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Research Article

Spatial heterogeneity in son preference across India's 640 districts: An application of small-area estimation

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Abstract

BACKGROUND
Son preference is culturally rooted across generations in India. While the social and economic implications of son preference are widely acknowledged, there is little evidence on spatial heterogeneity, especially at the district level.

OBJECTIVE
To derive estimates of son preference for the 640 districts of India and examine spatial heterogeneity in son preference across the districts of India.

METHODS
We apply model-based Small-Area Estimation (SAE) techniques, linking data from the 2015–2016 Indian National Family Health Survey and the 2011 Indian Population and Housing Census to generate district-level estimates of son preference.

RESULTS
The diagnostic measures confirm that the model-based estimates are robust enough to provide reliable estimates of son preference at the district level. Son preference is highest in the districts across northern and central Indian states, followed by districts in Gujarat

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and Maharashtra, and lowest in the southern districts in Telangana, Andhra Pradesh, Kerala, and Tamil Nadu.

CONCLUSIONS
There is considerable heterogeneity in son preference across Indian districts, often masked by state-level average estimates. Our findings warrant urgent policy interventions targeting specific districts in India to tackle the ongoing son-preference attitudes and practices.

CONTRIBUTION
Our study demonstrates the power of SAE techniques to generate robust estimates of son preference at the district level. This study is the first of its kind to examine spatial patterns in parity-specific son preference at the district level in India.

1. Introduction

Strong son preference and discrimination against girls in India has been widely acknowledged in the gender literature. Research studies have primarily focused on the demographic, social, and economic determinants and associated implications of son preference in India, such as slow transition to low fertility, male-dominated sex ratios at birth, sex-selective abortions, excess female mortality, and poor health and educational outcomes for girls (Aksan 2021; Arnold, Kim Choe, and Roy 1998; Arnold, Kishor, and Roy 2002; Chao et al. 2020; Clark 2000; Echavarri and Ezcurra 2010; Guilmoto et al. 2018; Guo, Das Gupta, and Li 2016; Kashyap and Villavicencio 2016; Mitra 2014; Patel et al. 2013; Robitaille and Chatterjee 2018; Saikia et al. 2021; Singh et al. 2021). Existing data on son preference at the state level often mask within-state heterogeneity and hence are less useful for targeted policy intervention. India's healthcare-planning, policy, intervention, and monitoring systems are decentralized, but there are no robust data to examine spatial differentials in son preference at the district level.

Son preference in India is historically and culturally rooted. A hymn from the ancient Indian Vedic period describes the age-old prescription related to preference for sons over daughters in India: "May HE (Prajapati – God) elsewhere afford the birth of a female, but here HE shall bestow a man" (Bloomfield 1897). Son preference in India is generally propagated through traditionally held customs, norms, and practices, which vary across geographies. Therefore, generalizing son preference across India does not provide insight for targeted policy or program interventions. Providing district-level estimates is therefore essential for tackling social challenges such as son preference in a large and diverse country like India. In this study we derive robust model-based district-level estimates of son preference indicators using the 2015–2016 Indian National Family

Health Survey (NFHS) and combining auxiliary data from the 2011 Indian Population and Housing Census for the 640 districts in India. The choice of auxiliary variables for our models is guided by the demographic, social, and economic determinants of son preference identified in earlier literature. The study builds on the existing demographic literature and contributes to a better understanding of spatial variation in son preference across Indian districts. Our findings have considerable potential to inform and influence policy and program interventions aimed at changing the traditionally held norms and practices related to son preference in India.

2. Research context

Studies show that son preference is deeply rooted in Indian culture due to the perception of the economic, social, and religious utility of sons (Arnold, Kim Choe, and Roy 1998; Das Gupta et al. 2003; Dyson and Moore 1983; Pande and Astone 2007). Economic utility stems from participation in agriculture, contribution to household income in the form of earnings, and old age security, among other things (Basu 1989; Mamdani 1972; Miller 1981).

Social utility is borne out of India's traditional kinship system and inheritance laws, which expect women to move to their husband's house after marriage (Kishor 1995) and allow men to retain the family wealth and property (Agarwal 1994). In India, sons confer special status and strength to families by assuring household security or exercising power in violent areas (Dharmalingam 1996; Oldenburg 1992). The ancient legal text of *Manusmriti* – used by the British colonial government to formulate Hindu law – states that "Her father protects her in childhood, husband protects her in youth and her sons protect her in old age" (Davis Jr. 2010). Additionally, the Indian marriage system allows husbands to receive dowry payments at the time of marriage (Caldwell, Reddy, and Caldwell 1989; Dyson and Moore 1983; Kapadia 1966; Karve 1965; Robitaille 2013; Srivastava et al. 2021). A study by Anderson (2007a) notes that dowry is almost universal in Indian marriages, with a huge increase in recent times (Anderson 2007b; Anderson 2003). Girls are often considered an economic burden on the family because of the dowry system and the high cost of Indian weddings (Kishor 1995; Pande and Astone 2007; Radkar 2018). Although dowry is banned by law[7] in India, it is still widely practiced across the country (Anderson 2007; Srivastava et al. 2021). There is growing evidence of how dowry impacts the health and wellbeing of young brides in terms of domestic violence, severe injuries, and even suicides and homicides (Retheesh Babu and Veerraju

[7] The Dowry Prohibition Act (Act 28) was enacted in May 1961 to prevent the transaction of any financial or non-financial items as dowry.

Babu 2011; Jeyaseelan et al. 2015), as well as leading to a marriage 'squeeze' (Bhat and Halli 1999).

Religious utility comes from the important role that men play in performing religious duties, such as the cremation of deceased parents and performing *pind daan* to save their souls (Arnold, Kim Choe, and Roy 1998; Vlassoff 1990).

Studies have highlighted the wider demographic, economic, and social consequences of the traditionally held son-preference practices in India (Aksan 2021; Alkema et al. 2014; Arnold, Kim Choe, and Roy 1998; Arnold, Kishor, and Roy 2002; Arokiasamy 2002; Basu 1989; Caldwell, Reddy, and Caldwell 1989; Chao et al. 2020; Chaudhuri 2012; Clark 2000; Echavarri and Ezcurra 2010; Guilmoto et al. 2018; Guo, Das Gupta, and Li 2016; Kashyap 2019; Kashyap and Behrman 2020; Kashyap and Villavicencio 2016; Mitra 2014; Patel et al. 2013; Robitaille and Chatterjee 2018; Saikia et al. 2021; Singh et al. 2021), particularly how parents discriminate against their daughters in food allocation, child immunization, and healthcare (Mishra, Roy, and Retherford 2004; Pande 2003; Pande and Yazbeck 1999). Given the serious social consequences of son preference in India, it is important to examine its magnitude and patterns of practice at the district level. A few studies have highlighted that son preference is stronger in the north of India than in the southern part (Arnold, Kim Choe, and Roy 1998; Bharati et al. 2011; Dyson and Moore 1983; Gaudin 2011; Radkar 2018). All these studies have reported state averages, which often mask important inter-state variation. Providing robust district-level estimates is therefore essential to support intervention programs and monitor progress at the level of the lowest administrative units.

