the rich), and the method of estimating these fractions for the different years, and states in India. Section 5 presents the theory behind the roles of the middle class and female education levels in affecting the SRB. Sections 6 and 7 contain the empirical results and forecasts of the sex ratio at birth till 2025. Section 8 provides policy implications. Section 9 concludes. Appendix I details the procedure for making SRS sex ratio data consistent with Census data. There are five Annexure tables detailing the state-level pattern of the data.

Before the late-1990s, the sex ratio at birth (SRB) for India was close to 111, which rose to a peak of 113.6 in 2004. However, post 2004, a fast decline has been seen with SRB reducing to 110 in 2012 – a significant improvement but well above the “norm” of 105. A consistent explanation is required to explain both the rise and fall in the SRB.

Two major factors are identified as the explanation behind the rise and fall in the SRB – middle class and education. Within middle class, a distinction is drawn between “emerging” and “stable” middle class. It is contended that mobility strategies of a class have gendered effects translating into a lower value of girls among upwardly mobile emerging middle class families. Therefore while “emerging” middle class has a negative effect on the SRB, the “stable” middle class has a positive effect. Within education, the rise in female education is seen to have a strong positive effect.

With the rise in female education and middle class, it is expected that the SRB for India will reduce to 105 in 2025 i.e. the normal value.

<sup>3</sup> All number reported in the paper are as collected by the Sample Registration System (SRS), unless otherwise mentioned.

# 2

## Section

# Data, Methods, and Measurement

## *Sex Ratio at Birth*

*Two estimates of SRB have been presented in this paper. The first is the three-year moving average of the SRB published by the Sample Registration System (SRS), Office of the Registrar General of India. The time period for the available data is 1998–2012.<sup>4</sup>*

A second estimate is also presented, which is the SRS data, adjusted for discrepancies vis-à-vis the Census (hereafter, adjusted SRS data). The Census of India publishes the child sex ratio (0 to 6 years) every ten years, with the latest being for 2011. Over the years, there has been a large mismatch between the SRS estimates and the implicit Census estimates of SRB. And this mismatch is bound to occur as the Census is based on the entire population as opposed to the SRS, which is based on survey data.

While the official SRS data are available from 1998 onwards; data between 1984 and 1998 are taken from Kulkarni (2007). For example in 1984, the SRS estimate of the SRB was 110 while the Census equivalent estimate was a “normal” 105. While son-preference was no doubt prevalent in India in 1984, sex-determination technology was absent. This means that the SRS data for 1984 was most likely reporting the SRB after infanticide. As the Census is considered to be the “gold” standard, it is imperative that we adjust the yearly SRS data to the decadal Census data. This method has been adopted by other demographers as well, such as Kulkarni (2007).

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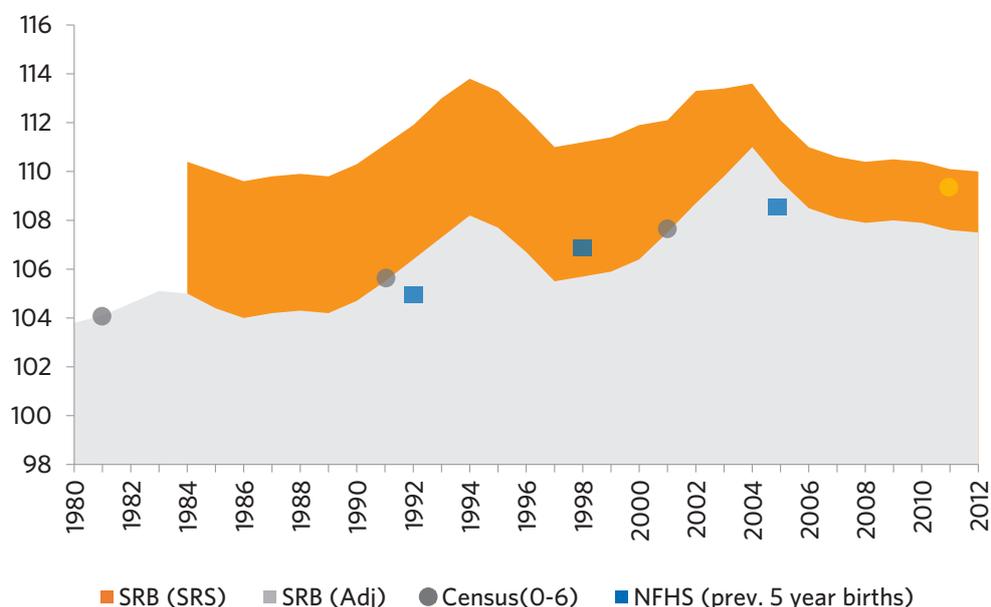
<sup>4</sup> The SRS data is published as three year moving averages; therefore, the data are available from 1997-1999 to 2011-2013.

Figure 1 presents four different estimates of SRB—one, the SRS data; two, the adjusted SRS data; three, the Census child (0-6) sex ratio; and four, the previous 5 year birth sex ratio from the NFHS. It is seen that once consistency adjustments are made for the SRB (see Appendix 1 for details), then broadly the same trend is observed between the adjusted SRS and the Census. Moreover, the SRS estimates of SRB are also converging to the levels observed in the Census—gap between the two is only 1 points in 2012 versus a gap of 5 point in 1984. The trend according to both SRB estimates is the same, as is the reversal in trend.

Due to the mismatch in the SRS and the Census data for SRB, we adjust the yearly SRS data to the decadal Census data to provide an alternative, more robust measure. This method has been adopted by other demographers as well, such as Kulkarni (2007).

Figure 1: Different Estimates of Sex Ratio at Birth

Source: SRS, Census, NFHS



Note: SRS data on SRB is adjusted to the Census child sex ratio for more accurate estimates (details in Appendix - I).

### Middle Class

Middle class data are calculated using the distribution obtained from National Sample Survey Organization (NSSO) surveys for income and consumption for the years of 1983, 1993–1994, 1999–2000, 2004–2005, 2009–2010, 2011–2012 and the income level from state per capita income. The entire population is classified into four groups according to their respective income lines—the poor, the emerging middle class, the middle class and the rich. The middle class and the rich are aggregated into one group, as the percentage of the rich is very low; the sum of the proportions of middle class and rich will be referred to as the middle class. Therefore, throughout the paper, the impact of three classes is investigated—the poor, the emerging middle class and the middle class. Section 4 details the definition and measurement of the each class.

## Other Variables

The other variables included in the analysis are education, labor force participation rate (LFPR) and inequality—all of which are key ingredients in influencing sex ratio at birth. Education is measured as percent of people with at least 11 years of education in the age group of 18 to 39, i.e. the age group which is liable to make fertility decisions. LFPR is defined as the proportion of the population that is economically active. For this paper, it is calculated for urban females in the age group of 18–39 years. Rural females are excluded as there is little variation in the LFPR for them. Both education and LFPR are calculated from the NSSO unemployment/employment surveys for the years 1983, 1993–1994, 1999–2000, 2004–2005, 2007–2008, 2009–2010 and 2011–2012.

Inequality is measured as the Gini coefficient for consumption as estimated from the NSS consumption surveys for the years 1983, 1993–1994, 1999–2000, 2004–2005, 2009–2010 and 2011–2012. Consumption is then adjusted to rural 2004–2005 prices (base); hence, the calculation of inequality is based on *real* consumption. For all these variables, data for the missing years are interpolated and then, extended up to 2025 according to the same trend.

All variables are estimated for the 15 big states.<sup>5</sup> The states are further disaggregated into normal and deficit SRB states; the deficit states are those states where the prevalence of “son-preference” is the strongest and are defined to be Haryana, Punjab, Rajasthan and Uttar Pradesh.

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5 The 15 big states are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

# Review of Determinants and Patterns of the Sex Ratio at Birth



## Section

*There is a voluminous literature on the determinants of the SRB. Brian-Jaisson (2007) document its biological constancy around 105, a fact noted by several scholars over the centuries. Chahnazarian (1988) and Das Gupta and Bhat (1997) contain some of the early investigations on the pattern of the SRB. This section focuses on studies that draw a relationship between socio-economic inequalities and SRBs or sex selection.*

### Caste

Caste and class have been highly correlated in the Indian social structure with higher castes generally being more prosperous. Ownership of assets such as land and access to literacy and education contributed to this association. Yet, with the modernization of Indian society this relationship is continuously weakening. Historically, there has also been an association between higher sex ratios and upper caste status. Upper castes, which were economically better-off, were known to practice female infanticide (Vishwanath 2004; Panigrahi 1972; Miller 1981). Many of these castes were landed and were averse to having daughters to protect depletion of land and family wealth. To protect their higher status, they were resistant to

marrying daughters downwards in the socio-economic hierarchy and therefore preferred to eliminate them at birth rather than suffer dishonour and risk lowering of their socio-economic status. In contrast, the poorer, lower castes and tribal communities had better sex ratios. Chakraborty and Kim (2008) reconstruct caste data from several regions of India from the 1901 census and find that the female to male sex ratio varied inversely by caste-rank. John et al. (2008) found child sex ratios to be between 300 and 807 among upper castes in selected villages/wards in five states of north and west India. [These unusually high sex ratios (normal is 950) are most likely due to the small sample size used.]

Until 1991, Scheduled Castes (SC) and Scheduled Tribes (ST) had better sex ratios than the rest of the population. However, since 2001 there has been a deterioration in SC and ST child sex ratios (CSR) and recent studies demonstrate a convergence in sex ratios among upper and lower castes (Agnihotri 2000; Murthi et al. 1995; John et al. 2008). The SCs, therefore, seem to be emulating and imitating the better off castes in opting for abortion of female fetuses, especially in urban areas. Pointing to possible future trends, an ICRW-UNFPA study (2014) on son-preference and masculinity found that 44 percent of the STs in the sample had high son-preferring attitudes as compared to around 35 percent of the General (upper caste), OBCs and SCs in the sample. However, as will be seen, this behavior fits in with the hypothesis of this paper that upwardly mobile groups tend to shape their families through male biased sex selection.

In some regions, Other Backward Classes (Castes) (OBC) - middle castes - were found to have better sex ratios than the castes above and below them. Hence, while caste patterns might have been somewhat distinctive in an earlier period, there is much greater heterogeneity currently in the behavior of caste groups vis-à-vis gender discrimination.

### Role of Prosperity and Education

Moving away from the link with caste, this section reviews the literature on whether there is a link between prosperity and worsening sex ratios. Several articles and studies since the 1980s have noted counter-intuitive relationships between daughter discrimination and levels of wealth and education. Krishnaji (1987) pointed out that higher levels of poverty were associated with lower levels of female disadvantage in child survival. He found this consistent with the hypothesis that anti-female discrimination is particularly strong among privileged classes (p. 765). Murthi et al. (1995), after assessing the evidence, argue that we do not have conclusive evidence that poor households are less discriminatory *per se* (p.755).

