A SPATIAL DIAGNOSIS OF CHILD SEX RATIO DISTRIBUTION AND ITS DETERMINANTS IN INDIA

USING LONGITUDINAL CENSUS DATA 1961-2011

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Paper prepared for the 2014 Meeting of the Population Association of America, Boston, MA

1-3 May 2014

India has witnessed a growing male preponderance in its population since the last decade. However, with the publication of the 2011 census data there was an apparent relief with an increase in overall sex ratio up to 7 points, but what worried the academia and policy makers was a more than fall in child sex ratio (0-6 years boy/girl ratio) up to 8 points between 2001 and 2011. Whereas child sex ratio has declined both in rural and urban India, the decline in rural India is more than three times compared to drop in urban India in 2011. As these groups are the 'feeder source' of adult population in future, such a trend if unchecked, will continue to haunt the society in decades to come until and unless corrective measures are taken (Registrar General of India, Paper 1, 2001).

Table.1 presents the results of first level of multivariate analysis which includes the assessment of quantitative effects of selected indicators on child sex ratio from 1961-2011. Separate OLS estimates have derived for each year to check the changing effect of each factor on child sex

ratio. Visual inspections like scatter plots suggest no evidence of non-linearities or quadratic trends.

The present analysis reveals certain key results. It can be observed that the most robust estimator which has a stable positive effect over child sex ratio is female labour force participation. It can be noted that the effect has decreased slightly during the last two censuses. It is also important to control the effects of FWPR for the level of poverty, which is also not possible in the present context given the aforementioned limitations of the present study to measure the 'prosperity effect.' However, even after controlling for the proportion of agricultural labourers, SC and ST, the estimates of FWPR have shown robust and positive effects, thereby supporting the earlier hypothesis of economic worth.

The effect of female literacy on child sex ratio is somehow dynamic and not robust throughout the study period. The general negative effect of female literacy on child sex ratio has followed a significant positive departure in 2011. However, such effect is independent of male literacy which, if included, possesses a negative but statistically insignificant effect on child sex ratio for all the census years. It is noteworthy that despite of strong negative bivariate association between male literacy and child sex ratio in 1981 and 2001, the present study has not incorporated it into the analysis due to its higher level of collinearity with female literacy. Interestingly, the negative effect of male literacy remains same, although insignificant, if female literacy is dropped from regression.

The effect of urbanization on child sex ratio is also statistically robust throughout the years and is negatively associated. Temporal comparison of the estimates reveals more or less stable effects over the years. However, the higher value in 1961, followed by a statistically less significant figure at 1971 might be attributed to a change in the nationwide definition of 'urban' between 1961 and 1971, which resulted huge declassification of settlements from urban to rural.

Table 1. OLS Estimates of Determinants of Child Sex Ratio (1961-2011)
(Without Religion)

Independent Variables	1961	1971	1981	1991	2001	2011
Constant	926*** (13.729)	928*** (19.423)	922*** (12.536)	825*** (14.122)	890*** (22.689)	811*** (21.809)
log of Population Density	11.312*** (2.500)	6.736* (3.612)	8.536*** (2.191)	16.621*** (2.150)	7.864*** (0.016)	7.116** (2.820)

Urbanization	-0.607*** (0.161)	-0.400* (0.218)	-0.248** (0.121)	-0.440*** (0.113)	-0.546*** (0.168)	-0.422*** (0.152)
Female Literacy	-0.581** (0.262)	-0.224 (0.279)	-0.494*** (0.131)	-0.064 (0.097)	-0.103 (0.181)	0.779*** (0.199)
Female WPR	0.814*** (0.176)	0.914*** (0.283)	0.835*** (0.183)	1.735*** (0.177)	0.556* (0.332)	0.636** (0.278)
Agricultural Labourers	0.381** (0.190)	0.544*** (0.206)	0.296** (0.129)	0.212* (0.126)	0.779*** (0.198)	0.657*** (0.169)
SC Population	-0.321 (0.278)	-0.361 (0.398)	-0.030 (0.128)	-0.298 (0.236)	-1.342*** (0.337)	-0.494* (0.290)
ST Population	0.659*** (0.112)	0.710*** (0.163)	0.637*** (0.101)	0.716*** (0.104)	0.707*** (0.158)	0.839*** (0.138)
R^2	0.322	0.281	0.310	0.459	0.270	0.265
Adjusted R^2	0.308	0.264	0.295	0.447	0.255	0.250
N[€]	336	337	329	328	337	337

Standard Errors in parentheses

[€]Data not available for NEFA in 1961, Assam in 1981, and Jammu & Kashmir in 1991

***Significant at 1%, **Significant at 5%, *Significant at 10%

The only variable used to measure the prosperity effect in the present analysis is the proportion of agricultural labourers, which has, as expected, shown a positive and statistically significant effect over child sex ratio over the years. The stronger effect of this variable in the recent two censuses is of particular interest, if viewed through the lens of landholding-patriarchy hypothesis and the increasing land inequality across the country (Rawal, 2008; Arokiasamy, 2012). In other words, an increase in the proportion of large-landed classes over time may trigger larger skewness in child sex ratio distribution.