The demographic literature has proposed a number of indicators to measure son preference based on census and survey data. These include the ideal number of sons compared to daughters (Bharati et al. 2011; Bhat and Francis Zavier 2003; Clark 2000; Gaudin 2011; Pande and Astone 2007; Radkar 2018; Robitaille 2013), the desire of families with all girls for an additional child compared to families who already have a son (Arnold 1992; Arnold 1997), the higher propensity of couples with all daughters to opt for another child compared to couples with a son (Arnold, Kim Choe, and Roy 1998), sex-selective abortions (Aksan 2021; Arnold, Kishor, and Roy 2002, Echavarri and Ezcurra 2010; Kashyap and Villavicencio 2016; Robitaille and Chatterjee 2018; Saikia et al. 2021; Singh et al. 2021), differential child mortality (Arnold, Kim Choe, and Roy 1998; Bhattacharya 2006; Guilmoto et al. 2018; Murthi, Guio, and Dreze 1995), and child sex ratio (Mitra 2014; Patel et al. 2013).

An obvious disadvantage of the ideal number of children is the reporting bias effected by the actual number and sex composition of children (Vanneman, Desai, and Vikram 2012). Moreover, given that the majority of Indian couples prefer two children, there is a tendency to report one son and one daughter as ideal. Therefore, women reporting a greater number of sons than daughters likely differ from those reporting one

son and one daughter as ideal. This indicator is also likely to be affected by social desirability bias: the responses are conditioned on women's perceptions of what would be a socially desirable response. By comparison, the desire for an additional child of families with all girls compared with families who already have a son is less likely to be affected by social desirability bias, and women's responses are less likely to be related to fertility preferences. The biases associated with the third indicator, the propensity for couples with all daughters to have another child compared to couples with a son, are similar to that of the second indicator (Vanneman, Desai, and Vikram 2012). The main difference is that while the third indicator reflects actual behavior, the second represents desires. Sex-selective abortions (which can also be measured in terms of sex ratio at birth) may act as a direct indicator of son preference. However, it is often difficult to correctly measure sex-selective abortions in low- and middle-income countries (LMICs), and India is no exception.

Differential child mortality has been regarded as an important indicator of son preference. However, gender differentials in under-5 mortality have narrowed or moved in favor of females (Office of the Registrar General and Census Commissioner of India 2020). This is more the case in the northern and central Indian states such as Haryana, Punjab, Delhi, Rajasthan, Uttarakhand, Madhya Pradesh, and Chhattisgarh, which are categorized as states with high son preference. With a decline in fertility and access to reproductive and sex-selection technology, postnatal discrimination against female children may shift to prenatal discrimination (Bhat and Francis Xavier 2003). In such a situation, differential child or under-5 mortality may not reflect the true son preference prevalent in Indian society. Since differential child mortality is the ratio of male to female child mortality, any recall bias or age misreporting by the mother in household surveys can be substantial. Finally, child sex ratios in LMICs usually suffer from measurement errors such as undercounting female children and age misreporting, which often create problems in interpreting patterns (Guillot 2002; Singh et al. 2021) and make estimating the child sex ratio at the district level tricky.

The desire of families with all girls for an additional child compared to families who already have a son is an indicator that is fairly straightforward to measure and comprehend. This indicator is also readily available in most of the demographic and health surveys conducted in LMICs at regular intervals. Unlike the other four indicators of son preference discussed above, this indicator is also unlikely to be affected by social desirability and measurement and recall biases (Vanneman, Desai, and Vikram 2012). Hence, we used this indicator to estimate son preference across Indian districts.

The Indian NFHS provides reliable survey estimates of son preference at the national and state levels, but at the district level the sample sizes are too small. Small sample size increases sampling variability and thus results in biased and unreliable estimates (Pfeffermann 2002; Rao and Isabel 2015). Therefore, for targeted interventions

and monitoring we need techniques that can generate reliable estimates at the district level, such as Small Area Estimation (SAE). SAE is a model-based method that derives small area estimates by linking the variable of interest from a survey to auxiliary information from census or administrative data sources. We use model-based, small-area estimation techniques to estimate, first, the percentage of women with at least one son who do not want an additional child, and second, the percentage of women without a son who do not want an additional child, both differentiated by parity to account for actual family size. We then subtract the latter from the former for women of each parity to derive our first indicator of son preference. The larger the difference, the larger the son preference. Our analysis will inform the recent patterns of son preference differentiated by parity beyond the simple north–south divide observed in earlier studies (Bharati et al. 2011; Dyson and Moore 1983; Radkar 2018).

3. Data and methods

3.1 Data

Two datasets were used in this analysis. The dependent variables for which small-area estimates were required were derived from the 2015–2016 India National Family Health Survey (NFHS-4),[8] while the auxiliary variables (covariates) available at the population level were derived from the 2011 Census of India. The NFHS-4 is a nationally representative household survey which provides key national and state-level estimates of indicators of fertility, mortality, family planning, nutrition, utilization of maternal and child healthcare services, domestic violence, sexual life, and HIV/AIDS (International Institute for Population Sciences 2017). In addition, the NFHS-4 provides estimates of selected indicators of fertility, family planning, utilization of maternal and child healthcare services, nutrition, etc. for the 640 districts of India (International Institute for Population Sciences (IIPS) and ICF 2017).

The NFHS-4 used a stratified two-stage sampling design to collect data from households and women. In the first stage, villages or Census Enumeration Blocks (CEB) were sampled from rural or urban areas using a probability-proportional-to-size sampling scheme. In the second stage households were selected using systematic sampling. The NFHS-4 collected data from 699,686 women of reproductive age and used the 2011 Census of India listing of villages and CEB as its sampling frame, making it possible to link the target variables from the survey with the census covariates at the district level.

[8] NFHS-4 is the most recent NFHS for which anonymized micro-data is available.

