Determinants of Declining Child Sex Ratio in India: An Empirical Investigation

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Abstract

Using fixed effects model of pooled least squares for the last four decennial census data across fifteen major states in India; the paper examined the determinants of declining child sex ratio in India. The results suggest that the child sex ratio is inversely related to the spatial socio-economic characteristics, in particular, female literacy rate and female economic activity rate; with relatively higher elasticity coefficients for urban India. The spatial spillover effects associated with juvenile sex ratio is controlled in the models, however the spatial dependence of the phenomenon was found insignificant. The monotonic decline in the juvenile sex ratio over the last four decades despite the improving socioeconomic characteristics reinforces the existence of gender discriminatory practices which starts *even before birth*; which requires urgent attention of public policy, as improving literacy and economic value of woman is necessary but not sufficient for enhancing the relative life chances of girl child.

JEL code: J16, C3

Key words: sex ratio, fixed effects, missing women, female economic activity rate, decennial census.

Determinants of Declining Child Sex Ratio in India: An Empirical Investigation

Amartya Sen set off a debate in development economics when he estimated that there are 100 million 'missing women[i]' in the world, referring to the magnitude of female survival disadvantage due to unequal treatment in the intra-household allocation of survival-related commodities[ii]. India has the dubious distinction of having the largest share of 'missing women' in the world along with China (Sen, 1989; Coale, 1991 and Klasen, 1994 and Klasen and Claudia, 2003). It is important to analyse the process by which they went 'missing'; irrespective of the debate whether the excess death due to the unequal access to the intrahousehold resources and sex selective abortions should be treated ethically equivalent[iii]. The aim of the paper is to examine the trends and determinants of cross state variations in the relative life chances of girls in India.

The relative life chances of girls is captured through the estimates of juvenile sex ratio (0-6 age group), which is the age cohort most sensitive to the gender discriminatory practices, whether it is via intrahousehold distribution of resources or through sex selective abortions. Although the overall sex ratio in India improved to 933 in Census 2001 by six percentage points compared to that of 1991, the juvenile sex ratio declined to 927 in 2001 relative to 945 in 1991. However this figure conceals the wide variations across states in India and a distinct geographical pattern. Though Kerala is the only state in which overall sex ratio is consistently favourable to women, at 1058 as per 2001 census, the juvenile sex ratio is only 963. It is more alarming to note that the number of States/UTs in the Northern belt (relatively rich States in terms of economic growth) with child sex ratio below 900 has almost doubled over the last one decade, from three (Punjab, Haryana and Chandigarh) in 1991 to six (Delhi and Himachal Pradesh in addition to the earlier three) in 2001. This points to the hypothesis that economic growth and human development seldom move together, when it comes to improving gender relations.

In explaining the trends and determinants in the juvenile sex ratio, yet another matter of debate is link between the economic value of women and relative survival chances of girls (Bardhan, 1974; Sen, 1991; Berik, 2000). It is often traced that gender discriminatory practices in the intrahousehold distribution of resources have roots in lower economic value of women. We examine the hypotheses whether female economic activity rate and literacy rate improves the relative survival chances of girls; along with economic growth.

The paper is organized as follows. Apart from introduction, section II presents a review of literature on the determinants of high mortality due to the relative neglect of girl child. Section III interprets data and discusses methodology. Section IV presents the empirical model and provides the results of regression analysis. Section V summarizes and draws policy conclusions.

II. Review of Literature

The empirical literature related to declining sex ratio and its determinants can be categorized into three: the studies related to the estimation of missing women; the econometric studies related to the determinants of the declining sex ratio and microeconomic analysis of gender well being in intrahousehold resource allocation. In a series of papers in the late 1980s, Amartya Sen claimed that about 100 million women in the world are missing, referring to the number of females who had died as a result of unequal access to resources in parts of the developing world (Stephan Klasen, 1994; Klasen and Claudia, 2003). He produced such estimate by comparing the sex ratios in countries with large female deficits to the sex ratio prevailing in sub-Saharan Africa. Stephen and Claudia (2003) found that of number of missing women has increased in absolute terms to over 100 million. Regional analyses point to a better status for women in North Africa and West Asia, as compared to South Asia. Within South Asia, India now has the largest share of missing females in South Asia and next to China in the global comparison. The latest estimates of missing women across three methodologies are given in Table 1.

Table 1: Selected Estimates of Missing Women

	Sen's Method		Coale's Method		Klasen's Method	
	No.	%	No.	%	No.	%
China	**49.9**	**8.2**	**32.3**	**5.3**	**40.9**	**6.7**
Taiwan	0.7	6.3	0.3	3.2	0.5	4.7
South Korea	0.5	2.1	0.2	1.0	0.2	0.7
India	**42.6**	**8.6**	**24.6**	**5.0**	**39.1**	**7.9**
Pakistan	**6.0**	**9.6**	**3.4**	**5.5**	**4.9**	**7.8**
Bangladesh	**3.3**	**5.2**	**1.0**	**1.6**	**2.7**	**4.2**
Nepal	**0.1**	**1.0**	**0.3**	**2.4**	**0.1**	**0.5**
Sri Lanka	0.2	1.9	0.1	1.4	0.0	0.0
West Asia:	**5.3**	**5.7**	**1.8**	**2.0**	**3.8**	**4.2**
of which						
Turkey	1.1	4.0	0.2	0.7	0.7	2.4
Syria	0.4	6.1	0.1	1.6	0.2	3.1
Afghanistan	0.7	6.8	0.5	4.4	1.0	9.3
Iran	1.4	4.7	0.3	0.9	1.1	3.7
Egypt	**1.8**	**6.2**	**0.7**	**2.4**	**1.3**	**4.5**
Algeria	0.5	3.1	0.1	0.8	0.2	1.2
Tunisia	0.2	3.5	0.0	0.0	0.1	2.1
Sub-Saharan Africa	0.0	0.0	3.6	1.2	5.5	1.8
Total (Comparable)	**108.9**	**8.0**	**63.6**	**4.7**	**92.8**	**6.8**
Total (World)	113.0	6.4	60.6	3.4	101.3	5.7

Source: Klasen and Claudia, 2003, page 279.