A surprising pattern that scholars have noticed is that extremely high sex ratios predominate in the more prosperous states, cities, classes and castes around the country. The highest SRBs are to be seen in the richest states and cities of India, e.g. Punjab, Haryana, Gujarat, Delhi and Chandigarh. The western, more prosperous part of Uttar Pradesh is also plagued with high sex ratios. As states like Maharashtra began to prosper, they too have depicted worsening sex ratios. As the demographer, Kulkarni, notes,

*“the fact that this practice (of sex selection) is seen in some relatively prosperous areas is quite worrying. Now that India has been experiencing a steady growth in the economy, one must ask whether the tendency to go for sex-selective abortions would become more widespread as incomes rise.” (2007: 16-17).*

Satish Agnihotri (2000) was perhaps the first scholar to centrally raise the issue of the link between prosperity and worsening sex ratios in his book *Sex Ratio Patterns in India: A Fresh Exploration*. He pursued his hypothesis further by examining consumption data from three rounds of the NSSO (between 1987–2000) to show that there is a clear trend of masculine sex ratios among the prosperous groups in nearly all the states accompanied by an intensification of such trend with time.

### Female Education, Prosperity and Daughter Discrimination

Scholars have often looked at the role of female (or mother’s) education in tandem with household prosperity as a factor influencing discrimination against daughters. An underlying assumption is that the better educated are likely to be economically better-off. A related assumption is that the better-off will have lower fertility and smaller families. In son-preference areas, the gender composition of the family remains important, so mothers with some education tend to sex select to attain the desired size and composition of the family. Das Gupta’s study (1987) of selective discrimination against higher birth order girls in Punjab showed that “women’s education was associated with reduced child mortality but stronger discrimination against higher birth order girls” (p.78). Among young educated women, girls experienced 2.36 times higher child mortality than their siblings (p.95). Although landownership or wealth were not significantly associated with discrimination, prosperous, young and educated women from the upper caste of Jats consciously reduced the number of female children they would have.

Jha et al. (2006) showed that families with higher incomes and women with education up to 10th standard tended to sex select more than those with lower incomes and less education. In another study conducted by Jha et al. in 2011, based on NFHS data, the authors note a sharp decline in the girl-to-boy sex ratio for second order births when the first-born was a girl. This ratio falls at an average rate of 0.5 per cent per year between 1990 and 2005. They again stress that the declines are greater in educated and in richer households than in illiterate and poorer households. Similarly, Arokiasamy and Goli (2012) come to the conclusion that higher the landholding and level of education of the mother, the worse the CSR (Child Sex Ratio). CSR is high in households which have 10 or more acres of landholding and where the mothers have higher education (p.90). The authors state, “The higher the size of landholding, the wealth quintile and the education category, the more powerful the combination that strengthens patriarchal traits and gender imbalance” (p.91).

These studies, thus, seem to point to a disturbing trend—the richer and more educated one is, the more one tends to sex select or discriminate against daughters. Agnihotri (2000) points out that these findings are contrary to “prosperity

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A surprising pattern that scholars have noticed is that extremely high sex ratios predominate in the more prosperous states, cities, classes and castes around the country. The highest SRBs are to be seen in the richest states and cities of India e.g. Punjab, Haryana, Gujarat, Delhi and Chandigarh.

optimism” which argues that prosperous families would not discriminate between children on the basis of gender and would be neutral as to the sex of the children born.

Some recent studies support Agnihotri’s conjecture. Pande and Malhotra (2006) find that while wealth and economic development do not reduce son-preference, women’s education and media exposure make a difference. However, they find that wealth in terms of ownership of assets has a weakening influence on son-preference, although only among the wealthiest. In contrast to other findings on education, their study finds that women’s education is the single most significant factor in reducing son-preference. Clark (2000) finds even stronger evidence for the hypothesis that mother’s education reduces gender bias. She says, “Women who have ever attended school have significantly lower odds of having sons than do women who did not attend school” (p.106). These studies, thus, go against earlier evidence that some education heightens gender bias.

A few recent studies also favor the hypothesis that development improves gender equality. Chung and Das Gupta (2007) argue that the turnaround in SRBs in South Korea was associated with the country’s rapid development and urbanization. According to them, increased urbanization and education transformed societal structures and values that underpinned son-preference, sharply accelerating the speed of the reduction in son-preference. In a follow-up paper, Das Gupta, Chung and Li Shuzhuo (2009) forecast that a similar turnaround was likely to happen in India and China despite the slower pace of development in these countries. While the authors were among the first to suggest that prosperity might be pro-gender, they played down the role of prosperity by suggesting that *strong government policies* were needed to equalize the value of girls and boys.

Bhat and Xavier (2003) find that urban residence, educational level, and regular exposure to mass media have strong negative effects on the preference for sons. Of these three factors, education of women has the strongest effect. Although few studies have looked at father’s education, these authors find that “the odds of reporting more sons than daughters in the ideal family size are about 7%-11% lower among illiterate women with literate husbands than among illiterate women with illiterate husbands” (p.648).

Gaudin (2011) specifically tests the relationship between wealth and son-preference using NFHS data to show that “higher absolute wealth is strongly associated with lower son-preference, and the effect is 20%-40% stronger when the household’s community-specific wealth score is included in the regression” (p.343). She finds that “the observed negative influence of ‘prosperity’ on gender equality appears to work through notions of local economic status, that is, it is the higher relative wealth position of a household in the local community that generates gender bias” (p.367). Gaudin’s study, thus, points to an important factor that influences family building decisions—the desire for upward mobility.

Guilmoto and Ren (2011) also underline the potential role of modernization, urbanization and education in equalizing SRBs at higher levels of socio-economic prosperity. However, they pointedly confirm a *different* trajectory for the two populous giants with adverse SRBs—India and China. Comparing the two, they note “India is a textbook case for a positive relationship between socio-economic status and birth masculinity.” (emphasis added). In India, the SRBs are reported

to be the highest for the richest quintile of the population while in China they peak for the second quintile. According to the authors, China depicts an inverted U-shaped curve in the relationship between socio-economic status (SES) and SRBs. More recently, Chaudhri and Jha (2013) reiterate the findings for India that large families with low monthly per capita expenditure (MPCE)—the poor—have a lower gender bias and that with lower fertility and higher prosperity gender bias rises sharply. As in some other studies, they claim that both improved education of females in the age group 15–49 and higher prosperity do not guarantee lesser gender bias in the 0–6 age group. According to them, “increasing prosperity alone is likely to worsen gender bias.” (p.28). However, in contrast with Agnihotri and Guilmoto-Ren, they point to an inverted U for India, similar to China’s, predicting that at higher values of interaction of education and prosperity, there would be a turnaround in the SRB trend. But like Das Gupta-Chung-Shuzhuo (2009), the authors make the improvement in India conditional on the presence of policies that favor gender equality. However, none of these studies separate the population into broad income classes.

There are, thus, two contradictory conclusions about the relationship between SRB and prosperity (or higher class status). First, an optimistic view that prosperity leads to an improvement in the SRB; the second, an opposite pessimistic view. The reasoning behind the optimistic view is supported by the observation that as people become richer and more educated, their ideas and perceptions of the value of girls and boys begins to shift towards becoming more gender equal. The implicit assumption made in the optimistic view is that with a rise in prosperity, there is a rise in educational attainment as well. However, the pessimistic view is that sex selection will rise as socio-economic circumstances improve. A likely explanation for this phenomenon is that as the poor begin to move up the economic ladder, they tend to shape the composition of a smaller family through recently acquired means and access to sex selection technology, preferring more sons.

### Fertility and Sex Ratio at Birth

Fertility decline is often associated with higher education and greater prosperity. Das Gupta and Bhat (1997) anticipated two effects of fertility decline: (1) the decline in fertility in son-preference regions could lead to an intensification of the gender bias against daughters as people would ensure that sons and not daughters were born within the desired smaller number of children or (2) that there would be a “parity effect”—if there were no higher order birth girls, there would be no elimination. They argued that the intensification effect was more likely in India as fertility would decline faster than son-preference, skewing further the sex ratio against girls. Guilmoto (2007) has argued that in the first instance, the use of such technologies is taken up by the better-off in society and later percolates down to the lower sections of society which emulate the practices of the better off. Thus, in many ways, the relationship between fertility decline, education and family size and composition remains a sociologically complex one. Our study allows us to integrate the contradictions by taking into account the desire of families to move up. As discussed later, upwardly mobile families employ various strategies among which reducing family size while shaping the sex composition of the family is

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There are two contradictory conclusions about the relationship between SRB and prosperity (or higher class status). First, an optimistic view that as people become richer and more educated, their ideas and perceptions of the value of girls and boys begins to shift towards becoming more gender equal; the second, an opposite pessimistic view that as the poor begin to move up the economic ladder, they tend to shape the composition of a smaller family through recently acquired means and access to sex selection technology, preferring more sons.

crucial. Thus fertility management influences the sex ratio although as Bhalla et al. (2013) show, this effect is a “zig-zag” one.

### The Emerging Middle Class (EMC)

Income, occupation and education are important components of class identity, and also important sources of social mobility. Sociologists recognize that class is more than just income and argue that we can identify specific class behavior in relation to various social practices. In order to study the effect of classes on SRBs, Kaur (2011–2015) specifically identifies the crucial role of what she calls the “emerging middle class” in the recent rise and decline of SRBs in India; this happens because the emerging or nascent middle class tends to shape its family the most. The arrival of easy to use sex determination technologies in the 1980s facilitated this objective. She also contends that a mature middle class would indulge in less gender discrimination, and that the emergence of a stable middle class is most likely related to the improvement in SRBs since 2004.

Recent sociological literature has also been talking about a “new” middle class. Many scholars have noted the shift from an early post-Independence Indian middle class, a product of the colonial period, to one that is a much larger formation and a product of the more recent phases of the developing state (Baviskar 2011; Beteille 2001).

By definition, the emerging middle class consists of people who have recently moved out of poverty. Saavala (2010) and Dickey (2012) point to the new *first time* entrants into the middle class. Saavala (2010:234) in her study in Andhra Pradesh talks about people who belong to the new middle class. These are likely to be those whose parents were/are from the labouring class—upwardly mobile but not possessing any form of inherited material, social, or symbolic capital. Such people might also be at the beginning stages of acquiring durable assets, property or entering into small-scale entrepreneurial ventures. Undoubtedly, the majority of members in the emerging middle class gain their livelihoods in the informal sector and lack both social and economic security. Beteille (2001) points out that many manual workers today might have incomes approximating those of the middle class.

Besides traditional members of the old lower middle class, Kapadia in her work on Tamil Nadu (1993) includes occupations such as typesetter, bank clerk, teacher, librarian, policemen, driver, paper mill worker, railway clerk, village officer, bill collector etc. in this class (all non-agricultural occupations). In the post economic reforms period, many newer kinds of workers are joining the emerging middle class—those employed in the private sector in malls, shops, call centres, delivery and courier boys, drivers, restaurant workers, security guards, domestic workers, personal health attendants and numerous other service occupations. This new class cuts across all caste and community identities.

The emerging middle class is found in all locations—rural and urban—but especially in villages on the peripheries of cities, in urban villages, in slums and in working class neighborhoods. New migrants to towns and cities often form a substantial proportion of this class. Principally, it is an upwardly mobile class employing strategies of spatial and social mobility to improve its lot.

The size of this class ballooned as poverty began to decline from the 1980 onwards coinciding, but not co-incident, with the period of the worst deterioration in sex ratios. This emerging class occupies a precarious and liminal position in between the poor and the stable middle class. Their per capita income is not very high and their life is characterized by a great deal of “precarity”, i.e. they face an economically and socially precarious existence. Standing (2011) refers to such individuals as being part of the “the precariat”—those who have a more restricted range of social, cultural, political and economic rights than citizens around them. Krishna and Bajpai note, “that fragility and volatility, rather than stability or continued progress, appear to characterize the new Indian middle class”, implying that this is a class that can as easily fall back into poverty (2015 : 76).