The auxiliary variables derived at the district level from the 2011 Census of India were the percentage of women with primary or higher education, the gap between men's and women's literacy rates, the percentage of women residing in urban areas, the percentage of women in the workforce, the total fertility rate,[9] the proportion of female population aged 15–49, the percentage of scheduled castes/tribes, the percentage of Muslim population, and the state where the district is located to account for state-wise unobserved heterogeneity.

3.2 Measuring son preference

To measure son preference in India we used the percentage of women not desiring an additional child among (1) women with at least one son, and (2) women without a son, differentiated by parity (women of parities 1, 2, and 3 or higher).

We used the Generalized Linear Mixed Model (GLMM) with a logit-link function, under the SAE model framework, to estimate the $\hat{P}_{1sd}$ proportion of women of parity 1 who have one son *s* and do not desire an additional child in district *d*

$$\hat{P}_{1sd} = \frac{n_{1sd}}{N_{1d}} * 100 \quad (1)$$

where n_{1sd} is the number of women of parity 1 with one son *s* who reported no desire for an additional child in district *d*, and N_{1d} is the total number of women of parity 1 in district *d*.

$\hat{P}_{1nd}$ is the proportion of women of parity 1 with no son *n* and those reporting no desire for an additional child in district *d*.

$$\hat{P}_{1nd} = \frac{n_{1nd}}{N_{1d}} * 100 \quad (2)$$

where n_{1nd} is the number of women of parity 1 with no son *n* and those reporting no desire for an additional child in district *d*.

$\hat{P}_{2sd}$ is the proportion of women of parity 2 with at least one son *s* and those reporting no desire for an additional child in district *d*.

$$\hat{P}_{2sd} = \frac{n_{2sd}}{N_{2d}} * 100 \quad (3)$$

[9] Borrowed from Singh et al. (2017)

where n_{2sd} is the number of women of parity 2 with at least one son *s* and those reporting no desire for an additional child in district *d*, and N_{2d} is the total number of women of parity 2 in district *d*.

$\hat{P}_{2nd}$ is the proportion of women of parity 2 with no son *n* and those reporting no desire for an additional child in district *d*.

$$\hat{P}_{2nd} = \frac{n_{2nd}}{N_{2d}} * 100 \quad (4)$$

where n_{2nd} is the number of women of parity 2 with no son *n* and those reporting no desire for an additional child in district *d*.

$\hat{P}_{3+sd}$ is the proportion of women of parity 3 or higher who have at least one son *s* and those reporting no desire for an additional child in district *d*.

$$\hat{P}_{3+sd} = \frac{n_{3+sd}}{N_{3+d}} * 100 \quad (5)$$

where n_{3+sd} is the number of women of parity 3 or higher with at least one son *s* who do not desire an additional child in district *d*, and N_{3+d} is the total number of women of parity 3 or higher in district *d*.

$\hat{P}_{3+nd}$ is the proportion of women of parity 3 or higher with no son *n* and those reporting no desire for an additional child in district *d*.

$$\hat{P}_{3+nd} = \frac{n_{3+nd}}{N_{3+d}} * 100 \quad (6)$$

where n_{3+nd} is the number of women of parity 3 or higher with no son *n* who do not desire an additional child in district *d*.

Notably, $\hat{P}_{1sd}$, $\hat{P}_{1nd}$, $\hat{P}_{2sd}$, $\hat{P}_{2nd}$, $\hat{P}_{3+sd}$, and $\hat{P}_{3+nd}$ are proportions, which can be easily modelled under the SAE framework.

From these estimated proportions, we estimate

$$\hat{D}_{1s} = \hat{P}_{1sd} - \hat{P}_{1nd} \quad (7)$$

$$\hat{D}_{2s} = \hat{P}_{2sd} - \hat{P}_{2nd} \quad (8)$$

and

$$\hat{D}_{3+s} = \hat{P}_{3+sd} - \hat{P}_{3+nd} \quad (9)$$

where positive values of $\widehat{D}_{1s}$, $\widehat{D}_{2s}$, and $\widehat{D}_{3+s}$ indicate son preference among parity 1, parity 2, and parity 3 or higher women, respectively, in each district. Negative values of $\widehat{D}_{1s}$, $\widehat{D}_{2s}$, and $\widehat{D}_{3+s}$ indicate no son preference among parity 1, parity 2, and parity 3 or higher women, respectively, in each district.

The districts with higher positive values of $\widehat{D}_{1s}$ have higher son preference at parity 1; the districts with higher positive values of $\widehat{D}_{2s}$ have higher son preference at parity 2; and the districts with higher positive values of $\widehat{D}_{3+s}$ have higher son preference at parity 3. These indicators are robust as they are less likely to be affected by social desirability and recall bias.

3.3 Statistical methodology

Although NFHS-4 provides estimates of selected indicators at the district level, in some districts the number of eligible women to estimate son preference are small. Small sample sizes result in high sampling variability (Pfeffermann and Sverchkov 2007). For example, NFHS-4 shows that at the district level the number of parity 1 women who have at least one son ranges between 29 and 332 (Appendix Table A-1). Similarly, the number of parity 1 women who have no son ranges between 18 and 265, the number of women of parity 2 who have no son ranges between 11 and 114, and the number of women of parity 3 or higher who have no son ranges between 1 and 51. This clearly indicates that at the district level the sample sizes are not large enough to produce reliable district-level estimates of son preference directly from NFHS-4.

To address this problem, survey methodologists have developed Small-Area Estimation (SAE) techniques to derive reliable small-area estimates. SAE techniques are classified into two broad types: unit-level and area-level random effect models. Unit-level models are used when auxiliary data are available at the individual level, while area-level models are used when auxiliary variables are only available at the aggregate (e.g., district) level (Amoako Johnson et al. 2010; Amoako Johnson et al. 2012; Rao 2003; Saei and Chambers 2003). For this study we adopted the area-level SAE approach, since auxiliary data were only available at the district level. Given the binomial nature of the target (dependent) variables of interest, we used the special case of GLMM with a logit-link function, described in Amoako Johnson et al. (2010) and Amoako Johnson et al. (2012). Using these models, we derived model-based district-level estimates of son preference for the 640 districts of India. The direct district-level survey estimates were derived by applying survey weights and weighted direct estimates modelled to derive model-based district-level estimates (Chandra, Chambers, and Salvati 2019; Amoako Johnson et al. 2010; Amoako Johnson et al. 2012).