Among the two social variables included in the present analysis, the proportion of scheduled caste population has shown negative effect on child sex ratio, which has become strongly significant in the last two decades. Such a finding is important keeping in mind the complex interaction involving the 'Sanskritization' process. The child sex ratio of the scheduled castes in India have shown a noticeable decline by 1991, and in 2001 it was very close (939) to the ratio in the population as a whole (927). In other words, differences in gender relations between the SCs and the rest of the population appear to have narrowed in recent years. The 'Sanskritization' process, which theorizes the idea of 'Ascendant Caste', mainly involves the emulation of high caste practices by members of the lower castes as a means of improving their social status, provides the most plausible explanation for this convergence. However, such process of 'vertical

diffusion' is collateral with a 'horizontal diffusion' which enhances larger interpersonal exchanges of value systems through the inclusion of geographical variables like spatial proximity or spatial interaction. The recent spatial pattern of changes in child sex ratio at a Pan-Indian level, coupled with the concept of technology transfer and larger cultural assimilation of gender relations provides useful insight of analysis. Another important point is that the process of vertical diffusion is nevertheless, heralded by a situation where socio-cultural factors interacts with the measures of economic development at different spatial scales to determine changes across groups.

Unlike the SCs, a higher proportion of ST population increases the extent of high child sex ratio across Indian districts, and this effect is highly significant over the years. It can be also noted that this effect prevails even after controlling by the female labour force participation which is generally higher among the tribal groups and have shown the strongest effect in the recent census. Such a result is natural keeping into view the distinct kinship systems of the tribal society and the concept of property rights of females, although the recent changes needs further scrutiny.

Coming to the diagnostics of the models, it can be observed that the variables so far included in the model can explain 27%-46% of the variation in child sex ratio. All of the models are statistically significant but showing marked instance of heteroskedasticity, especially for the regressions using the census data of 1991, 2001 and 2011.

Incorporation of the religious variables in the previous model explains nearly 38% of the district level differentials in child sex ratio in 1981, and more than half of the variation in 1991 and 2001. The result has been modified significantly; the negative effect of urbanization becomes statistically insignificant, followed by a positive change in the co-efficient of literacy, although not significant. Another important change is observed in case of SC population, which portrays still a negative association with child sex ratio but lost its statistical significance, primarily due to incorporation of the Sikh population which have large SC population and nullifies its effect. Female labour force participation, agricultural labourers and ST population still remains robust and positively contributing factors.

However, the overall impact of religious variables is of more relevance than the socio-economic factors in explaining the variation in child sex ratio. It is obvious from the results that the socio-

cultural composition of the population in India appears to play a larger role in explaining child sex ratio differentials than purely economic factors. This is the central feature of the geography of discrimination in India that severely undermines the effects possessed by capitalist development, social modernization or the impact of increasing monetization (Guilmoto, 2005).

Table 2. OLS Estimates of Determinants of Child Sex Ratio (1981-2001)

(With religion)

Independent Variables	**1981**	**1991**	**2001**
Constant	933*** (12.971)	837*** (14.221)	860*** (19.898)
log of Population Density	4.993** (2.274)	10.641*** (2.199)	3.979 (2.723)
Urbanization	-0.051 (0.131)	-0.232 (0.114)	-0.137 (0.144)
Female Literacy	-0.567*** (0.161)	0.106 (0.108)	0.046 (0.165)
Female WPR	0.745*** (0.192)	1.631*** (0.177)	0.862*** (0.275)
Agricultural Labourers	0.331*** (0.127)	0.207* (0.117)	0.701*** (0.158)
SC Population	0.303 (0.242)	-0.269 (0.236)	-0.401 (0.307)
ST Population	0.683*** (0.098)	0.856*** (0.105)	0.902*** (0.141)
Muslim Population	0.139 (0.178)	0.676*** (0.155)	0.791*** (0.148)
Christian Population	0.820** (0.324)	0.056 (0.175)	0.433* (0.221)
Sikh Population	-0.619*** (0.152)	-0.679*** (0.127)	-2.007*** (0.164)
Buddhist Population	-0.873** (0.407)	-0.659** (0.326)	-0.379 (0.406)
Jain Population	-1.142 (1.726)	-5.212** (2.052)	-9.746*** (2.938)
R^2	0.380	0.555	0.554
Adjusted R^2	0.357	0.538	0.537
N[€]	329	328	337