Another study by Gunseli Berik and Cihan Bilginsoy (2000) in the context of Turkey to examine the effect of the economic value of women on the 0-9 cohort population sex ratio, indicated that Turkey does not reflect a significant deficit of women in the population as compared to the alarming figures from India and China. The study concluded a direct relationship between women's labor force participation and the sex ratio but this effect is present only where women's engagement is unpaid family labour.

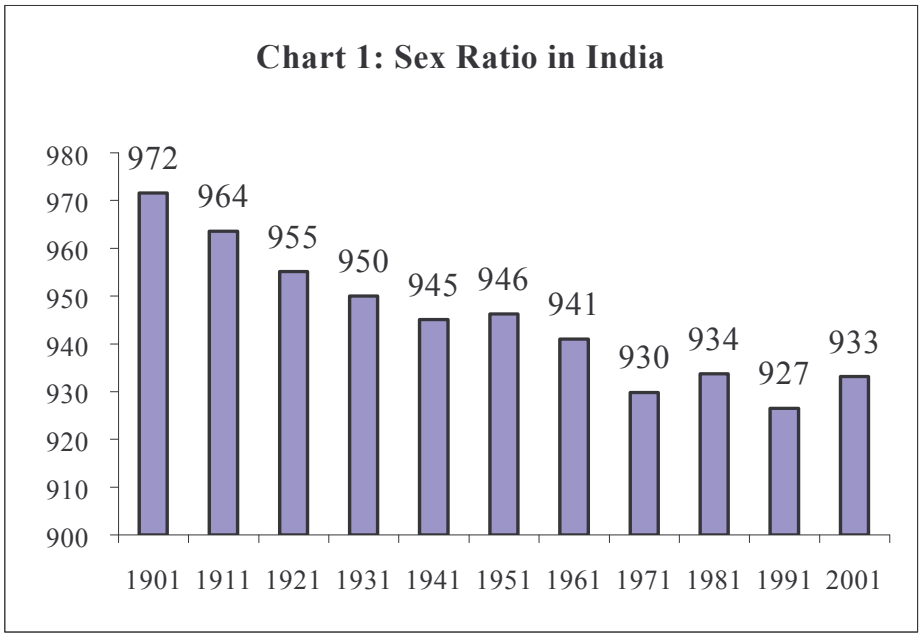
Another set of studies argued that unequal access to health care leads to higher mortality rates of girls (Basu, 1992; Chen, Huq and D'Souza, 1981; Sen and Sengupta, 1983; Hill and Upchurch, 1995). However, in some of these studies, it is noted that the gender differentials in the access to nutrition appeared a negligible factor. Sex selective abortions and son preference are also identified as determinants of declining sex ratio in certain studies related to Asian countries (D'Souza and Chen, 1980; Park and Cho, 1995; Kynch and Sen, 1983; Das Gupta, 1987). These studies attributed excess female mortality to a general preference

for sons, which in turn traced it to either higher expected returns to the labour of male over female children or anticipated old-age support from sons within the patrilineal kinship system (Berik and Bilginsoy, 2000). Visaria (1969) also claimed that 'excess female mortality' is the basic reason for declining sex ratio and excess female mortality in turn is the result of female infanticide, female foeticide, neglect of females and maternal mortality. Barbara Diane Miller (1989) examined the changes in the regional patterns of juvenile sex ratio in rural India from the censuses of 1961 and 1971. It was found that while sex differentials in childhood mortality were substantial and widely distributed in India at the time of the 1961 Census, they were even more so by the time of the 1971 census. Yet another recent study of spatial variations in sex ratio in the context of India is Klasen and Claudia (2003), where they found labour force participation rate and literacy rate of women significant in lessening sex ratio; while increasing recourse to sex selective abortions worsen it. This paper examines the trends in the juvenile sex ratio in rural and urban areas of 15 major States over the last four decades and investigates the determinants of current trends in this gender bias.

III. Interpreting Data

The present study is primarily based on secondary data collected from decennial Census Reports, Government of India, covering sex ratio, literacy rate and work participation rate in the rural and urban areas of major States of India. The point to be noted here is that the Census estimates of work force participation rate are lower than those estimated by the National Sample Survey (NSS) estimates. Census estimates are as much as 3 per cent lower than NSS estimates in the case of male workers, and as much as 10 to 16 per cent lower for female workers[iv] (Report on Human Development in South Asia, 2000). Socio-cultural variables such as dowry deaths, female infanticide, sex determination tests also tend to affect the sex ratio but our study is limited to few variables only due to paucity of these data across States over last four decades.

Given equal access to intrahousehold resources including health and nutrition, females have an evident biological advantage of survival over males. Despite this biological



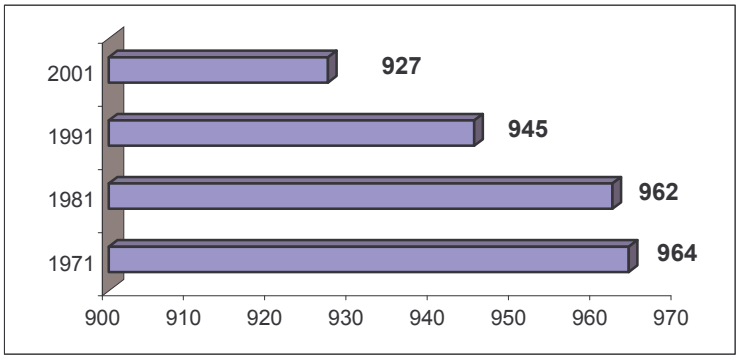
advantage, the sex ratio is generally adverse to women in India. It is primarily the consequence of high levels of female mortality, which begins at birth, after birth or even before birth.