### Middle Class Self Identification

There is ethnographic evidence that many more people today are self-identifying themselves as middle class. In her fieldwork in Madurai over three periods (1985–1987, 1991–1992, and in 1999), Sara Dickey found that in the first period almost no one identified themselves as middle class. When she returned in 1991, employers of domestic help identified themselves as middle and upper class. Those who described themselves as poor still recognized only two categories—the rich and the poor (as haves and have-nots); in 1999, however, even poor people spoke of a class structure that comprised at least three parts, one of which was middle class (p.561). Dickey says, “In short, ‘middle classness’ has become socially more significant, and culturally more elaborated, over the past two decades in Madurai.” She continues, “Few, if any, objective features of income, occupation, education, consumer goods, housing, or leisure practices, however, can be used to define the middle class in Madurai.”

Devesh Kapur and Milan Vaishnav found in a multi-year panel study (2014) that 49 percent of their respondents self-identified as “middle class”.<sup>6</sup> To their surprise, they found that 45 percent of those who were in the lowest income bracket self-identified as middle class, as compared to 48 percent of those who were in the highest income bracket. They argue that “the extent of ‘middle class’ identification is striking, not simply because of its size or the fact that it seems to run counter to households’ own economic realities, but also because it appears to have powerful experiential effects on respondents’ social attitudes.” As argued later in this paper, it is the mobility desires and strategies of people hoping to “become and stay middle class” that are important in influencing gender bias outcomes.

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The size of the “emerging middle class” ballooned as poverty began to decline from the 1980 onwards coinciding, but not co-incident, with the period of the worst deterioration in sex ratios. This class occupies a precarious and liminal position in between the poor and the stable middle class. Their per capita income is not very high and they face an economically and socially precarious existence.

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It is the mobility desires and strategies of people hoping to “become and stay middle class” that are important in influencing gender bias outcomes.

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6 Based on a representative survey conducted by Lok Foundation, in *The Hindu* on December 9, 2014

# 4

## Section

# Middle Class–Definition and Measurement

*The sharp rise in the SRB post-1990 took place subsequent to the economic reforms of the early 1990s—reforms which boosted economic growth, reduced poverty at a faster pace than before, and expanded the middle class. Popular and scholarly discourse today hints at the “middle class” as having the worst sex ratios and being the most calculating and discriminatory in its attitude towards girl children. While there are fairly clear definitions of the poor, definitions of middle class and rich vary widely. Sociological definitions of the middle class focus on quantitative factors like education, occupation, employment and income and qualitative factors like “middle class values”.*

While the study of the middle class is a very old subject for philosophers (e.g. Aristotle) and sociologists (e.g. Marx and Engels, Max Weber), and political scientists (Barrington-Moore), the subject is relatively new for economists. Among the very first to bring up the issue of definition and measurement were Bhalla-Kharas, who, in a 1991 study of Malaysia for the World Bank, suggested a middle class line as being four times the level of the (World Bank) poverty line.

In a study for the Peterson Institute, Bhalla (2007) offered the following simple definition of the middle class—it was the *poverty line for the developed rich world*. If an economy is broadly divided into only three classes, the poor, the middle class, and the rich, then, by *definition*, the poverty line is the line above which one enters the

middle class. One can have many categories of non-poor e.g. lower lower middle class, lower middle class, middle middle class, upper middle class, and so on. But the fact remains that as one graduates from being poor, one enters the middle class. Hence, the beginning of the middle class is the level of income at which a person transits from being poor to non-poor in the *developed* Western countries. By making the middle class line a common international line, what is being stated is that the consumption and savings pattern of the middle class from Kuwait to Kuala Lumpur to Karnataka to Kansas is the same. This is the essence of the definition of the middle class—the similarity in consumption (and saving) behavior across countries and over time.

The definition of middle class used is simple, straightforward, and absolute. In the Bhalla (2007) study, it was defined to be PPP \$ 10 per person per day in 2006 prices.<sup>7</sup> In 2011 PPP prices, the population weighted poverty line in developed countries is PPP \$ 4380 a year or PPP \$ 12 per person per day. Note that these are the same levels in US dollar prices since one US dollar, by definition, is equal to one PPP dollar at any point of time. The definition says that once an individual's income is more than PPP \$ 4380 a year, then that person has just crossed from being poor to being non-poor—or from poor to the middle class.

Once a middle class definition is obtained, the rich class should be a straightforward matter. There are no accepted definitions of the rich though a reasonable starting point (and one used here) is that the rich have a starting level of income that is ten times the starting level of the middle class. In 2011 prices, this is conveniently at PPP \$ 120 per person per day. According to this line, approximately 16 percent of the German population, 11 percent of the Japanese population and 29 percent of the US population was rich in 2011.

Absolute poverty in the developing world can be defined as per capita incomes below PPP \$ 1.6 per person per day (this is “equivalent” to the 1985 dollar a day poverty line). For middle income countries, the poverty line is often defined as twice the level of the poorer economies, i.e. PPP \$ 3.2 per day. By the kind of reasoning and definition offered above, a person earning more than PPP \$ 3.2 per day would be the beginning of the middle class. *However, at these incomes, while the individual would be lower middle class in a middle-income country, she would be poor in a developed economy.* Kaur (2011) terms such individuals (poor by developed world standards and not-poor by middle income developing country standards) as the *emerging middle class*.

Table 1 documents the different “lines” used to segregate the population into different classes. Four lines are shown—the poor according to the Indian poverty line which is based on per capita consumption; and the income lines used in this paper based on per capita income (based on national or state accounts). In 2011 prices, the Indian absolute poor are those with per capita consumption less than Rs. 13,500 per year; for this paper, the poor are those with incomes less than Rs. 17,650 a year; the emerging middle class are those with per capita incomes greater than Rs. 17,650 and less than Rs. 65,700 per year; the middle class are those with per capita incomes between Rs. 65,700 and Rs. 6,57,000 per year; and the rich are those with per capita

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<sup>7</sup> Conveniently, the poverty line in the developed world in 2006 PPP terms was PPP\$ 10 per person per day. Several authors have followed up on this definition of PPP\$ 10 per person per day (e.g., Kharas (2010), López-Calva and Ortiz-Juarez (2011)).

incomes greater than Rs. 657,000. The rich, being a small fraction (less than 1–3 percent), are subsumed within the middle class.

For 2011, the size of the middle class in India is estimated to be 19.4 percent or around 240 million. This fraction is expected to increase to 52.4 percent in 2025.<sup>8</sup> Beteille (2001) estimates the size of the middle class to be between 100 and 250 million. (For 2000, our estimate of the middle class is close to the lower end of Beteille’s estimate). Using assets to identify the middle class, Krishna and Bajpai (2015) peg the Indian middle class at 19 percent of the population in 2011. NCAER projects the middle class growing to be around 40 percent of the population in 2025, up from 13 percent in 2010. Using the same data set as NCAER but employing a slightly different definitional range, McKinsey Global Institute also estimates the middle class to be around 40 percent of the population in 2025 (p.70).

**Table 1: Middle Class Lines in 2011 Prices (2011 ICP base)**

Poverty Line	Income Lines (per person)		
	Per Day		Per Year
	in 2011 PPP \$	in 2011 Rs.	in 2011 Rs.
Tendulkar: India	2.4	37	13,500
Lines Used in the Paper:			
EMC	3.2	48	17,650
MC	12.0	180	65,700
Rich	120.0	1,800	657,000

Notes:

1. The Per Year Income Lines have been rounded off.
2. The Tendulkar line is the accepted poverty line for India, which is presented here as a benchmark.
3. The lower limit point for each class is presented here. For example, the EMC is between 3.2 and 12 PPP\$ a day.
4. These lines are adjusted according to the prevailing inflation for each year.

<sup>8</sup> There are two methods of defining per capita income. The first, and conventional, definition is to assume that GDP per capita, in PPP prices, corresponds to per capita household income. According to this conventional definition, the middle class in 2025 is projected to be 65.6 percent. The second definition is to add per capita household consumption and household savings to yield per capita income. This is the definition adopted in the paper.

# Effect of Gender, Education and Class Mobility on the Sex Ratio at Birth—Theory



## Section

*The expected “theoretical” effects of class structure (poor, emerging middle class and middle class) and education (female education versus male education) on SRBs are discussed in this section; the next section will discuss how close reality is to these theoretical predictions.*

As stated above, we distinguish the emerging middle class from what we call the “stable middle class”—the middle classes that lies above the emerging middle class in hierarchy and that have more of everything that the emerging middle class aspires for—more education, higher incomes, higher status jobs, more social security and higher social prestige.

We argue that the emerging middle class follows a specific set of strategies in the domains of family shaping, education, marriage and women’s participation in the labor force. Its actions in these domains are directed towards becoming and staying middle class, i.e. these are class mobility strategies. However, these strategies are inherently gendered and have negative consequences for women and the gender balance. The focus on strategies allows us to understand the dynamics of how social change takes place and how people’s actions in these domains affect SRB outcomes.

## Emerging Middle Class–Shaping the family–Size and Sex Composition

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The family shaping strategy - maneuvering with fertility and being able to control it, with respect to both size and composition of the family, is key to a sense of being emerging middle class; and distancing oneself from the poor who are presumed not to control their fertility as consciously. For the middle class, a small family is also a sign of modernity.

The family shaping strategy — maneuvering with fertility and being able to control it, with respect to both size and composition of the family, is key to the sense of being emerging middle class; and distancing oneself from the poor who are presumed not to control their fertility as consciously. Improvements in child mortality as well as the costs of bringing up healthy and well-educated children are factored into the acceptance of being a small family. Yet, instrumental reasons are not the only ones that drive couples to have fewer children; for the middle class, a small family is also a sign of modernity. The discourse of the national population policy and its main slogan - “*hum do, hamare do*” (*we are two, we have two*) - caught the imagination of those who wished to appear educated and informed, i.e. modern. Saavala highlights that such a view is pervasive, even for the south of the country, where fertility has declined to replacement level among all income classes. She says, “Having only two children is regarded as a sign of civilization and those who do not follow the code are considered uncivilized and even unpatriotic.” (2010 : 30) Although being middle class means having a small family, it is not the case that it has to be a gender balanced family; indeed it is the very opposite, with sons being wanted more than daughters. Such families are informed enough to use modern sex determination technologies to shape family composition. In families with three children, there is a preference for two sons; in families with two children, at least one son is ensured with the help of technology and by the elimination of unwanted female fetuses. In families with only one child—which though are few and far between in the EMC—the preference is again for a son. Families with first born sons often quickly put a stop to their fertility. As Bhalla et al. (2013) show, in son-preference societies, phases in which fertility is declining from even to odd numbers of children tend to skew the SRB against girls.

While these strategies are common to most of the middle class, an emerging middle class is the most caught up in conflicting and contradictory demands—its attitude towards women and daughters is a tough balancing act. With limited disposable income, it prefers to have fewer children and within those fewer children, more boys than girls. Irudaya Rajan et al. (2007), reporting on the matrilineal Nayars, state that negative attitudes towards daughters appeared more among lower and middle socioeconomic groups than the highest group. Similar findings are revealed in the ICRW-UNFPA study on masculinities (2014). Thus, strategies that are needed for the EMC to achieve its mobility goals hinge on having more sons than daughters.