The idea of SAE is to use statistical models to link the variable of interest to auxiliary information, accounting for area-specific random effects to derive model-based estimators at the district level. If the direct estimators do not provide adequate precision, then to derive estimates for small areas it is necessary to employ model-based estimators that 'borrow strength' from the auxiliary variables that are available for the entire population and from the area-specific effects that show how much of the variation in the outcome is explained by the covariates. Thus, the model-based estimates are strengthened by the auxiliary information available for the entire population (Rao and Isabel 2015). Geographically, evidence shows that neighbouring areas have similar characteristics and are correlated, with the correlation decaying to zero as the distance between areas increases (Pratesi and Salvati 2008). Although the area-specific random effects of the GLMM are assumed to be independent, district boundaries are arbitrary and so it cannot be assumed that the characteristics of neighbouring districts are not correlated. Although spatial correlations are not accounted for in deriving the model-based estimates, the area-specific random effects show that the covariates used in the model explain between 60% and 80% of the variability in the outcome variables at the district level; hence the effects of geographical correlation are likely to be small.

3.4 Diagnostic measures

Two types of diagnostic measures (model diagnostics and diagnostics for the small-area estimates) were employed to assess the validity of the fitted GLMM models and the reliability of the model-based district-level estimates of son preference. The model diagnostics were used to verify the assumptions underlying the model. Under the GLMM framework the random area-specific effects were assumed to follow a normal distribution with mean zero and a constant variance. If the model assumptions were upheld, then the area- (district-) level residuals were expected to be randomly distributed and not different from the regression line $y = 0$.

The diagnostics for small-area estimates were used to validate the reliability of the model-based small-area (district) estimates derived using the GLMM approach. These were examined using the bias diagnostics, coefficient of variation (CV), and 95% confidence intervals (CI) of the model-based small-area (district-level) estimates and the direct survey estimates. The model-based district-level estimates were derived using the special case of the GLMM with a logit-link function, while the direct survey estimates were derived directly from the survey data.

The bias diagnostics was used to examine the deviation of the model-based district-level estimates from the direct survey estimates to validate the reliability of the former. The CVs were used to assess the improved precision of the model-based estimates over

the direct survey-based estimates. Estimates with low CV were considered more reliable. The 95% CIs of the model-based estimates and direct survey-based estimates were compared to validate the robustness of the model-based estimates.

3.5 Geospatial clustering of son preference

We used the Local Indicator of Spatial Autocorrelation (LISA) and Moran's I to examine whether son preference is spatially randomly distributed or clustered. The LISA approach was used to identify local clusters and spatial outliers of son preference. It shows districts of high son preference that are close to other districts of high preference (high-high), districts of low son preference that are close to districts of low son preference (low-low), districts of high son preference close to districts of low son preference (high-low), and districts of low son preference close to districts of high son preference (low-high). High-high and low-low are considered spatial clusters, while high-low and low-high are spatial outliers (Anselin 1995). Moran's I was used to detect spatial clustering of son preference. Queen's contiguity weight matrix was used to estimate Moran's I and LISA. LISA and Moran's I were estimated using the geospatial software GeoDa (https://geodacenter.github.io/).

4. Results

4.1 Direct-survey-based summary measures of son preference

Direct-survey-based summary measures of son preference at the national level are presented in Table 1. Thirty-eight percent of parity 1 women with a son do not want another child, while only 26% of parity 1 women without a son do not want an additional child. The difference in the percentage of women not desiring an additional child among parity 1 women with and without a son is 12%. Similarly, at parity 2, about 88% of women with at least one son do not want an additional child. In comparison, 65% of parity 2 women without a son do not want an additional child. The difference in the percentage of women not wanting an additional child among parity 2 women with at least one son and with no son was 25%. Likewise, at parity 3 or higher, the difference in the percentage of women not desiring an additional son among women with at least one son and without a son was 24%.

Table 1: Summary of the measures of son preference, India, 2015–2016

Indicators	Percent
Percentage of women of parity 1 with son not desiring an additional child	38.1
Percentage of women of parity 1 without son not desiring an additional child	26.1
Percentage of women of parity 2 with at least one son not desiring an additional child	86.7
Percentage of women of parity 2 without a son not desiring an additional child	61.6
Percentage of women of parity 3 or higher with at least one son not desiring an additional child	88.4
Percentage of women of parity 3 or higher without a son not desiring an additional child	64.7
Difference in the percentage of women of parity 1 not desiring an additional child among women with a son and women without a son	12.0
Difference in the percentage of women of parity 2 not desiring an additional child among women with at least one son and women without a son	25.1
Difference in the percentage of women of parity 3 or higher not desiring an additional child among women with at least one son and women without a son	23.7

4.2 SAE model statistics

Auxiliary variables included in the models explained 59% to 83% of the variation in son preference across the districts of India (Appendix Table A-2). Other model parameters for the percentage of women not desiring additional children among women with at least one son and without a son at parities 1, 2, and 3 or more are shown in Appendix Table A-3.

4.3 Diagnostics

The model diagnostic is shown in Figure 1. The model diagnostic clearly suggests that the normality assumption regarding the residuals is upheld. To compare the level of consistency of the model-based estimates and the direct survey estimates, we compare the proximity of the 45^0 line ($y = x$) to the fitted regression line for both estimates (Figure 2). The figure shows that the linear equation of best fit was not significantly different from the line $y = x$ at the 5% level for the derived estimates, indicating consistency between the model-based and direct survey estimates.

Figure 3 shows the 95% CIs of the direct survey estimates and the model-based estimates. The direct survey estimates have much wider 95% CIs than the model-based estimates, which suggests that the standard errors of the direct survey estimates are too large and unreliable. This clearly shows that the model-based estimates are more robust than the direct survey estimates. The plot of the CV of the direct survey estimates and model-based estimates is shown in Figure 4. Both the CVs of the direct survey estimates and the fluctuations in the CVs are much larger than those of the model-based estimates. It is clear that the model-based estimates are more precise than the direct survey

estimates. These diagnostics clearly show the power of the SAE to produce unbiased, consistent, and reliable estimates of son preference across the 640 districts of India.

We find considerable state-level heterogeneity in son preference. Among the states, the difference in the percentage of parity 1 women with and without a son who do not want an additional child ranges between 1% in Mizoram and Meghalaya and 34% in Punjab. Likewise, the difference in the percentage of parity 2 women with at least one son and without a son who do not want an additional child ranges between 1% in Meghalaya and 60% in Haryana. At parity 3 or higher the difference in the percentage of women with at least one son and without a son who do not want an additional child varies between 1% in Kerala and 67% in Haryana. Furthermore, we compared the CVs of son preference obtained from direct-survey-based and model-based estimates for the states and union territories of India. The state-level CVs obtained from the model-based estimates were substantially lower than those obtained from direct-survey-based estimates (Appendix Table A-4). Overall, the model-based estimates of son preference were smoother than the direct survey estimates (Appendix Figure A-1).