The decennial censuses conducted in India suggest that there has been an almost monotonic decline in the sex ratio in India. In 1901, the sex ratio was 972 females for every 1000 males; by 1991 it had reached the lowest point at 927. In Census 2001, the sex ratio increased by six points to 933.

Statewise decomposition of the sex ratio over the period between 1901 and 2001 reveals mixed trends of social, cultural, economic and political influence on the relative magnitude of excess female mortality across the country. In 2001, only Kerala and Pondicherry have sex ratios of 1058 and 1001, respectively. The other States and Union Territories (UT), where the sex ratio is above 950, are Andhra Pradesh (978) Chattisgarh (990), Goa (960), Himachal Pradesh (970), Karnataka (964), Manipur (978), Meghalaya (975), Orissa (972), Tamil Nadu (986) and Uttaranchal (964). The North Indian belt of Delhi (821), Haryana (861), Punjab (874), Uttar Pradesh (898), along with Andaman and

Nicobar Islands (846), Dadra and Nagar Haveli (811), and Sikkim (875), account for a large part of the alarmingly low sex ratio in India (Table A1).

Chart 2: Intertemporal Trends in Juvenile Sex Ratio in India



Although the overall sex ratio improved in Census 2001 compared to that of 1991, the child sex ratio (sex ratio in age group 0-6 years) declined to 927 in 2001 relative to 945 in 1991 (Chart 2).

The rural-urban differentials in juvenile sex ratio revealed that rural child sex ratio has always exceeded the urban one (Table A2). However both have been declining over time, the rate of decline in urban area is much more than that of rural area, except for Tamil Nadu in 2001. It is to be noted that the adverse juvenile sex ratio is quite pronounced in the following districts of the country according to Census, 1991: Salem (849) in Tamil Nadu; Bhind (850) and Jaisalmer (851) in Rajasthan; Amritsar (861), Faridkot (863) and Bhatinda (865) in Punjab; Kathel (854), Jind (858), Kurukshetra (867) and Hissar (867) in Haryana. However, the unit of present study is States and not districts.

What determines these spatial variations in juvenile sex ratio? In explaining the trends and variations in the gender differential in child mortality or child sex ratio, much discussion has focused on the economic value of women measured by their labor force participation. The data analysis reveals that while almost all the States showed an improvement in Female Labour Force Participation Rate (FLPR) in the last four decades, Kerala and Maharashtra exhibited a downward pattern in the last two decades (Table A3).

Haryana's FLPR in 2001 surprisingly shot up to 27.22 per cent per cent from 10.76 per cent in 1991. Punjab indicated an irregular pattern in FLPR. It was 1.18 per cent in 1971, rose to 6.16 per cent in 1981, came down to 4.4 per cent in 1991 and then gone up to 19.05 per cent in 2001. Prima facie, the graphical plots of comovement of FLPR and juvenile sex ratio in rural and urban India negated the positive correlation between the two (Chart 3 and 4).

Chart 3: Movements of Child Sex Ratio and Female Labour Force Participation, Rural India, 2001

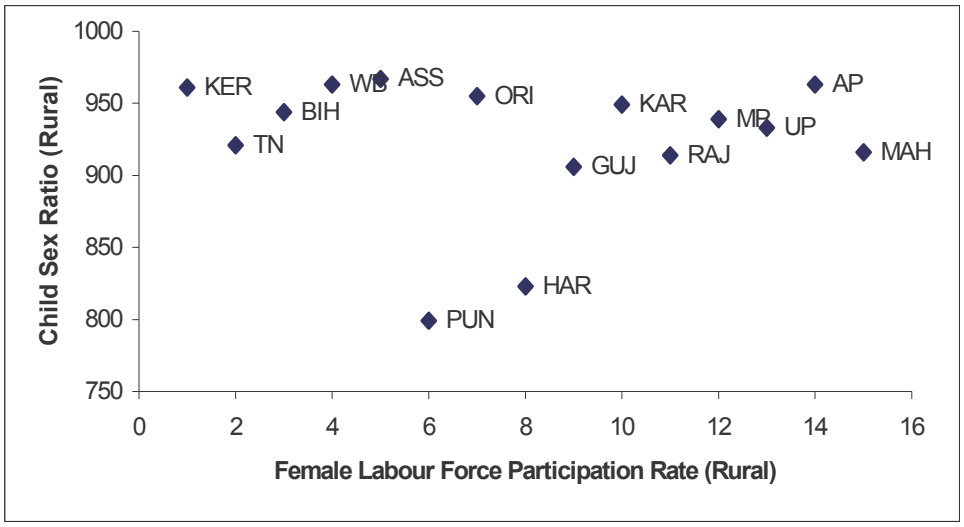
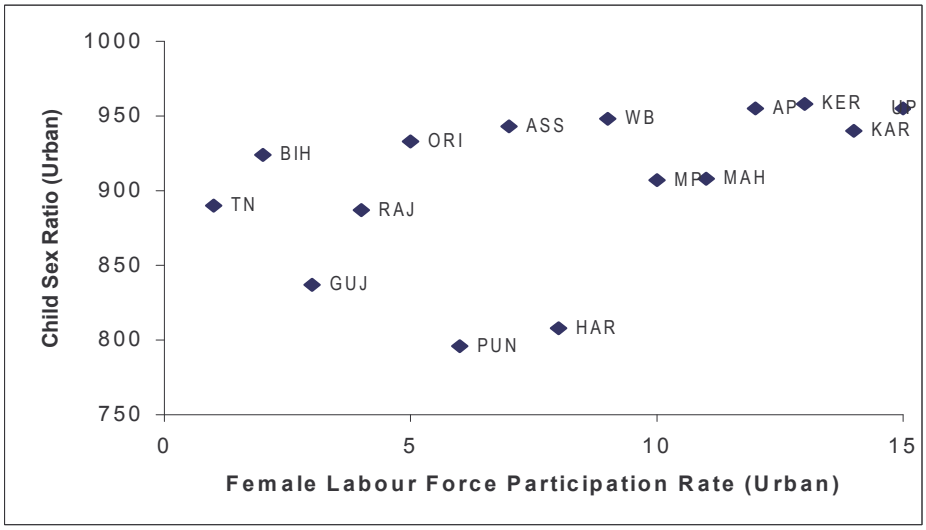