## Emerging Middle Class–Intra-household Distribution of Resources in Relation to Education and Marriage

Strategies in education and marriage are also aimed at ensuring the *upward mobility of the family*. They are closely related to decisions around family composition and the intra-household distribution of resources. However, the *upward mobility of the family resulting from these strategies does not have the same meaning and consequences for female and male members of the household and indeed might have crucially negative effects for women*. These strategies prevent daughters from gaining adequate marketable skills,

ensuring their dependence rather than independence in the natal family. In the marital family, their productive work is substituted with “status work” resulting in lowering of status.

Education and marriage demand household resources and their allocation is tied to expectations of future returns. Strategies in these areas directly and indirectly shape and are shaped by the value of daughters and sons. Given its limited resources, the emerging middle class emphasizes much more on the education of boys than it does of girls. As the gap in educational enrolment between girls and boys becomes narrower, the gender discrimination is on the length and quality of education and the goals towards which education is oriented (John et al. 2008).

Sons are also afforded better quality and longer education than daughters. Financial investments in tuitions, coaching and in other skill development programs or courses are more likely to be made for sons. With males being seen as the primary breadwinners, both economic and status reasons compel parents to invest more in sons. Occupational choices are oriented away from farm and manual jobs for which a certain amount of education is considered necessary. Efforts are made to secure non-farm jobs for sons. For those with adequate education, government jobs are the most sought after as they provide security and status. Financial investments are made by parents to acquire these jobs and these funds are sometimes acquired through dowries. Sons’ education is directed towards economic independence and maximizing the dowry advantage, both being important for the family’s upward social mobility. Girls are afforded lesser education with their education being oriented towards a timely and socially suitable marriage.

The marriage strategies of both sons and daughters are aimed at ensuring the stable “middle classness” of the family. Marriages of daughters are spatially and socially hypergamous—the EMC attempts to consolidate middle-class status by marrying daughters into better geographical locations (spatial hypergamy) and in families with higher socio-economic status [see Gaudin (2011) on local status seeking behavior and its effect on son-preference]. However, such marriages require substantial dowries that are seen as a drain on family resources with the daughter being seen as a burden on the family. Thus, EMC families prefer fewer or no daughters. The marriage of sons is aimed at bringing in substantial dowries; the value of sons is thus multiplied as household members who enhance the prospects of socio-economic mobility of the family.

### Emerging Middle Class-Labor Force Participation

Pre-marriage, the employment of girls is fraught with anxiety; while their incomes might be crucial to household sustenance and accumulation of their own dowries, parents worry about spoilt reputations. Saavala (2010) and Dickey (2012) point out how the dictates of a middle class morality impinge especially heavily on those attempting to consolidate middle-class status.

This need often compels newly prosperous households, whether in rural or urban areas, to withdraw women from work as part of status building strategies. While there might be a positive aspect to women being relieved of work that is considered akin to drudgery or is low in social status, the resultant lack of “productive work” often lowers their bargaining power and social status within the family (Kapadia

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Strategies in education and marriage are also aimed at ensuring the upward mobility of the family; however, they have gendered implications. Given its limited resources, the emerging middle class emphasizes much more on the education of boys than it does of girls. Marriages of daughters are spatially and socially hypergamous i.e. into better geographical locations and in families with higher socio-economic status. However, such marriages require substantial dowries; thus, daughters are seen as a burden on the family whereas sons bring in substantial dowries and are seen as a boon.

1993).<sup>9</sup> Even if there is no wish to withdraw them from work, such wives might have neither the education nor the skills required to join the labor force in a new capacity. Or the jobs available to such women might not be commensurate with their newly acquired middle-class status. Thus, Scrase (2006) points out that while lower middle-class Bengali Bhadrak women in West Bengal want to work, only a narrow range of work options and jobs are available to them.

In rural areas, women might have been visibly occupied in what was seen as productive work even if it was part of family labor and was as such unpaid. Under the new circumstances, their value to the family is seen to decline while the value of higher-earning males or those in service jobs tends to rise and with it, the amount of dowry that can be demanded. Thus, as the newly prospering class spreads, it adopts attitudes and practices that help the upward mobility of families, but with negative consequences for women and girls.

### (Stable) Middle Class—Progressive Attitudes

As Guilmoto and Ren reiterate for China (p.1272),

*“However, unequal gender values tend to dissipate among urban middle classes in which women enjoy better education and employment opportunities, and gain a higher degree of autonomy in society”.*

The attitudes of the already established middle class towards girl children is substantially different to that of the emerging middle class. While some members of the stable middle class might continue to sex select, discrimination against daughters are reduced. Several studies show that once a girl is born in prosperous states such as Punjab, Haryana and Himachal Pradesh, she is likely to be treated more or less equally and well cared for (John et al. 2008).

Basu and Desai (2010) discuss a new middle class trend—families with only one child. In itself, this trend would not be surprising but what is surprising is that among the urban middle classes, a high percentage of families (14 percent) have stopped at having one child or even two daughters (NCAER Human Development Survey 2004–2005). Of the women who had only one daughter, 28 percent had high school level education. Even more interestingly, 11.7 percent of these women were fluent in English. Less than 3 percent of the women with only daughters practiced purdah.

An ICRW-UNFPA study in 2014 showed that men belonging to the highest socio-economic strata were almost twice as more likely to be gender equitable as compared to those from the lowest strata (p.31). Economic security is an important factor in how parents perceive the relative value of daughters and sons. Larsen’s study in Himachal Pradesh showed that fifteen families in one of the villages had only girl children—and all fifteen were “service class” families with pensions, i.e. quintessential middle-class families who have an assured source of old age support (2009). Himachal Pradesh is one state that has seen a bounce back in SRBs

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9 Murthy et al. (1995) “Perhaps the only uncontroversial finding of earlier studies is that female labor force participation tends to be associated with lower levels of female disadvantage in child survival. The empirical studies of Rosenzweig and Schultz (1982) and Kishor (1993) both confirm this hypothesis.”

: Chaudhri and Jha attribute the inverted U in Himachal Pradesh to appropriate policies (2013: 26).

Further enhancing a shift towards gender equality, there is an incipient trend of daughters contributing more to old age care of parents, especially daughters who live and earn in cities. Earning middle class daughters also contribute to parental households before and sometimes even after marriage, with the potential that this might change how educated and earning daughters might be perceived. Indian data on gender preferences shows that more than half of Indian women do not express a preference for sons (Pande and Malhotra 2006). There is evidence that these women and families are more likely to be found in better socially and materially endowed classes.

### Middle Class—Female Education

In a detailed study of sex ratios in Haryana, Sapru (2007) shows that middle class women wish to ensure a better future for their girl children; the higher the mother's education, the more she was interested in ensuring her daughter's future well-being. As Pande and Malhotra (2006) argue, girls' education and economic independence begin to take greater importance in the stable middle class. Thus, the factors which in the past tilted the balance against having daughters lessen in importance in the secure middle class.

Female empowerment comes about as a result of higher educational levels for women and independent sources of income and right to property. It can also come from participation in women's organizations. Such involvement leads to a decrease in practices of seclusion and increase in mobility. Where there is prosperity but little improvement in female education and no female empowerment through wage earning or community participation, there is devaluation of women through housewifization and dowry tends to go up (Larsen 2009; Larsen and Kaur 2013).

# 6

## Section

# Modelling the Effect of Education and Class Structure on Sex Ratios

*In this section, we model the determinants of sex ratio, across states and over time, by looking at two key determinants—the income class distribution and education of those making the decision to have a child and/or to sex select (men and women ages 18 to 39 years). Other variables that might affect the sex ratio are per capita income, fertility, urbanization, female labor force participation (LFPR) and the real Gini index of consumption inequality. However, neither state per capita income nor the average level of fertility in the state are incorporated into the model. Income is not used as a determinant by itself as both income, and its distribution, are used to estimate the different income class percentages, i.e. if both income and class percentages are used in the regression, then one will be unable to isolate the individual effects of income and class. The correlation between per capita income and the emerging middle class is  $-0.78$ ; with the middle class, the correlation is a  $+0.83$ .*

One of the important, and consistent, explanators of sex ratio decline is the level, and change, in fertility. Bhalla et al. (2013) develop a zig-zag model to explain how significantly the sex ratio at birth is affected by both the level of fertility, and by the change in this level. However, fertility itself is affected by all the included variables (class, female education, LFPR). And the simple correlations are also very high. For example, the level of fertility has a 0.75 correlation with being poor in a cross-section time series panel data spanning over 14 years and 15 big states. The correlation of fertility with the middle class is  $-0.66$  and  $-0.49$  with the emerging middle class. Hence, the same exclusion from model argument that applies to per capita income applies to fertility rates; including fertility in the model will prevent the isolation of the effects of class, education, and LFPR.

The base model for the determinants of the sex ratio at birth consists of the fraction of population belonging to the two income classes (emerging middle class and middle class) and the percent of males and females with at least 11 years of education in the 18–39 age group (the parents that are likely to be self-selecting). Both male and female education are considered *separately* as it is hypothesized that the two variables could have separate, if not contradictory, effects on SRB.

Before proceeding further, let us look at the trends in SRBs and its major explanatory variables. Table 2 presents this for varying time periods between 1984 and 2011. Both the SRS and the adjusted SRS data are presented on SRBs—while the trend remains the same, the difference in the levels is evident. Regarding class, the pace of increase in EMC slows from 1.5 percent to 0.7 percent, while the pace of MC, on the other hand, dramatically increased from 0.2 percent to 1.1 percent per year between 1984–1998 and 1998–2011, respectively.

In terms of education, while the females are clearly behind the males as a percent of population with at least 11 years of education, the pace of arithmetic change is almost equivalent for the period between 1998 and 2011. Therefore, while the percent for both the males and females will rise in the future, the gap between them will take a longer time to bridge. As reported in Kaur et al. (2015a), in 2011 there was near equality in educational attainment of men and women in the age-group 15–19; the mean educational attainment was 8.4 years of schooling for a typical 17-year old female, just marginally less than the 8.8 years observed for males. As shown later, this catch-up in education has played an important role in reducing son-preference from the 2004 peak, and is expected to play an equivalent strong role over the next decade.

**Table 2: Trends in Sex Ratio at Birth and Its Explanatory Variables (1984-2011)**

Year	Sex Ratio at Birth		Class (%)		Population with >= 11 Years of Education	
	SRS	Adjusted	EMC	MC	Male	Female
1984		105.0	29.1	1.6	19.4	7.8
1998	111.2	105.7	51.5	4.1	19.5	10.6
2004	113.6	111.0	50.8	7.6	24.4	14.6
2011	110.1	107.6	61.1	19.4	28.8	20.8
<b>Overall Change</b>						
1984-1998		0.7	22.4	2.5	0.1	2.8
1998-2004	2.4	5.3	-0.7	3.6	4.9	4.0
2004-2011	-3.5	-3.4	10.3	11.8	4.4	6.1
1984-2011		2.6	32.0	17.9	9.4	13.0
1998-2011	-1.1	1.9	9.6	15.4	9.4	10.2
<b>Per Year Change</b>						
1984-1998		0.05	1.5	0.2	0.0	0.2
1998-2004	0.3	0.8	-0.1	0.5	0.7	0.6
2004-2011	-0.4	-0.4	1.3	1.5	0.6	0.8
1984-2011		0.1	1.1	0.6	0.3	0.5
1998-2011	-0.1	0.1	0.7	1.1	0.7	0.7

Source: Sample Registration System, NSS Employment Unemployment Surveys

Notes:

1. The SRS data of the Sex Ratio at Birth is a three year moving average; year here represents the middle of the three year segment. For the calculation of Sex Ratio at Birth (Adjusted), the SRS data on SRB is adjusted to the Census child sex ratio for more accurate estimates (details in Appendix-I).
2. The classes are estimated as follows: Poor—earning less than Rs. 17,650 per year, Emerging Middle Class—earning between Rs. 17,650 and Rs. 65,700 per year, Middle Class and Rich - earning more than Rs. 65,700 per year. As the percentage of rich was small, it is easier to show the middle class as a combined percent of the two.