Figure 1: Model diagnostic plots

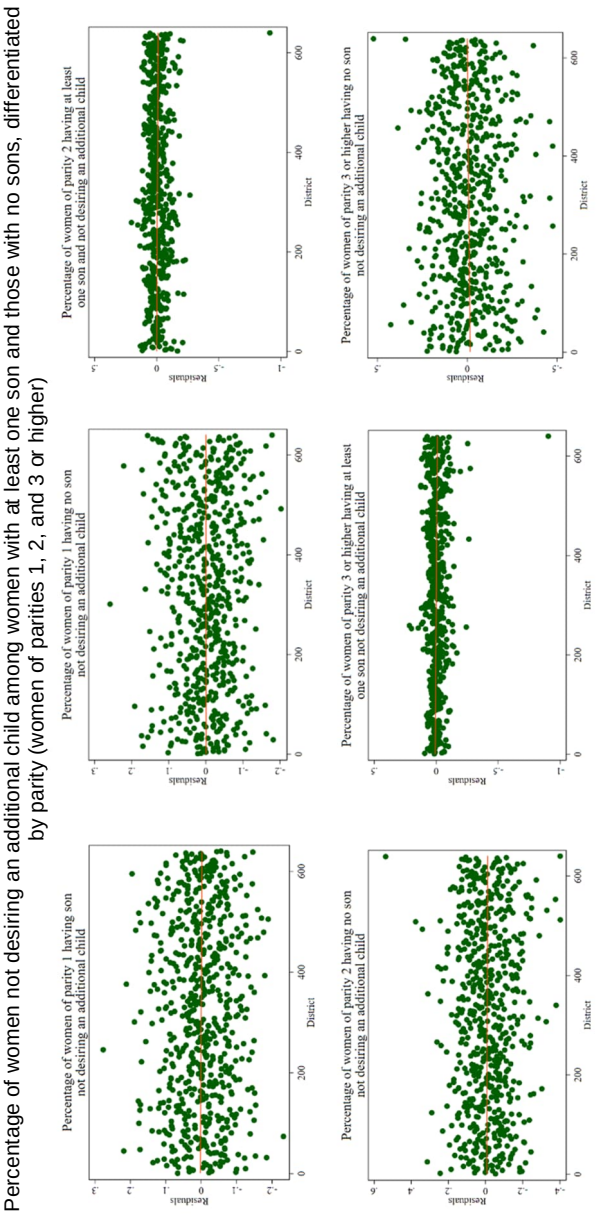
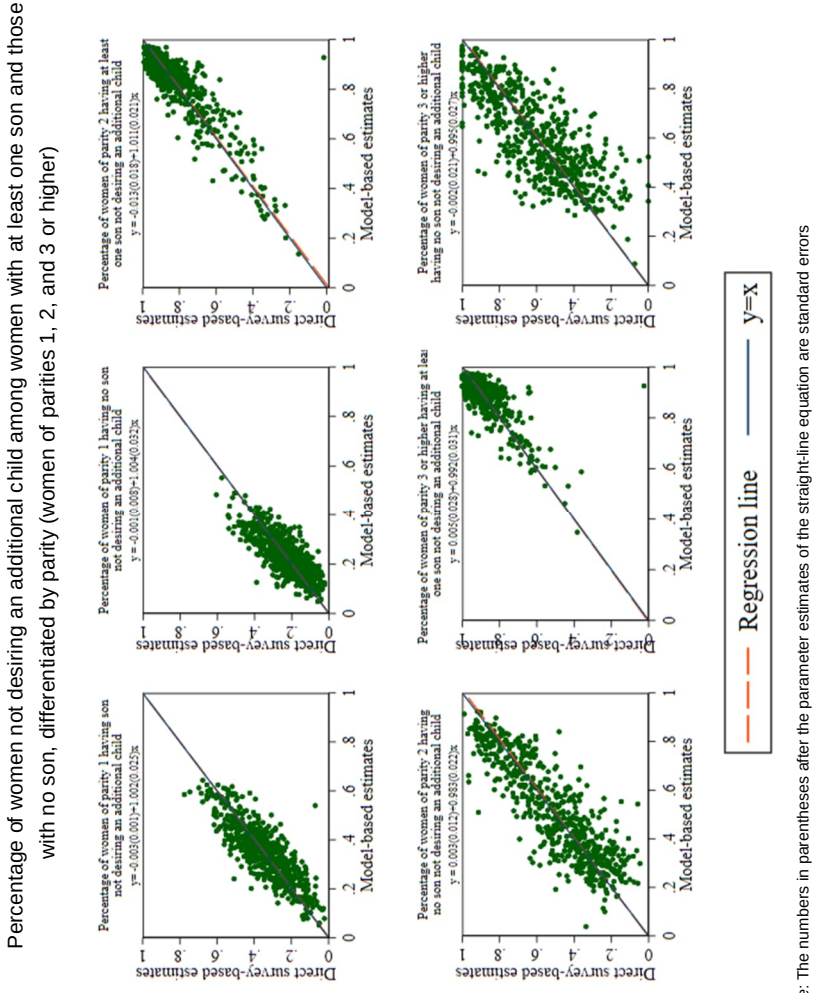


Figure 2: Plots comparing the ordinary least squares regression line (dashed line) and y=x (solid line), India, 2015–2016



Note: The numbers in parentheses after the parameter estimates of the straight-line equation are standard errors

Figure 3: District-wise 95% CI for model-based estimates and direct-survey-based estimates for percentage of women not desiring additional child among women having son and no son, according to women's parity, India, 2015–2016