Chart 4: Movements of Child Sex Ratio and Female Labour Force Participation, Urban India, 2001



However, it is to be noted that women's contribution to the economy remains significantly invisible in national accounts. Although a certain degree of statistical invisibility of women in the economy is a global phenomenon, it is particularly predominant in India and other South Asian nations due to the orthodox socio-cultural milieu. The official labour force statistics do not incorporate the significant component of unpaid labour by women. However, the attempt of United Nations Statistical Division in extending the production boundary of Systems of National Accounts (SNA), 1993 has led to the inclusion of the activities of unpaid work of women into national accounting system as satellite accounts. This extended production boundary of SNA 1993 provides a better understanding of women's contribution to the economy. The labour force participation rate may not be able to reveal these meticulous aspects of statistical invisibility of women's work. It is also to be noted that Sen's hypothesis that only "gainful work outside" improves the relative survival chances of girls and not often the inside work may not be able to test due to the data constraints on the women's work within and outside, which has further complications in terms of paid and unpaid components.

An equivalent analysis on literacy, particularly female literacy indicated a fairly good improvement over the decades in all the States. Kerala ranked top (87.7 per cent) among all States in female literacy followed by Maharashtra (67 per cent), Tamil Nadu (64.4 per cent) and Punjab (63.4 per cent). West Bengal, Gujarat, Haryana and Karnataka also showed tremendous improvement from 1971 to 2001. In general, though literacy among females has increased over time, the level of female literacy has been lower than that of males even in urban areas (Table A4). The low level of female educational attainment results in women's low earning potential, low nutritional status, high level of mortality and low financial and functional autonomy within households, which in turn has positive impact on sex ratio. Prima facie, The graphical plots of comovement of FLPR and juvenile sex ratio in rural and urban India negated the positive correlation between the two (Chart 5 and 6).

Chart 5: Movements of Child Sex Ratio and Female Literacy Rate, Rural, 2001.

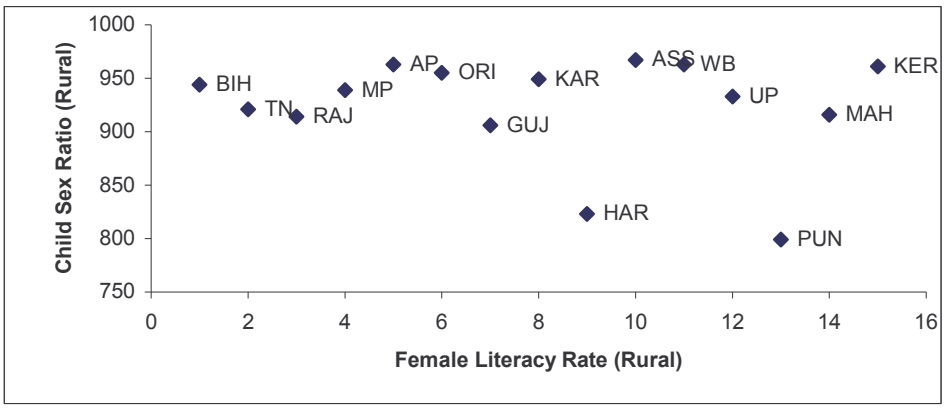
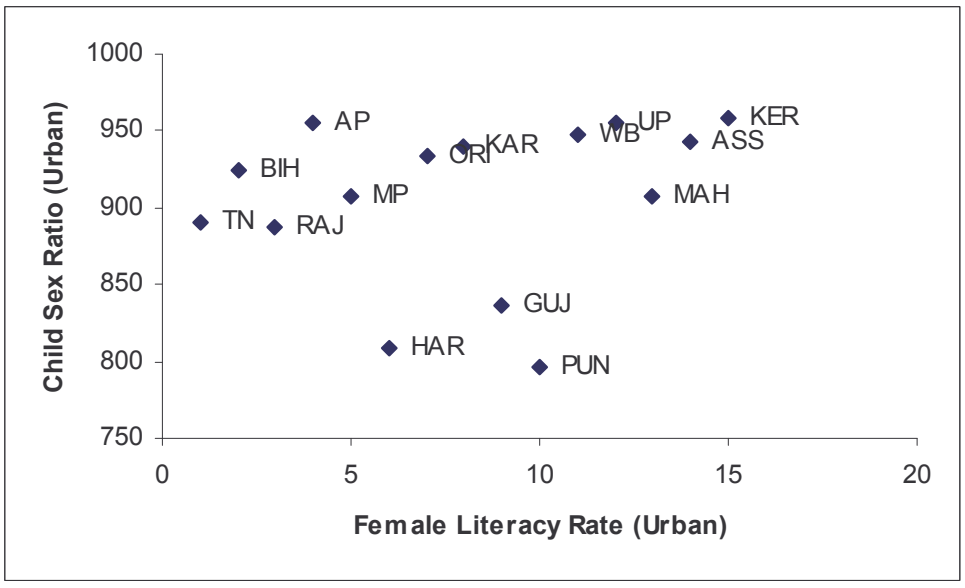


Chart 6: Movements of Child Sex Ratio and Female Literacy Rate, Urban, 2001.