### Sex Ratio at Birth—Econometric Estimation

The “base” model estimated is

$$SRB = Constant + b_1 * EMC + b_2 * MC + b_3 * FemaleEdu + b_4 * MaleEdu$$

(i)

where SRB is the sex ratio at birth; EMC, MC are the shares in the population of emerging middle class and middle class, respectively; FemaleEdu and MaleEdu are the percent of females and males with at least 11 years of education, respectively. In addition, the following three determinants are also included: female LFPR (urban only since there is very little variation in rural LFPR), urbanization of a state, and the Gini (real) index of consumption inequality.

Tables 3 and 4 report the results for equation 1 for two sets of data on SRB. Table 3 reports the results for the SRS data 1998–2011; these data have not been adjusted, and the end year is 2011 since the NSS data for education ends in 2011–12. As discussed earlier, we have estimated an adjusted SRB for the different states for the years 1984–2011, which uses all of the available data on SRB and adjusts these data to make it consistent with the Census data on the child sex ratio (0–6 years). The results for this sex ratio are reported in Table 4. While both results are presented, and are very similar, the primary discussion below is with regard to the SRS data on SRB, i.e. with these data, there are no adjustments.

The base model (Table 3, Model 3) has a very high explanatory power ( $R^2$  of 0.87); this is partly because of the high explanation embedded in the state constants (see Table 5). The state constants capture individual state effects, and effects that are constant over time, e.g. culture of male-female power relationships, son-preference etc.

The models have the poor as the “reference” class. For most of the models estimated, the coefficient for the middle class is very strongly negative, and significant. The coefficient for the emerging middle class is generally not significant, except in Model 6 (which has all the variables). In Model 6, the coefficient for the EMC is +.07, i.e. for each 10 percent increase in the population share of the EMC, the sex ratio at birth goes up by approximately 0.7 percentage points (ppt). In contrast, as the share of the middle class increases by 10 percentage points, the sex ratio declines by 1.4 ppt in Model 3.

One of the strongest results emerging from our models is the importance of female education. Estimation of separate effects of father and mother’s education is rare in the literature. Our result on female education is consistent with the findings of others. What is surprising is the strength of the son-preference effect of males; each 10 ppt increase in the percentage of males with more than 11 years of education, increases the SRB by 4.7 ppt. In contrast, an equivalent increase in the share of females with 11 years (or more) of education, decreases the SRB by 4.5 ppt.

The effects of three additional variables on the SRB were also estimated—LFPR for urban women, urbanization and (real) inequality. The results are presented for the sake of completeness, and should be interpreted with caution because of the strong multi-collinearity with the base variables like class and female-male education. For example, both urbanization and real inequality have a correlation coefficient greater than 0.6 with the middle class; labor force participation of women is very negatively correlated with the fraction of the population that is poor.

The results, while suggestive, are consistent with those obtained above. High inequality (correlated with middle class) is strongly negative, i.e. if inequality increases, the sex ratio improves. An increase in LFPR of urban women leads to a worsening of the sex ratio—this result is suggestive of the emerging middle class sex-selecting, *ceteris paribus*.

Table 5 reports the individual state effects for Model 3 (basic model with just class and education). There are no surprises here—Punjab has a 21 point higher sex ratio than the reference state of Andhra Pradesh, and Haryana’s sex ratio at birth is 15 points higher. These individual state effects reflect the average “fixed” effect for the period 1998–2011, and are not necessarily indicative of time trends; the latter are captured by the trends in the varying variables like education and class.

The pace of increase in EMC slows from 1.5 percent to 0.7 percent, while MC, on the other hand, dramatically increased from 0.2 percent to 1.1 percent per year between 1984-1998 and 1998-2011, respectively. In terms of education, while the females are clearly behind the males as a percent of population with at least 11 years of education, the pace of change is almost equivalent for the period between 1998 and 2011.

An interesting finding is the strength of the son-preference effect of males; each 10 ppt increase in the percentage of males with more than 11 years of education, increases the SRB by 4.7 ppt. In contrast, an equivalent increase in the share of females with 11 years (or more) of education, decreases the SRB by 4.5 ppt.

**Table 3: Regression Using SRS Data, 1998-2011**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Reference: Poor</i>						
Emerging Middle Class	0.007		0.015	0.028	0.029	0.070***
Middle Class	-0.134***		-0.137***	-0.104**	-0.134**	-0.086
<i>Reference: Less Than 10 Years of Education</i>						
Male Education (%)		0.386***	0.472***	0.455***	0.473***	0.369***
Female Education (%)		-0.581***	-0.455***	-0.485***	-0.504***	-0.229
LFPR (Urban Females, 18-39)				0.201***	0.192***	0.292***
Urbanization					0.166	0.063
Gini						-0.760***
Constant	112.524***	111.543***	108.289***	103.558***	99.236***	117.056***
Adjusted R-squared	0.856	0.861	0.868	0.873	0.874	0.882
Number of Observations	210	210	210	210	210	210

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Notes:

1. Male and Female Education is calculated as percent of population that have at least 11 years of education or more.
2. Labor Force Participation Rate is calculated for the age group 18-39 in the urban areas.

**Table 4: Regression Using Adjusted Data, 1984-2011**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Reference: Poor</i>						
Emerging Middle Class	0.083***		0.056***	0.050***	0.019	0.02
Middle Class	0.022		-0.123***	-0.106***	-0.211***	-0.216***
<i>Reference: Less Than 10 Years of Education</i>						
Male Education (%)		-0.012	-0.019	0.147	0.292***	0.292***
Female Education (%)		0.222**	0.343**	0.126	-0.063	-0.068
Labor Force Participation Rate				0.496***	0.349***	0.342***
Urbanization					0.553***	0.562***
Gini						0.05
Constant	103.642***	105.248***	101.903***	90.694***	80.973***	79.508***
Adjusted R-squared	0.642	0.635	0.654	0.69	0.711	0.711
Number of Observations	420	420	420	420	420	420

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Notes:

1. Male and Female Education is calculated as percent of population that have at least 11 years of education or more.
2. Labor Force Participation Rate is calculated for the age group 18-39 in the urban areas.

**Table 5: Regression Using SRS Data, 1998-2011**

Variable	Coefficient
<i>Reference: Poor</i>	
Emerging Middle Class	0.015
Middle Class	-0.137***
<i>Reference: Less Than 10 Years of Education</i>	
Male Education	0.472***
Female Education	-0.455***
<i>State Constants (Ref: Andhra Pradesh)</i>	
Assam	-0.093
Bihar	2.591**
Gujarat	9.776***
Haryana	14.886***
Karnataka	-0.27
Kerala	5.642***
Madhya Pradesh	-0.881
Maharashtra	5.523***
Orissa	-0.706
Punjab	21.399***
Rajasthan	5.594***
Tamil Nadu	1.266
Uttar Pradesh	6.707***
West Bengal	-0.54
Constant	103.562***
Adjusted R-squared	0.868
Number of Observations	210

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Notes:

1. *Male and Female Education is calculated as percent of population that have at least 11 years of education or more.*

# 7

## Section

# Sex Ratio Projections for India and its States

*The broad result emerging from the econometric analysis is that the share of the middle class has a dominant and significant effect on the sex ratio at birth. On an all-India basis, the share of the MC increased between 1998 and 2011 by 15.3 percentage points—from 4.1 percent to 19.4 percent. Given a coefficient of minus 0.14, the model predicts a decline in the SRB of around 2.1 points—the actual decline 0.6 points. For the forecast 2011–2025 period, on an all-India basis, the middle class is projected to increase its share by 32 percentage points to 52.4 percent; this is forecast to lead to a decline of  $(32 \times -.14)$  or 4.5 percentage points in the SRB. Given a level of SRB of 109.9 in 2011, one should expect a normal level of  $(109.9 - 4.5)$  or 105.4 in 2025.*

The broad result emerging from the econometric analysis is that the share of the middle class has a dominant and significant effect on the sex ratio at birth. For the forecasted 2011–2025 period, on an all-India basis, the middle class is projected to increase its share by 32 percentage points to 52.4 %; this leads to a decline of  $(-0.14 \times 32)$  or 4.5 percentage points in the SRB. Given a level of SRB of 109.9 in 2011, one should expect a normal level of  $(109.9 - 4.5)$  or 105.4 in 2025.

Table 6 reports the sex ratio at birth for four selected years—1984, 2004, 2011, and 2025. These are obtained from the base model (equation 1, Model 3). Note that the data are in sample for years prior to 2011, and out-of-sample for the years post 2011. By 2025, India has a SRB of 108, with the non-deficit states at 106.8 and the deficit states at 110.7. However, two of the deficit states—Haryana and Punjab—see the sharpest declines ( $-14.5$  and  $-15.1$  ppt) in SRB between 1998 and 2025.

Figure 2 is a plot of the changing shares of the poor, EMC and MC for the two years, 2011 and 2025. The distribution of income is assumed to be the same for the two years; what the graph reveals is how the shift in mean (log) income affects the shares of the middle class. Note that in the 2011 distribution the middle class begins significantly to the right of the (log) normal distribution. By 2025, the middle class begins at close to the (log) mean and the share of both the EMC and the MC are about equal and about 50 percent for each.

Two of the deficit states - Haryana and Punjab - see the sharpest declines ( $-14.5$  and  $-15.1$  ppt) in SRB between 1998 and 2025; equivalently, these two states have seen a huge jump in their middle class, with the 2025 values at 78.3 and 76.7, respectively. However, both states have a SRB of 110 in 2025, far from the norm of 105.