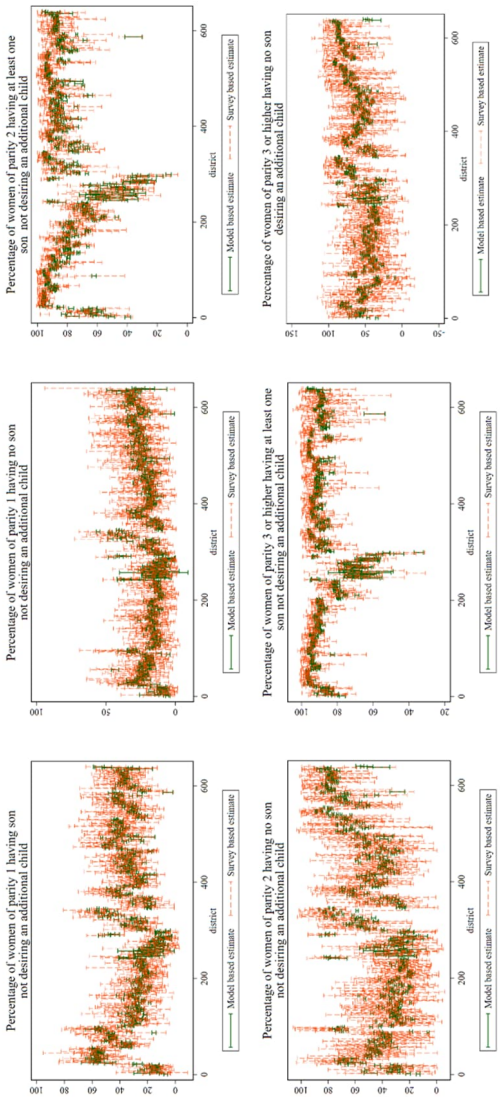
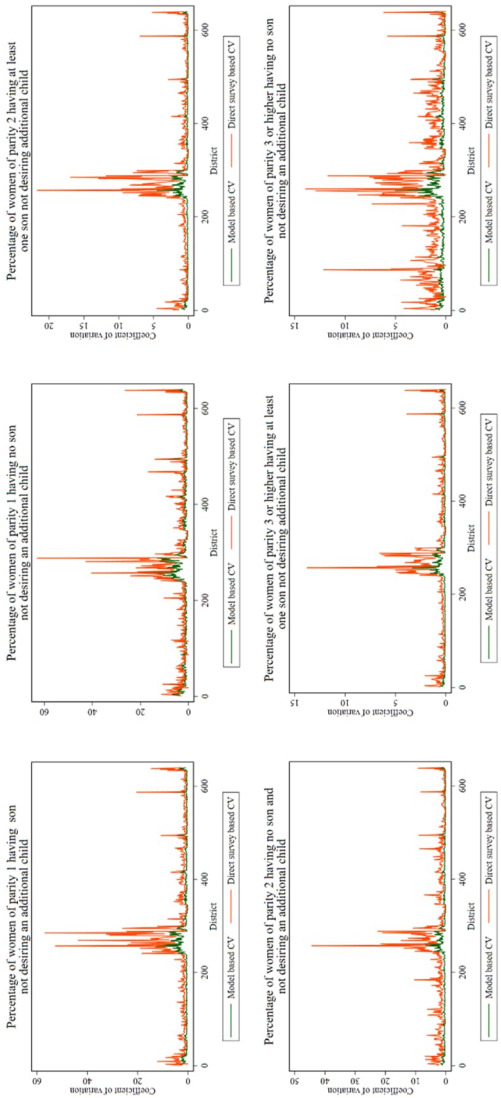


Figure 4: District-wise coefficient of variation (CV) for model-based estimates and direct-survey-based estimates for percentage of women not desiring additional child among women having son and no son, India, 2015–2016



4.4 Summary of model-based estimates of son preference at the district level

The difference in the percentage of parity 1 women with a son and without a son who do not want an additional child ranges between –13% and 34% at the district level (Table 2). Likewise, the difference in the percentage of parity 2 women with at least one son and without a son who do not want an additional child ranges between –10% and 68%. The difference in the percentage of parity 3 or higher women with at least one son and without a son who do not want an additional child varies between –7% and 73%. These differences clearly indicate considerable district-level spatial heterogeneity in son preference at different parities in India. At parity 1, the difference in the percentage of women not desiring an additional child among women with a son and without a son was negative in only 19 districts.[10] At parities 2 and 3 or higher, the difference was negative in only 6 and 7 districts[11] respectively. Henceforth, we will only discuss model-based estimates of son preference in the districts of India.

Table 2: Summary of the measures of son preference, India, 2015–2016

	Number of districts	Minimum	Maximum
Percentage of women of parity 1 with son not desiring an additional child	640	5.3	62.8
Percentage of women of parity 1 without son not desiring an additional child	640	3.8	55.8
Percentage of women of parity 2 with at least one son not desiring an additional child	640	12.5	97.0
Percentage of women of parity 2 without a son not desiring an additional child	640	6.2	89.3
Percentage of women of parity 3 or higher with at least one son not desiring an additional child	640	34.6	97.0
Percentage of women of parity 3 or higher without a son not desiring an additional child	640	9.7	95.2
Difference in the percentage of women of parity 1 not desiring an additional child among women with a son and women without a son	640	–13.3	34.3
Difference in the percentage of women of parity 2 not desiring an additional child among women with at least one son and women without a son	640	–9.8	68.0
Difference in the percentage of women of parity 3 or higher not desiring an additional child among women with at least one son and women without a son	640	–6.7	73.1

4.5 Spatial patterns of son preference in India

The model-based estimates show a high degree of spatial variation in the indicators of son preference (Figure 5). At parity 1, the highest son preference was apparent in districts in the north Indian states of Himachal Pradesh, Punjab, Haryana, and Delhi. A few districts in Gujarat also showed very high son preference. High son preference was also observed in all the districts in Uttarakhand, most districts in Rajasthan and Gujarat, and

[10] Seven districts from Nagaland, 5 from Meghalaya, 2 each from Telangana, Puducherry and Kerala, and 1 from Lakshadweep.

[11] At parity 2, 3 districts from Meghalaya and 1 district each from Goa, Kerala, Puducherry. At parity 3 or higher, 3 districts from Tamil Nadu and 1 district each from Telangana, Karnataka, Kerala, and Puducherry.