The hypothesis related to the link between intrahousehold gender differentials in health seeking behavior requires microlevel data for empirical investigation. As noted by earlier studies, the only variable that reflects these aspects from the secondary level data is the nutrition data revealed from anthropometrics. The nutritional status of children under three years calculated on the basis of anthropometric data by National Family Health Survey (NFHS) (second round) revealed that around half of children under three are

underweight, with 45.3 per cent male and 48.9 per cent female children disadvantaged nutritionally (Table 2).

Table 2: Nutritional Status: Gender Disaggregation[1]

Nutritional Status	Male	Female	Total
a. Undernourished			
i. Underweight (weight-for-age)	45.3	48.9	47.0
ii. Stunted (height-for-age)	44.1	47.0	45.5
iii. Wasted (weight-for-age)	15.7	15.2	15.5
b. Severely Undernourished			
i. Underweight (weight-for-age)	16.9	19.1	18.0
Ii. Stunted (height-for-age)	21.8	24.4	23.0
Iii. Wasted (weight-for-age)	2.9	2.7	2.8

Note: [1]Percentage of children under 3 years classified as undernourished on three anthropometric indices of nutritional status, according to selected demographic characteristics, India, 1998-99.
Source: National Family Health Survey-2, 2000, India.

As the anthropometrics evidence on nutrition indicates that there is only slight difference between girls and boys in terms of nourishment, therefore the health-related intrahousehold variable is not considered for the model. The availability of health infrastructure is also a potential dependent variable for the analysis. As per NFHS second round data, only 35 per cent of the deliveries are institutional in India, it may not explain the gender bias in the mortality rates of girls more than boys in age cohort 0-6. The studies also noted that availability of health infrastructure might not reduce gender bias in health seeking behaviour, if parents are less likely to use such facilities for girls (Bardhan, 1988; Murthi et al, 1995).

Prima facie evidence of interstate data analysis revealed that juvenile sex ratio is worse in among the educated elite and economically well-off regions. For instance, it is ironical to observe that Punjab and Haryana, two rich states of India in terms of economic growth, are the ones reporting minimum child juvenile sex ratio. This may point to the fact that economic growth per se does not translate into better gender sensitive human development. Based on this preliminary evidence from the data exploration, model specification is attempted in the next section.

V. Econometric Model and Estimation Results

The objective of the paper is to detect the relationship between the shortfall of girls and the socio economic characteristics of States. The unit of analysis of the study is States, which are not behavioural units, but aggregates of behavioural units (such as households or individuals). The dependent variable in the model is the juvenile sex ratio of age cohort 0-6. The effect of sex selective interstate migration is filtered out through confining to the sex ratio of 0-6 age cohort, rather than overall sex ratio.

$$ln\ jcr_{it} = \alpha + \beta_1 ln\ flit_{it} + \beta_2 ln\ flpr_{it} + \rho + \mu_{it} \quad \text{(I)}$$

$$ln\ jcr_{it} = \alpha + \beta_1 ln\ flit_{it} + \beta_2 ln\ flpr_{it} + \mu_{it} \quad \text{(ii)}$$

$$ln\ jcr_{it} = \alpha + \beta_1 ln\ T\ lit_{it} + \beta_2 ln\ flpr_{it} + \rho + \mu_{it} \quad \text{(iii)}$$

$$ln\ jcr_{it} = \alpha + \beta_1 ln\ T\ lit_{it} + \beta_2 ln\ flpr_{it} + \mu_{it} \quad \text{(iv)}$$

$$ln\ jcr_{it} = \alpha + \beta_1 ln\ flit_{it} + \beta_2 ln\ flpr_{it} + \beta_3 ln\ deg_{it} + \mu_{it} \quad \text{(v)}$$

where, $ln\ jcr_{it}$ = *log of sex ratio of age cohort 0-6*
$ln\ flit_{it}$ = *log of female literacy rate (+7)*
$ln\ flpr_{it}$ = *log of female labourforce participation rate*
$lnT\ flit_{it}$ = *log of total literacy rate (+7)*
$lndeg_{it}$ = *log of decadal economic growth rate*
ρ = *spatial dependence error correction term*
μ_t = *surrogate of omitted explanatory variables.*

The conditioning set includes two important variables that measure the economic value of women as well as the educational attainment. Educational attainment of the state captured through general literacy rate (the number of literate divided by the population above age seven) is a better measure of development that goes further than GDP per capita to to broadly capture the effectiveness of public policy stance in terms of development interventions, based on the assumption of significant *trickling down* effects[v]. However, we have controlled for decadal economic growth rates also in model specification. Prima

facie, the relative chances of survival of the girl child should improve with rising literacy rates. The availability of health infrastructure and access to intrahousehold resources including healthcare proxied through nutritional disadvantage across gender are omitted as per the reasons mentioned in the earlier section.

All the variables are taken in natural logarithms because the dependent variable is a ratio and therefore asymmetric around the reference value. With logarithmic transformation, a deviation from a reference point becomes equidistant in either direction (Fossett and Kiecolt, 1991). The regression coefficients are then elasticities of the juvenile sex ratio with respect to the explanatory variables.

The data exploration across states revealed that not only does juvenile sex ratio worsen as one moves from Southern belt of India to Northern belt, but there is also a clustering of the sex ratio such that low sex ratio states tends to have similar neighbouring States. Econometrically, this problem of spatial dependence can be treated through two ways. Introduction of dummy variable for the Northern States may partially capture this pattern. Alternatively, the observed spatial dependence may be modeled directly. Measurement problems associated with the arbitrariness of geographic delineation and aggregation of States, spatial spillover effects, or omission of spatially correlated explanatory variables may cause spatial correlation in errors. This type of spatial dependence, called spatial error autocorrelation, makes ordinary least square (OLS) estimates inefficient. It can be corrected by adding an autoregressive process whereby the error term depends on its spatially lagged value and a random error term.