**Table 6: Sex Ratio at Birth and Middle Class**

State	Sex Ratio at Birth, SRS Data				Share of Middle Class (%)			
	1998	2004	2011	2025*	1998	2004	2011	2025*
North	114.7	115.1	112.7	108.8	2.3	4.4	10.7	38.6
Haryana	124.4	120.6	116.7	109.9	9.3	17.7	36.5	78.3
Madhya Pradesh	108.5	108.7	106.9	102.0	1.0	2.9	8.7	44.3
Punjab	124.5	124.8	115.9	109.5	11.5	15.1	32.5	76.7
Uttar Pradesh	115.1	116.0	114.4	111.8	0.8	2.0	5.6	25.8
South	105.4	108.6	107.1	103.8	5.4	11.0	32.4	71.9
Andhra Pradesh	103.7	109.1	109.4	107.1	2.5	8.2	30.9	72.6
Karnataka	105.7	110.5	105.3	102.0	5.1	8.8	24.4	65.5
Kerala	107.3	109.6	103.5	102.0	6.9	18.4	33.7	69.8
Tamil Nadu	106.1	106.0	107.8	102.0	8.3	12.5	40.4	77.6
East	108.7	111.4	107.8	109.4	1.4	3.4	8.0	34.4
Assam	105.2	110.3	108.5	103.8	0.9	3.6	6.1	28.0
Bihar	112.5	115.3	109.7	114.4	0.5	0.9	2.7	17.6
Orissa	107.7	107.3	105.5	102.0	0.9	3.9	12.3	52.6
West Bengal	105.3	108.0	105.9	107.7	2.9	6.7	14.0	52.1

**Table 6: Sex Ratio at Birth and Middle Class**

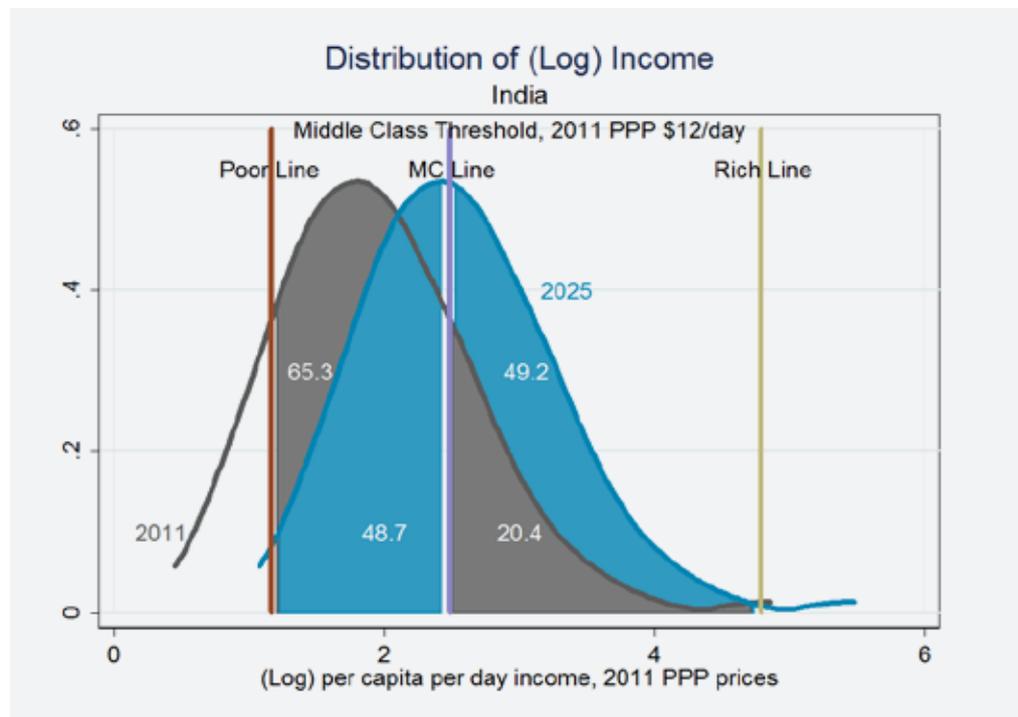
State	Sex Ratio at Birth, SRS Data				Share of Middle Class (%)			
	1998	2004	2011	2025*	1998	2004	2011	2025*
West	112.3	116.9	111.3	109.2	8.5	13.9	32.9	74.7
Gujarat	115.7	118.5	110.0	111.8	9.7	18.3	43.7	84.6
Maharashtra	109.5	114.7	111.6	108.5	11.7	17.2	37.4	79.0
Rajasthan	114.4	119.2	112.0	108.2	2.0	4.4	15.8	58.8
Deficit States	116.5	117.8	114.2	110.7	2.6	4.8	12.4	41.0
Non-Deficit States	108.2	111.2	108.2	106.8	4.6	8.7	22.3	57.0
India	110.5	113.1	109.9	105.3	4.1	7.6	19.4	52.4

\* Projected values

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. Sex Ratio at Birth - Adjusted is defined as number of boys born per 100 girls. The SRS data on SRB is adjusted to the Census child sex ratio for more accurate estimates (details in Appendix - I).
3. The middle class is estimated as those earning more than Rs. 65,700 per year.

**Figure 2: Class Structure, 2011-2025**



Note: The middle class is estimated as those earning more than Rs. 65,700 and less than Rs. 650,700 per year.

## Sex Ratio at Birth: A State Level Analysis

Table 7 presents the determinants of sex ratio for the year 2025 for India, deficit states and non-deficit states. It can be seen that the middle class is at a much higher percentage for the non-deficit states as compared to the non-deficit states, and therefore, the higher SRB for the deficit states is consistent with our model. In terms of education, the deficit states are lower in both female and male as compared to the non-deficit states.

**Table 7: Sex Ratio and Middle Class, 2025**

State	Sex Ratio at Birth	Share in Population (%)			>=11 Years of Education (%)	
		Poor	EMC	MC	Male	Female
North	108.8	5.4	56.0	38.6	29.1	26.2
Haryana	109.9	0.0	21.7	78.3	75.2	64.3
Madhya Pradesh	102.0	2.9	52.8	44.3	14.5	20.8
Punjab	109.5	2.1	21.2	76.7	52.3	54.7
Uttar Pradesh	111.8	7.7	66.5	25.8	27.1	20.1
South	103.8	1.2	26.9	71.9	55.4	61.9
Andhra Pradesh	107.1	1.3	26.1	72.6	66.4	46.6
Karnataka	102.0	1.8	32.7	65.5	67.3	75.0
Kerala	102.0	2.5	27.7	69.8	16.8	66.4
Tamil Nadu	102.0	0.0	22.4	77.6	51.5	67.3
East	109.4	4.8	60.7	34.4	38.0	20.0
Assam	103.8	3.1	68.9	28.0	15.1	13.1
Bihar	114.4	7.3	75.1	17.6	47.3	22.7
Orissa	102.0	3.0	44.4	52.6	8.5	9.4
West Bengal	107.7	2.8	45.2	52.1	46.0	23.4
West	109.2	1.8	23.5	74.7	43.6	24.9
Gujarat	111.8	1.2	14.2	84.6	34.0	11.1
Maharashtra	108.5	1.5	19.4	79.0	51.5	35.3
Rajasthan	108.2	2.7	38.5	58.8	38.9	19.6
Deficit States	110.7	5.6	53.4	41.0	35.4	26.4
Non-Deficit States	106.8	2.8	40.2	57.0	42.2	34.6
India	105.3	3.6	44.0	52.4	40.2	32.2

Notes:

1. Sex Ratio at Birth is the predicted value from the Base Model regression.
2. The poor is estimated as those earning less than Rs. 17,650 per year.
3. The emerging middle class is estimated as those earning between Rs. 17,650 and Rs. 65,700 per year.
4. The middle class and rich (shown combined here) is estimated as those earning more than Rs. 65,700 per year. As the percentage of rich was small, it is easier to show the middle class as a combined percent of the two.
5. Male and Female years of education refers to the percentage of males and females with at least 11 years of education.



## Section

# Policy Implications

*The literature review and the quantitative analysis leads to the following policy implications.*

*First*, the need for higher growth that generates jobs and wider distribution of the fruits of growth is one obvious conclusion, as our findings (and those of many others) show that, on average, people stop caring about the sex of their children at higher levels of prosperity.

*Second*, this prosperity, however, needs to be accompanied by higher levels of education for women and men. The role of education in transforming patriarchal attitudes receives strong evidence in most studies. One clear conclusion therefore is regarding the role of education in decreasing gender discrimination. Reduced educational inequality between the sexes and higher levels of education of mothers help improve the SRB.

*Third*, social security policies are an important characteristic of developed societies and their potential for addressing economic insecurities and reducing dependence on children, especially sons, is helpful in equalising the value of sons and daughters. Social security policies will help in both providing financial security and in helping to reduce the imbalance in the sex ratio at birth. Parents who are confident that they will be economically secure in their old age are less likely to ensure that they have sons.

*Fourth*, it is clear from our study (and other similar studies) that the pace of economic change has been accelerating and that with higher educational levels, greater urbanization and influence of the media, parental attitudes towards girls' education and employment are rapidly changing. Daughters are beginning to be

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The policy implications arising from the analysis are four-fold: one, need for higher growth; two, higher levels of education for both men and women; three, provision of social security policies; and four, focused media campaigns on the equality of gender.

seen as contributors to natal and conjugal households and as contributing to the care of parents in old age. There is usually a lag effect in the visibility and recognition of such social change. Media campaigns that bring focus on these changing realities would go a long way in further changing extant mindsets.



# 9

Section

## Conclusions

*Many demographic studies have either pointed out the worsening of sex ratio at birth with increasing prosperity, or the middle class—not rich or poor—as having a deteriorating effect on SRB. The findings of this paper suggest that there is a complex relationship between economic class and sex-selection which takes the shape of a pronounced inverted U. The poor do not sex-select, the emerging middle class sex-selects, and the middle class shows a distinct pattern of neutrality towards the sex composition of their children. Fathers tend to have son-preference, but this is increasingly being negated by the neutral or positive attitudes of mothers.*

The emerging middle class—a class compressed between the poor and the middle class—emerges as an important determinant, along with male education, of the deteriorating sex ratio at birth. The emerging middle class, anxious about its socio-economic status and keen to consolidate its new class status, shapes the family the most. We have suggested that family mobility strategies of the emerging middle class have gendered effects, favoring sons over daughters. The negative effect of male education is possibly explained by the fact that males are the prime movers behind family mobility strategies.

Going forward, the conversion of emerging middle class, which is presently close to two-thirds of the population, into the middle class along with greater improvement in female education relative to male education is expected, to reduce SRBs to a near normal level by 2025. This is one of the more robust conclusions emerging from this research on class behavior and the sex ratio at birth.

# Appendix-I

## Data Adjustments and Projections

### Adjustment to SRS Sex Ratio at Birth

There are large differences between the levels of SRB from SRS and the Census child sex ratio (Table 8). Census child sex ratio being the more accurate estimate for sex ratio, the SRS levels for SRB need to be adjusted. The correlation between SRB and child sex ratio was established through child mortality rates, and thus, an adjustment factor was calculated. When this adjustment factor is applied on SRS data, a continuous series of adjusted SRB is obtained from 1984 onwards. For data on SRB before 1984, NFHS surveys were used. The NFHS birth history data was also taken to calculate adjusted SRB in 1970s and 1980s. Three NFHS surveys in 1992–93, 1998–1999 and 2005–2006 record women respondent’s birth history, i.e. no. of children born, birth order and current age of the children. Based on these variables, the year of birth is computed and using sample weights in the three surveys, yearly sex ratio at birth is calculated and averaged over a three-year moving period. We see that the NFHS adjusted series and SRS adjusted series are very close for the common period which validates the adjustment method adopted. Outliers in the NFHS series are replaced by an interpolated value obtained from adjoining non-missing NFHS values. NFHS data before 1984 and SRS data after 1984 has been combined to generate the continuous series for sex ratio at birth.

**Table 8: Official Estimates of Sex Ratio**

Year	Census, 0-6	NFHS, previous five year births	SRS, at birth
1981	104.0		
1991	105.8		111.1
1992-1993		105.2	112.4
1998-1999		107.0	111.4
2001	107.9		112.1
2005-2006		108.7	111.6
2009			110.5
2011	109.4		

## Assumptions for Projections of Determinants of Sex Ratio, 2013-2030

For forecasting the sex ratio at birth after 2012, the variables required are—the percentage poor, emerging middle class, middle class in the population, male years of education and female years of education. Education years for males and females have been linearly extrapolated till 2030. When education years for either males or females reaches 14 years, then these are made constant at 14 years. State level projections for the different classes have been obtained by assuming that state level distributions remain the same post-2012, and that the share of national income for each state remains constant at its 2012 value. The derived future sex ratios at birth are assumed to not go below 102.