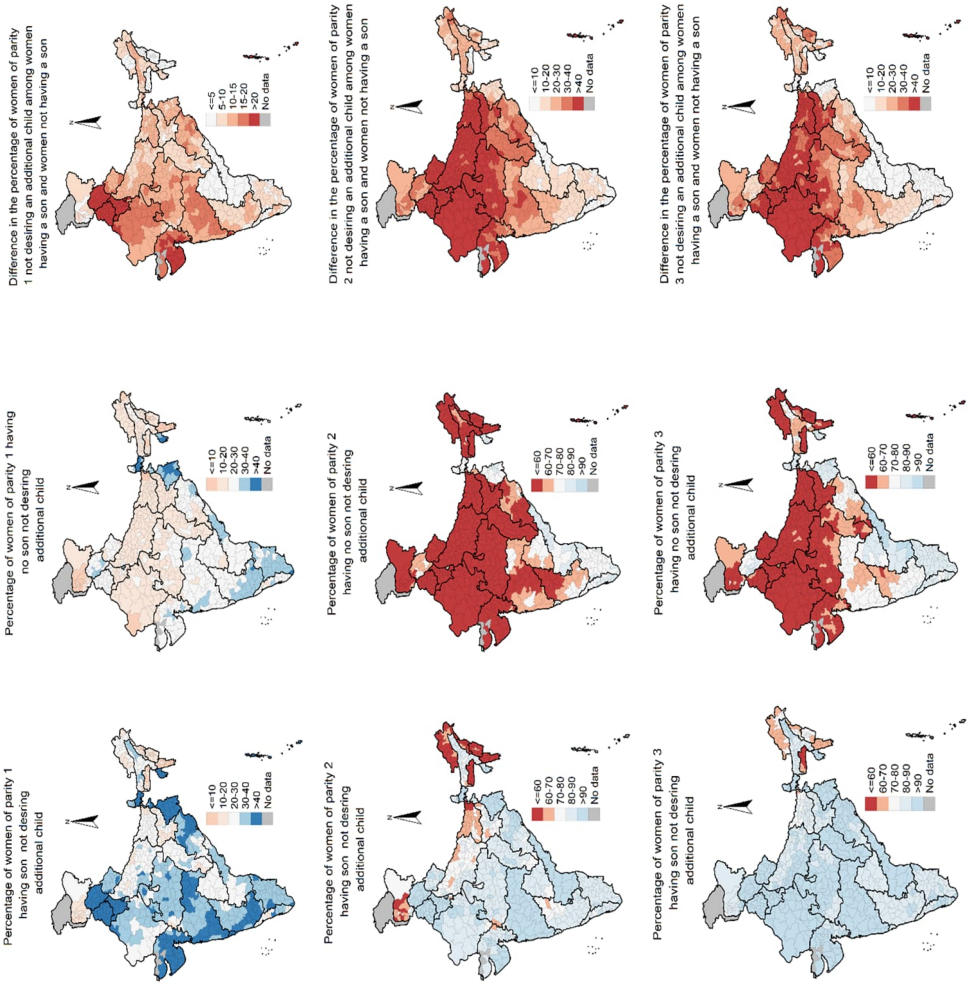
a few districts in Madhya Pradesh, Maharashtra, and Odisha. By contrast, the lowest son preference was observed in districts in Telangana, Andhra Pradesh, Kerala (all three in the south of India) and in the north-eastern states (except Assam and Tripura).

At parity 2, highest son preference was noted predominantly in districts in Punjab, Haryana, Uttarakhand, Uttar Pradesh, Rajasthan, Bihar, Jharkhand, and Madhya Pradesh. Son preference was also high in the districts in the union territory of Jammu and Kashmir and in Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Gujarat, and Maharashtra. The lowest son preference was in the districts in Telangana, Andhra Pradesh, Kerala, and Tamil Nadu. It is worth mentioning that son preference varied considerably across districts in a number of states, such as Maharashtra, Chhattisgarh, Odisha, and the union territory of Jammu and Kashmir.

The variation in son preference among women of parity 3 or higher was similar to that of parity 2 women. Son preference among women of parity 3 or higher was lower than among parity 2 women in the districts of Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, Chhattisgarh, West Bengal, and Odisha.

The model-based estimates are clearly better than thedirect-survey-based estimates (Appendix Table A-5). For example, at parity 1 the direct-survey-based difference in the percentage of women not desiring an additional child among women with and without a son in the Ernakulam district of Kerala was 30%. By comparison, the model-based difference in the percentage of women not desiring an additional child among women with and without a son in the same district was 7%. Thus, the difference between the two was 20%. Additionally, the percentage direct-survey-based difference not desiring an additional child among women with and without a son (30%) is inconsistent with the Kerala state average of 4%. However, the percentage model-based difference not desiring an additional child among women with and without a son (7%) is very close to the Kerala average (4%). Note that the child sex ratio in Ernakulum (104 male births per 100 female births) is within the normal biological limit, female literacy rate is 94%, and the district has a high proportion of Christian population (38%). Likewise, at parity 2 the direct-survey-based estimates for Basti district in Uttar Pradesh are implausible given the national and state averages. The direct-survey-based estimate suggests the percentage difference among women with and without a son not desiring an additional child is 27%. This estimate is much lower than the direct-survey-based national (31%) and state (47%) averages. These estimates seem implausible given that Basti is one of the least developed districts of Uttar Pradesh in terms of female literacy (56%), female workforce participation (12%), urban population (5%), etc. The model-based estimate is 47%, which is consistent with the state average (of 47%).

Figure 5: Model-based estimates for percentage of women not desiring an additional child among women with at least one son and women with no son, by parity, India, 2015–2016



4.6 Moran's I and LISA results

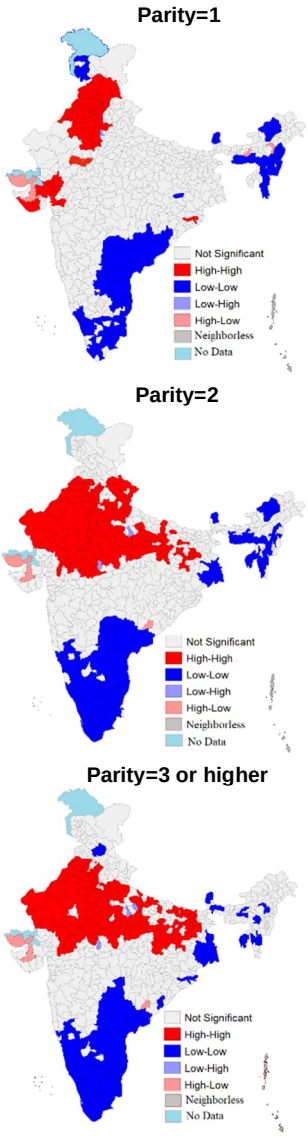
The Moran's I results indicate strong spatial autocorrelation in son preference between districts (Table 3). The positive high values suggest a high level of spatial clustering of son preference across the districts of India. For example, the Moran's I value for the difference between not wanting an additional child among parity 1 women with and without a son is 0.85. Likewise, the Moran's I value for the difference between not wanting an additional child among parity 2 women with at least one son and those without a son is 0.81.