Standard Errors in parentheses

[€]Data not available for Assam in 1981, and Jammu & Kashmir in 1991

***Significant at 1%, **Significant at 5%, *Significant at 10%

The inclusion of the spatial error term in the models containing religious variables have shown nearly similar results, except the persistence of the stronger effects possessed by the tribal, Muslim, Sikh and Jain population (Table.3). The spatial error terms seem to be highly

correlated; the negative effect of female literacy remained high and statistically significant, while most of the other variables have shown a reduction in effect or ceases to be significant.

Table 3. Maximum Likelihood Estimates of Determinants of Child Sex Ratio (1961-2011)

Independent Variables	1981	1991	2001
Constant	989*** (15.115)	908*** (16.482)	949*** (19.369)
Kinship Dummy	-32*** (6.952)	-43*** (6.937)	-27*** (8.260)
log of Population Density	-0.873 (2.261)	5.945*** (2.206)	0.069 (0.297)
Urbanization	-0.135 (0.122)	-0.068 (0.106)	-0.041 (0.099)
Female Literacy	-0.703*** (0.178)	-0.271** (0.129)	-0.520*** (0.166)
Female WPR	0.028 (0.229)	0.572*** (0.221)	0.243 (0.247)
FWPR*Kinship Dummy	0.631 (0.430)	1.274*** (0.379)	0.573 (0.434)
Agricultural Labourers	0.269* (0.146)	0.118 (0.126)	0.087 (0.167)
SC Population	0.249 (0.250)	-0.285 (0.223)	-0.318 (0.227)
ST Population	0.431*** (0.101)	0.576*** (0.112)	0.603*** (0.119)
Muslim Population	0.251 (0.188)	0.557*** (0.158)	0.618*** (0.151)
Christian Population	0.671** (0.321)	0.052 (0.166)	0.084 (0.154)
Sikh Population	-0.326** (0.188)	-0.270* (0.148)	-0.883*** (0.187)
Buddhist Population	-0.773** (0.375)	0.119 (0.318)	0.166 (0.322)
Jain Population	-0.018 (1.853)	-4.009* (2.063)	-4.543* (2.378)
λ	0.546*** (0.059)	0.403*** (0.069)	0.849*** (0.029)
Pseudo R^2	0.586	0.678	0.849
N[€]	329	328	337

Standard Errors in parentheses
[€]Data not available for Assam in 1981, and Jammu & Kashmir in 1991
***Significant at 1%, **Significant at 5%, *Significant at 10%

The contribution of the local level factors, therefore, widens the interpretative prospect of child sex variation in India beyond socio-economic or demographic dimensions. The consequent error term, which is not representative of random or fortuitous errors but portrays unobserved regionalized factors, provides useful interpretation of the spatial mechanisms that are observed to propagate discriminatory behaviours from specific core areas or hot spots to the peripheries or cold spots. However, it is unlikely that the severely skewed child sex ratio distribution in a socially fragmented domain like India can be explained only in terms of the gross effect of a bunch of socio-economic and demographic factors, rather becomes responsive to various micro-level objective conditions like interaction among social, cultural and economic variables at a community level. The geographical distribution of communities, coupled with additional spatial processes usually guides the socially distinctive but spatially mobile pattern of discrimination to explain the changing pattern of child sex ratio variation in India.

Concluding Remarks

The analysis so presented outlined the centrality of the socio-cultural factors to explain the geographical variability of child sex ratio distribution. Indicators of economic development like urbanization and prosperity, crudely measured by agricultural labourers, have shown varied effects. Among the factors of women's agency, female literacy has shown a negative effect unlike female workforce participation which has shown a robust positive influence. However, these factors together, either at an overall level or controlled by large scale regional effects, cannot explain substantial part of child sex ratio variation in India without the specific socio-cultural factors. For example, providing the facts that mother's literacy promote spread of information regarding new technologies or higher economic status exacerbates the access to those technologies, the typically concentration of religious and caste groupings in India have shown more or less concrete internal homogeneity in terms of gender discrimination over the years, in spite of other differentials in social and economic development within themselves. Geographical concentrations of specific communities and the importance of these institutions in shaping discriminatory behaviour among their members explain then to a large part why child sex ratio as an index of discrimination towards girls displays strong spatial patterning. This particular factor remains more important than the large-scale kinship differentials as the

discriminatory behaviours against female offsprings were obtrusive among several communities also in South India for long time

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