### Annexure I: Share of Poor, 1998-2025

State	1998	2001	2004	2007	2011	2015*	2025*
North	52.4	56.2	52.8	41.2	27.1	17.4	5.4
Haryana	21.3	21.2	18.6	10.1	3.2	1.8	0.0
Madhya Pradesh	48.5	52.6	47.4	35.0	18.1	9.3	2.9
Punjab	13.9	16.8	20.9	12.6	6.0	4.1	2.1
Uttar Pradesh	63.5	67.7	63.8	51.8	37.1	24.8	7.7
South	30.4	27.5	22.2	12.4	6.8	3.9	1.2
Andhra Pradesh	36.6	28.1	23.2	12.6	6.5	3.5	1.3
Karnataka	31.1	27.3	22.1	10.9	8.5	4.9	1.8
Kerala	24.2	26.8	25.2	19.1	9.9	6.6	2.5
Tamil Nadu	25.3	27.1	19.6	10.0	4.3	2.1	0.0
East	62.5	64.0	58.7	48.9	31.6	19.3	4.8
Assam	60.4	59.4	51.3	46.2	30.1	17.8	3.1
Bihar	77.5	81.6	78.1	69.2	48.6	30.6	7.3
Orissa	58.3	59.5	47.2	28.7	15.9	9.0	3.0
West Bengal	45.4	43.5	39.3	30.5	15.3	8.6	2.8
West	26.0	28.2	24.4	14.5	6.6	4.1	1.8
Gujarat	19.4	20.6	13.9	5.5	3.7	2.8	1.2
Maharashtra	22.1	23.7	19.9	10.4	4.6	2.9	1.5
Rajasthan	38.6	42.8	41.4	29.2	12.4	7.3	2.7
Deficit States	50.8	54.5	52.0	40.5	26.7	17.7	5.6
Non Deficit States	42.0	42.5	37.4	27.5	16.6	9.9	2.8
India	44.5	45.9	41.6	31.2	19.5	12.1	3.6

\* Projected Values

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. The poor is estimated as those earning less than Rs. 17650 per year.

**Annexure II: Share of Emerging Middle Class, 1998-2025**

State	1998	2001	2004	2007	2011	2015*	2025*
North	45.3	39.9	42.8	52.1	62.2	66.6	56.0
Haryana	69.4	64.0	63.7	63.3	60.4	51.0	21.7
Madhya Pradesh	50.5	45.1	49.7	60.4	73.2	75.2	52.8
Punjab	74.6	66.9	64.0	64.9	61.5	52.9	21.2
Uttar Pradesh	35.7	30.8	34.2	45.1	57.4	66.4	66.5
South	64.2	64.4	66.7	68.7	60.8	53.0	26.9
Andhra Pradesh	60.9	65.9	68.6	72.0	62.7	54.4	26.1
Karnataka	63.7	65.8	69.0	72.8	67.1	60.5	32.7
Kerala	68.9	61.2	56.4	55.5	56.3	49.0	27.7
Tamil Nadu	66.4	63.1	67.9	68.0	55.3	46.9	22.4
East	36.1	33.5	37.8	46.1	60.5	67.7	60.7
Assam	38.7	38.0	45.1	49.3	63.8	72.8	68.9
Bihar	21.9	17.5	20.9	29.6	48.7	64.5	75.1
Orissa	40.7	38.5	48.8	63.4	71.8	70.0	44.4
West Bengal	51.7	51.6	54.0	60.3	70.8	69.5	45.2
West	65.5	61.8	61.7	62.9	60.5	53.6	23.5
Gujarat	70.9	69.8	67.8	64.3	52.5	40.4	14.2
Maharashtra	66.3	62.2	62.9	61.7	58.0	52.0	19.4
Rajasthan	59.4	53.9	54.2	63.8	71.8	68.1	38.5
Deficit States	46.6	41.2	43.1	52.1	60.9	64.4	53.4
Non Deficit States	53.4	51.1	53.9	58.3	61.1	59.9	40.2
India	51.5	48.3	50.8	56.5	61.1	61.2	44.0

\* Projected Values

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. The emerging middle class is estimated as those earning between Rs. 17,650 and Rs. 65,700 per year.

### Annexure III: Share of Middle Class and Rich, 1998-2025

State	1998	2001	2004	2007	2011	2015*	2025*
North	2.3	3.9	4.4	6.7	10.7	16.0	38.6
Haryana	9.3	14.8	17.7	26.6	36.5	47.2	78.3
Madhya Pradesh	1.0	2.3	2.9	4.6	8.7	15.4	44.3
Punjab	11.5	16.3	15.1	22.5	32.5	43.0	76.7
Uttar Pradesh	0.8	1.6	2.0	3.1	5.6	8.8	25.8
South	5.4	8.1	11.0	18.9	32.4	43.1	71.9
Andhra Pradesh	2.5	6.0	8.2	15.4	30.9	42.1	72.6
Karnataka	5.1	6.9	8.8	16.3	24.4	34.6	65.5
Kerala	6.9	12.0	18.4	25.4	33.7	44.4	69.8
Tamil Nadu	8.3	9.8	12.5	22.0	40.4	51.0	77.6
East	1.4	2.5	3.4	5.0	8.0	13.0	34.4
Assam	0.9	2.6	3.6	4.4	6.1	9.4	28.0
Bihar	0.5	0.9	0.9	1.1	2.7	4.9	17.6
Orissa	0.9	2.0	3.9	7.9	12.3	20.9	52.6
West Bengal	2.9	4.8	6.7	9.2	14.0	22.0	52.1
West	8.5	10.0	13.9	22.6	32.9	42.2	74.7
Gujarat	9.7	9.5	18.3	30.2	43.7	56.8	84.6
Maharashtra	11.7	14.1	17.2	27.9	37.4	45.1	79.0
Rajasthan	2.0	3.3	4.4	7.0	15.8	24.5	58.8
Deficit States	2.6	4.2	4.8	7.4	12.4	17.9	41.0
Non Deficit States	4.6	6.3	8.7	14.3	22.3	30.3	57.0
India	4.1	5.7	7.6	12.3	19.4	26.7	52.4

\* Projected Values

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. The middle class and rich (shown combined here) is estimated as those earning more than Rs. 65,700 per year. As the percentage of rich was small, it is easier to show the middle class as a combined percent of the two.

**Annexure IV: Males With Atleast 11 Years of Education (%), Age 18-39 Years, 1998-2025**

State	1998	2001	2004	2007	2011	2015*	2025*
North	19.8	21.7	25.0	22.7	27.1	27.7	29.1
Haryana	22.1	23.5	28.7	30.0	42.4	51.8	75.2
Madhya Pradesh	17.9	20.5	23.6	18.2	23.5	20.9	14.5
Punjab	20.6	21.6	25.6	27.4	31.1	37.2	52.3
Uttar Pradesh	20.3	22.1	25.1	23.2	26.3	26.5	27.1
South	20.5	22.2	25.5	25.6	35.8	41.4	55.4
Andhra Pradesh	18.6	19.9	22.0	22.8	34.1	43.3	66.4
Karnataka	19.9	20.8	23.5	24.8	36.2	45.1	67.3
Kerala	21.8	24.2	29.6	28.0	35.3	30.0	16.8
Tamil Nadu	22.6	25.1	29.3	28.7	37.8	41.7	51.5
East	16.0	17.4	20.2	17.3	21.4	26.1	38.0
Assam	15.6	16.3	18.5	18.8	17.6	16.9	15.1
Bihar	16.9	18.3	21.6	16.5	22.7	29.7	47.3
Orissa	14.5	16.0	18.3	19.2	21.0	17.4	8.5
West Bengal	15.6	17.1	19.6	17.0	20.9	28.1	46.0
West	22.2	24.0	27.6	27.4	33.3	36.3	43.6
Gujarat	21.5	22.1	24.6	21.1	26.6	28.7	34.0
Maharashtra	25.2	27.6	32.4	33.5	39.8	43.2	51.5
Rajasthan	17.5	19.6	22.3	22.8	28.4	31.4	38.9
Deficit States	19.9	21.7	24.8	24.0	28.4	30.4	35.4
Non Deficit States	19.3	21.0	24.2	22.5	29.0	32.8	42.2
India	19.5	21.2	24.4	22.9	28.8	32.1	40.2

\* Projected Values

Source: NSS Employment-Unemployment Surveys for various years.

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. The data has been interpolated for the years other than the survey years.

**Annexure V: Females With Atleast 11 Years of Education (%), Age 18-39 Years, 1998-2025**

State	1998	2001	2004	2007	2011	2015*	2025*
North	10.7	12.6	15.1	15.8	20.1	21.9	26.2
Haryana	12.7	16.4	22.4	20.8	29.3	39.3	64.3
Madhya Pradesh	9.4	10.9	12.3	9.8	15.6	17.1	20.8
Punjab	18.0	21.1	27.5	29.4	33.3	39.4	54.7
Uttar Pradesh	10.1	11.8	13.8	16.1	19.3	19.5	20.1
South	13.3	15.1	17.9	19.9	29.1	38.6	61.9
Andhra Pradesh	9.2	10.4	11.7	13.2	21.8	28.9	46.6
Karnataka	11.1	12.8	15.9	16.8	27.7	42.0	75.0
Kerala	22.2	24.8	30.2	32.6	41.9	48.9	66.4
Tamil Nadu	15.6	18.0	20.9	24.4	32.7	42.6	67.3
East	6.8	7.6	9.2	8.5	12.2	14.5	20.0
Assam	9.4	9.8	10.9	9.4	11.9	12.2	13.1
Bihar	4.9	5.3	6.3	5.9	10.9	14.3	22.7
Orissa	6.7	7.9	9.7	11.7	13.5	12.3	9.4
West Bengal	8.3	9.8	12.4	10.5	13.6	16.4	23.4
West	12.2	14.1	17.2	18.2	23.4	23.8	24.9
Gujarat	12.7	14.4	17.5	16.2	20.8	18.0	11.1
Maharashtra	14.6	17.2	21.6	23.9	30.3	31.7	35.3
Rajasthan	7.6	8.6	9.4	10.6	14.3	15.8	19.6
Deficit States	10.5	12.3	14.8	16.5	20.3	22.0	26.4
Non Deficit States	10.7	12.2	14.6	14.9	21.0	24.9	34.6
India	10.6	12.2	14.6	15.4	20.8	24.1	32.2

\* Projected Values

Source: NSS Employment-Unemployment Surveys for various years.

Notes:

1. Deficit States are Haryana, Punjab, Rajasthan and Uttar Pradesh, states with an extremely high sex ratio at birth.
2. The data has been interpolated for the years other than the survey years.