In the context of Turkey, Berik and Bilginsoy (2000) identified a spatial dependence, which indicates the presence of a pattern of interaction whereby neighbouring provinces influence each other's behaviour. This type of spatial dependence is called mixed regressive spatial autoregressive model, where the spatial lag in the dependent variable renders OLS estimates biased and inconsistent (Anselin, 1988; Case 1991 cited by Berik and Bilginsoy, 2000). This functional relationship between the dependent variables across provinces is modeled by including the spatially lagged sex ratio (that is, the weighted

average of the values of the sex ratio in neighbouring provinces) among the RHS variables of the regression equation. In the context of Turkey, Berik and Bilginsoy (2000) applied both spatial econometric models as they donot have theoretical priors on the type of dependence. But in the context of India, we opted out mixed regressive spatial autoregressive model because of the broad absence of influence of neighbouring provinces in the pattern of sex ratio except for few selective border units of provinces.

The results of pooled least squares estimation, not disaggregated across rural and urban, are reported in Table 3. The models (ii) and (iv) ignores spatial dependence term and all models were estimated by fixed effects. All models are adjusted for White Heteroskedasticity consistent standard errors and covariance. The analysis showed that female labour force participation rate and female literacy rate are significant in determining the juvenile sex ratio, but inversely related. The economic growth rate is also found inversely related to juvenile sex ratio but insignificant.

Table 3: Panel Estimation for 0-6 Age Cohort Sex Ratio (Total)

FIXED EFFECT MODELS					
	(I)	(II)	(III)	(IV)	(V)
$ln\ flit_{it}$ (Female Literacy Rate)	***-0.0303*** (-3.4608)* [0.0019]	***-0.024*** (-2.1806)* [0.0351]	-	-	***-0.019*** (-1.8045)* [0.0986]
$ln\ flpr_{it}$ (Female Labour Force Part. Rate)	***-0.0529*** (-4.3138)* [0.002]	***-0.2790*** (-2.2002)* [0.0336]	***-0.050*** (-4.2759)* [0.002]	***-0.0298*** (-2.2480)* [0.0302]	***-0.0588*** (-16.2781)* [0.0000]
$ln\ T\ lit_{it}$ (Total Literacy Rate)	-	-	***-0.052*** (-4.2303)* [0.003]	***-0.029*** (-1.8695)* [0.0689]	**-**
$Ln\ deg_{it}$ (Decadal Growth Rate)					***-0.0019*** (-0.3829) [0.7091]
Spatially lagged error	-0.1059 (-1.2498) [0.2229]	-	-0.094 (-1.222) [0.2330]	-	
R^2	*0.93*	*0.81*	*0.9351*	*0.81*	*0.96*

Source: (Basic Data), Census, Govt of India (various years)

In case of separate pooled least square estimation for rural and urban for the recent two decadal figures, literacy rate is found insignificant in determining child sex ratio. However, female labour force participation is inversely related to the relative survival

disadvantage of girls. The problem of multicollinearity between female literacy rate and female labour force participation rate is not severe as female literacy rate explains only 14 per cent of female labour force participation rate.

Table 4: Panel Estimation for 0-6 Age Cohort Sex Ratio (Rural)

	FIXED EFFECT MODELS	
	(II)	(IV)
$ln\,flit_{it}$	-0.0058 (-0.9948) [0.3380]	-
$ln\,flpr_{it}$	***-0.0505*** (-11.9007)* [0.0000]	***-0.0491*** (-10.7174)* [0.0000]
$ln\,T\,lit_{it}$	-	-0.0146 (-1.411) [0.1816]
R^2	0.9680	0.9689

Source: (Basic Data), Census, Govt of India (various years)

The analysis revealed that regression coeffients of urban panel is worse than rural panel for female labour force participation rate. In urban India, one per cent rise in female economic activity rate induce the worsening of juvenile sex ratio by 0.08 points, while same coefficient for rural India at 0.05 percentage points. The pattern of gender discrimination is more severe in urban India and it may get accentuated through technological advancements in terms of sex determination tests and sex selective abortions.

Table 5: Panel Estimation for 0-6 Age Cohort Sex Ratio (Urban)

	FIXED EFFECT MODELS	
	(II)	(IV)
$ln\,flit_{it}$	-0.0291 (-1.0899) [0.2955]	-
$ln\,flpr_{it}$	-0.0793 (-4.4549)* [0.0006]	-0.0787 (-4.3406)* [0.0008]
$ln\,T\,lit_{it}$	-	-0.0462 (-1.0804) [0.2996]
R^2	*0.9418*	0.9418

Source: (Basic Data), Census, Govt of India (various years)

The literacy rate is found insignificant in urban and rural panel data analysis. It may because of the fact that through it is growing at faster pace, the levels of female literacy is

still very low in India. More than half of Indian women are still illiterate. The policy conclusion is that improving literacy and economic value of woman is necessary but not sufficient for enhancing the quality of life of women.

V. Conclusion

In the backdrop of alarming magnitude of *missing women* due to unequal treatment in the intrahousehold allocation of survival related commodities, the paper examined the intertemporal and spatial trends and socioeconomic determinants of the spatial variations in the relative neglect of girl child in India. Using fixed effects model of pooled least squares for the last four decennial census data across fifteen major states in India, the paper revealed that higher socio-economic characteristics (female literacy, female work force participation and economic growth) has not been translated effectively in terms of containing the female sustenance and survival disadvantage. Even the economic growth showed an inverse relation with the juvenile sex ratio. The disaggregated panel data analysis by geographic units revealed that higher juvenile sex ratio is not an isolated phenomenon of rural India; rather the matter is dismal in urban units. It is alarming to note that sex ratio of age cohort 0-6 is inversely related to female education and female economic activity rate with relatively higher elasticity coefficients for urban India; catalyzed by the spread of sex determination tests and sex selective abortions, which played a key role in worsening the juvenile sex ratio. The spatial spillover effects associated with either geographic delineation or aggregation of States in terms of juvenile sex ratio is controlled in the models, however the spatial dependence of the phenomenon was found insignificant.

The argument that economic value of women increases their bargaining power in the intrahousehold decision making and the hypothesis of 'women's agency and empowerment' through higher educational attainment and participation in economic activity may not be refuted as the econometric results depicted an inverse relationship between labour force participation and juvenile sex ratio. Rather, the aggregate evidence could be interpreted as that improving female education and female labour force

participation rate in the recent years has not translated effectively in terms of bettering the relative life chances of girls, reflecting their relative neglect in the intrahousehold. The monotonic decline in the juvenile sex ratio over the last four decades despite the improving socioeconomic characteristics reinforces the existence of gender discriminatory practices which starts even before birth; which requires urgent attention of public policy, as improving literacy and economic value of woman is necessary but not sufficient for enhancing the relative life chances of girl child.

Appendix

Table A1: Trends in Sex ratio in India: A Statewise Decomposition, 1901-2001

	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001
INDIA	**972**	**964**	**955**	**950**	**945**	**946**	**941**	**930**	**934**	**927**	**933**
Jammu & Kashmir	882	876	870	865	869	873	878	878	892	896	900
Him. Pradesh	884	889	890	897	890	912	938	958	973	976	970
Punjab	832	780	799	815	836	844	854	865	879	882	874
Chandigarh	771	720	743	751	763	781	652	749	769	790	773
Uttaranchal	918	907	916	913	907	940	947	940	936	936	964
Haryana	867	835	844	844	869	871	868	867	870	865	861
Delhi	862	793	733	722	715	768	785	801	808	827	821
Rajasthan	905	908	896	907	906	921	908	911	919	910	922
Uttar Pradesh	938	916	908	903	907	998	907	876	882	876	898
Bihar	1,061	1,051	1,020	995	1,002	1,000	1,005	957	948	907	921
Sikkim	916	951	970	967	920	907	904	863	835	878	875
Arunachal Pradesh	NA	NA	NA	NA	NA	NA	894	861	862	859	901
Nagaland	973	993	992	997	1,021	999	933	871	863	886	909
Manipur	1,037	1,029	1,041	1,065	1,055	1,036	1,015	980	971	958	978
Mizoram	1,113	1,120	1,109	1,102	1,069	1,041	1,009	946	919	921	938
Tripura	874	885	885	885	886	904	932	943	946	945	950
Meghalaya	1,036	1,013	1,000	971	966	949	937	942	954	955	975
Assam	919	915	896	874	875	868	869	896	910	923	932
West Bengal	945	925	905	890	852	865	878	891	911	917	934
Jharkhand	1,032	1,021	1,002	989	978	961	960	945	940	922	941
Orissa	1,037	1,056	1,086	1,067	1,053	1,022	1,001	988	981	971	972
Chhatisgarh	1,046	1,039	1,041	1,043	1,032	1,024	1,008	998	996	985	990
Madhya .Pradesh	972	967	949	947	946	945	932	920	921	912	920
Gujarat	954	946	944	945	941	952	940	934	942	934	921
Daman& Diu	995	1,040	1,143	1,088	1,080	1,125	1,169	1,099	1,062	969	709
Dadra & Nagar Haveli	960	967	940	911	925	946	963	1,007	974	952	811
Maharashtra	978	966	950	947	949	941	936	930	937	934	922
Andhra Pradesh	985	992	993	987	980	986	981	977	975	972	978
Karnataka	983	981	969	965	960	966	959	957	963	960	964
Goa	1,091	1,108	1,120	1,088	1,084	1,128	1,066	981	975	967	960
Lakshadweep	1,063	987	1,027	994	1,018	1,043	1,020	978	975	943	947
Kerala	1,004	1,008	1,011	1,022	1,027	1,028	1,022	1,016	1,032	1,036	1,058
Tamil Nadu	1,044	1,042	1,029	1,027	1,012	1,007	992	978	977	974	986
Pondicherry	NA	1,058	1,053	NA	NA	1,030	1,013	989	985	979	1,001
Andaman &Nicobar Islands	318	352	303	495	574	625	617	644	760	818	846

Source: Census, Govt of India (various years)

Table A2: Sex Ratio and Child Sex Ratio in Rural and Urban Areas

	1991				2001			
	Sex Ratio		Child Sex Ratio		Sex Ratio		Child Sex Ratio	
States	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	977	959	979	962	983	965	963	955
Assam	934	838	977	955	944	872	967	943
Bihar	913	857	953	950	926	868	944	924
Gujarat	949	907	937	909	945	880	906	837
Haryana	864	868	877	884	866	847	823	808
Karnataka	973	930	963	951	977	942	949	940
Kerala	1037	1034	958	958	1059	1058	961	958
Maharashtra	972	875	953	934	960	873	916	908
Madhya Pradesh	921	887	944	931	927	898	939	907
Orissa	988	866	969	949	987	895	955	933
Punjab	888	868	878	866	890	849	799	796
Rajasthan	919	879	919	909	930	890	914	887
Uttar Pradesh	879	864	927	928	904	876	921	890
Tamil Nadu	981	960	945	954	992	982	933	955
West Bengal	940	858	969	955	950	893	963	948

Source: Census, Govt of India (various years)