# References

- Agnihotri, Satish Balram. 2000. *Sex Ratio Patterns In The Indian Population*. 1st ed. New Delhi: Sage Publications.
- Arokiasamy, Perianayagam, and Srinivas Goli. 2012. "Explaining The Skewed Child Sex Ratio In Rural India". *Economic And Political Weekly* 47 (42): 85-94.
- Basu, Alaka, and Sonalde Desai. 2011. *Middle Class Dreams: India's One Child Families*. Presented In The Annual Meetings Of The Population Association Of America. Dallas, TX.
- Baviskar, Amita. 2011. "Cows, Cars And Cycle-Rickshaws: Bourgeois Environmentalism And The Battle For Delhi's Streets". *Elite And Every-Man: The Cultural Politics Of The Indian Middle Classes* Edited by Amita Baviskar and Raka Ray, Routledge: 140-163.
- Beteille, Andre. 2001. "The Social Character Of The Indian Middle Class". *Middle Class Values In India And Western Europe* Edited by Imtiaz Ahmad and Helmut Reifeld (Social Science Press).
- Bhalla, Surjit S., Ravinder Kaur, and Manoj Agrawal. 2013. "Son Preference, Fertility Decline And The Future Of The Sex Ratio At Birth". *SSRN Electronic Journal*. doi:10.2139/ssrn.2342286.
- Bhalla, Surjit, and Homi Kharas. 1992. "Growth And Equity In Malaysia : Policies And Consequences". *Malaysia's Economic Vision : Issues And Challenges* Kuala Lumpur: Pelanduk Publications (1992): 41-88.
- Bhalla, Surjit. 2007. *Second Among Equals: The Middle Class Incomes Of India And China*. 1st ed. Washington D.C.: Draft for Peterson Institute for International Economics
- Bhat, P. N. Mari, and A. J. Francis Xavier. 2003. "Fertility Decline And Gender Bias In Northern India". *Demography* 40 (4): 637-657. doi:10.1353/dem.2003.0032.
- Brian, Éric, and Marie Jaisson. 2007. "The Descent Of Human Sex Ratio At Birth: A Dialogue Between Mathematics, Biology And Sociology". Springer.
- Chahnazarian, Anouch. 1988. "Determinants Of The Sex Ratio At Birth: Review Of Recent Literature". *Biodemography And Social Biology* 35 (3-4): 214-235. doi:10.1080/19485565.1988.9988703.
- Chakraborty, Tanika, and Sukkoo Kim. 2008. "Caste, Kinship And Sex Ratios In India". *NBER Working Papers*, 13828 National Bureau of Economic Research.
- Chaudhri, D.P., and Raghendra Jha. 2013. "India's Gender Bias In Child Population, Female Education And Growing Prosperity: 1951-2011". *International Review Of Applied Economics* 27 (1): 23-43. doi:10.1080/02692171.2012.696592.
- Chung, Woojin, and Monica Das Gupta. 2007. "Why Is Son Preference Declining In South Korea? The Role Of Development And Public Policy, And The Implications For China And India". *World Bank Policy Research Working Paper Series*. <http://ssrn.com/abstract=1020841>.
- Clark, Shelley. 2000. "Son Preference And Sex Composition Of Children: Evidence From India". *Demography* 37 (1): 95-108. doi:10.2307/2648099.
- Das Gupta, Monica, and P.N. Mari Bhat. 1997. "Fertility Decline And Increased Manifestation Of Sex Bias In India". *Population Studies* 51 (3): 307-315. doi:10.1080/0032472031000150076.
- Das Gupta, Monica, Woojin Chung, and Li Shuzhuo. 2009. "Evidence For An Incipient Decline In Numbers Of Missing Girls In China And India". *Population And Development Review, The Population Council, Inc.* 35 (2): 401-416. doi:10.1111/j.1728-4457.2009.00285.x.
- Das Gupta, Monica. 1987. "Selective Discrimination Against Female Children In Rural Punjab, India". *Population And Development Review* 13 (1): 77-100. doi:10.2307/1972121.

- Das Gupta, Monica. 1995. «Fertility Decline In Punjab, India: Parallels With Historical Europe». *Population Studies* 49 (3): 481-500. doi:10.1080/0032472031000148786.
- Dickey, Sara. 2012. "The Pleasures And Anxieties Of Being In The Middle: Emerging Middle-Class Identities In Urban South India". *Modern Asian Studies* 46 (03): 559-599. doi:10.1017/S0026749X11000333.
- Dickey, Sara. 2013. "Apprehensions: On Gaining Recognition As Middle Class In Madurai". *Contributions To Indian Sociology* 47 (2): 217-243. doi:10.1177/0069966713482963.
- Gaudin, Sylvestre. 2011. "Son Preference In Indian Families: Absolute Versus Relative Wealth Effects". *Demography* 48 (1): 343-370. doi:10.1007/s13524-010-0006-z.
- Guilmoto, Christophe Z., and Qiang Ren. 2011. "Socio-Economic Differentials In Birth Masculinity In China". *Development And Change* 42 (5): 1269-1296. doi:10.1111/j.1467-7660.2011.01733.x.
- Guilmoto, Christophe. 2007. "Characteristics Of Sex Ratio Imbalance In India, And Future Scenarios". Presentation, Paper presented at the 4th Asia Pacific Conference on Reproductive and Sexual Health and Rights, UNFPA.
- Hudson, Valerie M, and Andrea M. den Boer. 2004. *Bare Branches: The Security Implications Of Asia's Surplus Male Population*. 1st ed. Cambridge Mass: The MIT Press.
- Jha, Prabhat, Maya A Kesler, Rajesh Kumar, Faujdar Ram, Usha Ram, Lukasz Aleksandrowicz, Diego G Bassani, Shailaja Chandra, and Jayant K Banthia. 2011. "Trends In Selective Abortions Of Girls In India: Analysis Of Nationally Representative Birth Histories From 1990 To 2005 And Census Data From 1991 To 2011". *The Lancet* 377 (9781): 1921-1928. doi:10.1016/S0140-6736(11)60649-1.
- Jha, Prabhat, Rajesh Kumar, Priya Vasa, Neeraj Dhingra, Deva Thiruchelvam, and Rahim Moineddin. 2006. "Low Male-To-Female Sex Ratio Of Children Born In India: National Survey Of 1.1 Million Households". *The Lancet* 367 (9506): 211-218. doi:10.1016/S0140-6736(06)67930-0.
- John, Mary, Ravinder Kaur, Rajni Palriwala, and Saraswati Raju. 2008. "Planning Families, Planning Gender: Adverse Sex Ratio In Selected Districts Of Madhya Pradesh, Rajasthan, Himachal Pradesh, Punjab And Haryana". *Actionaid And International Development Research Centre*.
- Kapadia, Karin. 1993. "Marrying Money: Changing Preference And Practice In Tamil Marriage". *Contributions To Indian Sociology* 27 (1): 25-51. doi:10.1177/006996693027001002.
- Kapur, Devesh, and Milan Vaishnav. 2014. "Being Middle Class In India". *The Hindu*.
- Kaur, Ravinder. 2007. "Declining Juvenile Sex Ratios: Economy, Society And Technology Explanations From Field Evidence". *Margin: The Journal Of Applied Economic Research* 1 (2): 231-245. doi:10.1177/097380100700100204.
- Kaur, Ravinder. 2011. "Changing Contours Of Gender Imbalance In India: Does The Middle Class Play A Role?". Presentation, Paper presented at the International Symposium on Gender and Sustainable Social Development: Consequences and Public Policies, 15th – 17th October, Xi'an Jiaotong University, China.
- Kaur, Ravinder. 2011. *Changing Contours Of Gender Imbalance In India And The Role Of The Middle Class*. Mumbai: Presented at the Conference "Inequalities in India", organized by the Centre for South Asian Studies, University of Michigan.
- Kaur, Ravinder. 2015. "Becoming And Staying Middle Class In Contemporary India: The Role Of Sex Selection And Other Family Strategies". Lecture, NMML Public Lecture.
- Kishor, Sunita. "May God Give Sons to All": Gender and Child Mortality in India." *American Sociological Review* 58, no. 2 (1993): 247-65. <http://www.jstor.org/stable/2095969>.
- Krishna, Anirudh, and Devendra Bajpai. 2015. "Layers In Globalising Society And The New Middle-class In India- Trends, Distribu-

- tion And Prospects". *Economic And Political Weekly* 50 (5): 69-77.
- Krishnaji, N. 1987. "Poverty And Sex Ratios: Some Data And Speculations". *Economic And Political Weekly* 22 (23): 892-897.
- Kulkarni, P.M. 2007. *Estimation Of Missing Girls At Birth And Juvenile Ages In India*. Paper commissioned by the United Nations Population Fund, UNFPA.
- Larsen, Mattias, and Ravinder Kaur. 2013. "Signs Of Change? Sex Ratio Imbalance And Shifting Social Practices In Northern India". *Economic & Political Weekly* 48 (35): 45-52.
- Larsen, Mattias. 2009. "Vulnerable Daughters In Times Of Change". Ph.D Dissertation, University of Goteberg.
- Miller, Barbara D. 1981. *The Endangered Sex: Neglect Of Female Children In Rural North India*. 1st ed. Ithaca: Cornell University Press.
- Murthi, Mamta, Anne-Catherine Guio, and Jean Dreze. 1995. "Mortality, Fertility, And Gender Bias In India: A District-Level Analysis". *Population And Development Review* 21 (4): 745-782. doi:10.2307/2137773.
- Nanda, Priya, Abhishek Gautam, Ravi Verma, Aarushi Khanna, Nizamuddin Khan, Dhanashri Bramhe, Shobhana Boyle, and Sanjay Kumar. 2014. *Study On Masculinity, Intimate Partner Violence And Son Preference In India*. New Delhi: International Center for Research on Women.
- Pande, Rohini, and Anju Malhotra. 2006. *Son Preference And Daughter Neglect In India - What Happens To Living Girls?*. New Delhi: International Center for Research on Women.
- Panigrahi, Lalita. 1972. *British Social Policy And Female Infanticide In India*. 1st ed. New Delhi: Munshiram Manoharlal.
- Rajan, S. Irudaya, and Sreerupa. 2017. "Gender Disparity In Kerala: A Critical Reinterpretation". In *The Enigma Of Kerala Women: A Failed Promise Of Literacy*. Edited by Swapna Mukhopadhyay, 1st ed. Delhi: Social Science Press.
- Rajan, S. Irudaya, S. Sudha, and P. Mohanachandran. 2000. "Fertility Decline And Worsening Gender Bias In India: Is Kerala No Longer An Exception?". *Development And Change* 31 (5): 1085-1092. doi:10.1111/1467-7660.00190.
- Rosenzweig, Mark R., and T. Paul Schultz. "Market Opportunities, Genetic Endowments, and Intrafamily Resource Distribution: Child Survival in Rural India." *The American Economic Review* 72, no. 4 (1982): 803-15. <http://www.jstor.org/stable/1810018>.
- Saavala, Minna. 2003. "Auspicious Hindu Houses. The New Middle Classes In Hyderabad, India". *Social Anthropology* 11 (2): 231-247. doi:10.1017/s0964028203000168.
- Saavala, Minna. 2010. *Middle-Class Moralities: Everyday Struggle Over Belonging And Prestige In India*. 1st ed. New Delhi: Orient Blackswan.
- Sapru, Jyoti. 2007. "Son Preference In Haryana: Structures And Strategies". Ph.D Dissertation, Indian Institute of Technology, New Delhi.
- Scrase, Tim. 2006. *The 'New' Middle Class In India: A Re-Assessment*. Wollongong, Australia: Paper presented at the 16th Biennial Conference of the Asian Studies Association of Australia.
- Standing, Guy. 2014. *The Precariat: The New Dangerous Class*. 1st ed. London: Bloomsbury Publishing PLC.
- Vishwanath, L.S. 2004. "Female Infanticide: The Colonial Experience". *Economic And Political Weekly* 39 (22): 2313-2318.