Table A3: Statewise Labour Force Participation Rate in India: 1991 and 2001

	1991						2001					
	Rural			Urban			Rural			Urban		
States	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Andhra Pradesh	57.9	42.5	50.3	48.9	11.9	30.8	58.3	43.3	50.9	50.8	13.2	32.3
Assam	49.3	23.3	36.7	50.5	7.5	30.9	49.4	22.1	36.2	52.9	10.6	33.2
Bihar	48.4	12.6	31.3	41.3	4.9	24.5	48	20.2	34.7	41.7	7	25.6
Gujarat	54.9	35.6	45.5	51.1	7.2	30.2	55.5	38.5	47.2	53.9	9.4	33.1
Haryana	48.5	12.6	31.9	48.5	5.1	28.3	50.7	33.9	42.9	49.2	10.6	31.5
Karnataka	56	36.6	46.4	49.8	12.9	32	58.1	39.9	49.1	53.8	16.4	35.7
Kerala	47.9	16.9	32.1	46.8	13	29.6	50.1	16	32.5	50.6	13.6	31.6
Maharashtra	53.2	46	49.7	50.6	11.4	32.3	53.9	43.6	48.9	52.4	12.6	33.8
Madhya Pradesh	53.3	36.1	45.1	46.6	9.7	29.3	53	40.7	47.1	47.4	12	30.6
Orissa	54.7	22.6	38.7	48.4	8.1	29.7	53.2	27.1	40.2	49.1	10	30.6
Punjab	55	4.4	31.2	52.3	4.5	30.1	53.9	23.4	39.5	53.1	10.4	33.5
Rajasthan	50.1	33.3	42	46.6	7.2	28.2	50.7	40.6	45.9	47.4	9.5	29.6
Uttar Pradesh	50.6	12.9	33	46.2	4.7	26.9	47.4	19	33.9	44.6	6.8	26.9
Tamil Nadu	58.3	38.5	48.5	52.8	13.1	33.3	59.1	41.4	50.3	55.8	18.9	37.5
West Bengal	52.1	13.1	33.2	49.6	6.2	29.6	54.1	20.9	37.9	53.7	11.6	33.9

Source: Census, Govt of India (various years)

TableA4: Statewise Literacy Rates-1991 and 2001

	1991						2001					
	Rural			Urban			Rural			Urban		
States	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Andhra Pradesh	47.3	23.9	35.7	75.9	56.4	66.4	65.4	43.5	54.5	83.2	68.7	76.1
Assam	58.7	39.2	49.3	84.4	73.3	79.4	68.2	50.7	59.7	89.7	80.2	85.3
Bihar	48.3	18.0	33.8	77.7	55.9	67.9	57.1	29.6	43.9	79.9	62.6	71.9
Gujarat	66.8	38.7	53.1	84.6	67.7	76.5	74.1	47.8	61.3	88.3	74.5	81.8
Haryana	64.8	32.5	49.9	82.0	64.1	73.7	75.4	49.3	63.2	85.8	71.3	79.2
Karnataka	60.3	34.8	47.7	82.0	65.7	74.2	70.4	48	59.3	86.7	74.1	80.6
Kerala	92.9	85.1	88.9	95.6	89.1	92.3	93.6	86.7	90	95.9	90.6	93.2
Maharashtra	69.7	41.0	55.5	86.4	70.9	79.2	81.9	58.4	70.4	91	79.1	85.5
Madhya Pradesh	51.0	19.7	35.9	81.3	58.9	70.8	71.7	42.8	57.8	87.4	70.5	79.4
Orissa	60.0	30.8	45.5	81.2	61.2	72.0	72.9	46.7	59.8	87.9	72.9	80.8
Punjab	60.7	43.9	52.8	77.3	66.1	72.1	71	57.7	64.7	83	74.5	79.1
Rajasthan	47.6	11.6	30.4	78.5	50.2	65.3	72.2	37.3	55.3	86.5	64.7	76.2
Uttar Pradesh	52.1	19.0	36.7	70.0	50.4	61.0	66.6	36.9	52.5	76.8	61.7	69.8
Tamil Nadu	67.2	41.8	54.6	86.1	69.6	78.0	77.1	55.3	66.2	89	76	82.5
West Bengal	62.1	38.1	50.5	81.2	68.3	75.3	73.1	53.2	63.4	86.1	75.7	81.2

Source: Census, Govt of India (various years)

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[i] 'Missing women' refers to the deviation of actual sex ratio from the expected sex ratio.

[ii] This is acknowledged in empirical literature; Klasen and Claudia (2003) noted that it is far from a minor issue, but ranks among the worst human catastrophes of twentieth century as it is larger than the combined casualties of all famines in the twentieth century and it also exceeds the combined death toll of both world wars and the casualties of major epidemics such as the 1918-1920 global influenza epidemic or the currently ongoing AIDS pandemic.

[iii] One may argue that sex selective abortions are more problematic as it leads to death (or prevention of female life) with certainty; while female neglect in intrahousehold only increases the chance of female mortality. On the other hand, one may argue that sex selective abortions are somewhat less evil, as one should distinguish between pre-birth and post-birth interventions, with the latter usually judged worse than the former (Goodkind, 1996 and Klasen and Claudia, 2003). However, the phenomena of 'missing women' points to the fact that gender discrimination starts even before birth and it continues in all stages of life cycle.

[iv] It is also to be noted that the work participation rate figures for the year 1971 of Assam includes Union Territory of Mizoram which was carved out of Assam after the 1971 census; therefore the longitudinal census figures for Assam may not be strictly comparable. As Census was not held in Assam during 1981, the data for that period is not available and hence had to be excluded from some data interpretations. The literacy rates for 1971 are not strictly comparable with 1981 census, as these rates have been worked out on the then jurisdiction, which was in existence.

[v] Berik and Bilginsoy (2000) for this reason used general literacy rate rather than female literacy rate in their model. We have two sets of models, one with general literacy rate and other with female literacy rate.