Table 3: Moran's I values for the different measures of son preference, India, 2015–2016

Indicator	Moran's I
Percentage of parity 1 women with son not desiring an additional child	0.7868
Percentage of parity 1 women without son not desiring an additional child	0.7387
Difference in the percentage of parity 1 women not desiring an additional child among women with and without a son	0.8539
Percentage of parity 2 women with least one son not desiring an additional child	0.7248
Percentage of parity 2 women without a son not desiring an additional child	0.8112
Difference in the percentage of parity 2 women not desiring an additional child among women with at least one son and women without a son	0.8771
Percentage of women of parity 3 or higher with at least one son not desiring an additional child	0.5754
Percentage of women of parity 3 or higher without a son not desiring an additional child	0.8047
Difference in the percentage of women of parity 3 or higher not desiring an additional child among women with at least one son and women without a son	0.8586

LISA maps for the difference in the percentage of women not desiring an additional child among women with at least one son and those without a son are shown in Figure 6. Distinct patterns of spatial clustering of son preference were observed by the parity of women. Among parity 1 women, high-high (high son preference) spatial clusters of son preference were concentrated in the districts of Punjab, Haryana, Delhi, Himachal Pradesh, northern Rajasthan (5 districts), northeastern Rajasthan (4 districts), the northern plains of Gujarat (6 districts), Saurashtra (4 districts), and southeastern Gujarat (3 districts). By contrast, low-low (low son preference) spatial clusters were primarily located in the Jhelam Valley of the union territory of Jammu and Kashmir (6 out of 10 districts), the outer hills of Jammu and Kashmir (5 out of 7 districts), Telangana (8 out of 10 districts), coastal southern Andhra Pradesh, inland southern Andhra Pradesh, coastal northern Andhra Pradesh (12 out of 13 districts), Kerala, Tamil Nadu, Meghalaya, Manipur, Mizoram, and Nagaland.

Figure 6: LISA map for the difference in the percentage of women not desiring an additional child among women with at least one son and those with no son, India, 2015–2016



At parity 2, more high-high (high son preference) and low-low (low son preference) spatial clusters were evident. The high-high spatial clusters were predominantly in the districts of Haryana (18 out of 21 districts), Uttarakhand (11 out of 13 districts), eastern Uttar Pradesh (17 out of 27 districts), the southern upper Ganga plain of Uttar Pradesh (14 out of 18 districts), central Uttar Pradesh (5 out of 9 districts), southern Uttar Pradesh (7 out of 7 districts), Rajasthan, the Vindhya region of Madhya Pradesh (5 out of 10 districts), the Malwa region of Madhya Pradesh (9 of 11 districts), central Bihar (5 out of 17 districts), and southern Punjab (9 out of 11 districts). The low-low spatial clusters were predominantly concentrated in the southern plains of West Bengal, the western plains of West Bengal, the central plains of West Bengal (all 3 districts), Sikkim (2 out of 4 districts), the Cachar plains of Assam (2 out of 5 districts), Meghalaya, Nagaland (5 out of 11 districts), Mizoram (7 out of 8 districts), Tripura, Telangana, Andhra Pradesh, coastal Karnataka and the ghats of (all 3 districts), inland eastern Karnataka (all 4 districts), inland southern Karnataka (8 out of 9 districts), Kerala, Tamil Nadu, and Goa. The high-high spatial clusters at parity 3 or higher are similar to those at parity 2 except for the districts in Uttarakhand. The districts in Himachal Pradesh were grouped in the low-low spatial clusters at parity 3 or higher.

5. Discussion

This study is the first of its kind to apply model-based SAE techniques to examine spatial patterns in parity-specific son preference at the district level in India. The diagnostic measures used in the analysis confirm that the model-based estimates are robust enough to provide reliable estimates and spatial patterns of son preference by parity at the district level. The model-based estimates confirm district-level heterogeneity in son preference that is often masked by national- and state-level estimates.

A strong son preference within a local area indicates rigid cultural and social norms related to son preference, and these behaviors are further reflected in the poor performance of certain demographic indicators such as fertility, mortality, and contraceptive use. Reliable estimates of son preference at the district level can help policymakers and program managers formulate appropriate policies at the local level. The model-based estimates of son preference are also helpful in monitoring and evaluating the performance of policies and programs implemented by national and state governments.

The results show considerable spatial heterogeneity in son preference across the 640 districts in India. Son preference is highest in the districts of northern and central India, followed by western India, and lowest among the districts in the southern states of Telangana, Andhra Pradesh, Kerala, and Tamil Nadu. Our findings are consistent with

previous studies which produced evidence at the state level (Arnold, Kim Choe, and Roy 1998; Bharati et al. 2011; Dyson and Moore 1983; Gaudin 2011; Radkar 2018). The states in northern and central India where son preference is highest also have high fertility, high infant and child mortality, low contraceptive prevalence, high patriarchy, lower female autonomy, and high poverty (International Institute for Population Sciences (IIPS) and ICF 2017; Singh et al. 2021). Son preference is also high in the districts of Gujarat and Maharashtra. Overall, son preference is relatively low in the northeastern states of India.

This study demonstrates fresh evidence of significant spatial variation in son preference by parity. For example, at parity 1, son preference is particularly high in the districts of Himachal Pradesh, Punjab, Haryana, Delhi, and Gujarat. While Himachal Pradesh, Punjab, and Delhi have a fertility rate below 2 children per women, Haryana has a fertility rate slightly above 2 (International Institute for Population Sciences (IIPS) and ICF 2017). At parity 2, son preference is particularly high in the districts of Uttarakhand, Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, and Madhya Pradesh. Except for Punjab, the fertility rates of these states vary between 2.1 and 2.7 children per woman (International Institute for Population Sciences (IIPS) and ICF 2017). At parity 3 or higher, fewer districts show high son preference. High-high spatial clusters in the LISA maps support these findings. These findings reinforce that fertility norms at the local level are associated with son preference. The districts in the states of Andhra Pradesh, Kerala, and Telangana (with a few exceptions) recorded the lowest son preference. While Tamil Nadu and Karnataka showed relatively higher son preference at parity 1 than the other three south Indian states, only Karnataka shows relatively higher son preference at parities 2 and 3 or higher. The low-low spatial clusters in the LISA maps further confirm these findings. For example, Kerala in the low-low cluster had a matrilineal kinship structure in the past and most of the districts have the highest schooling rates in the country (Centre for Development Studies 2005; Chakraborty and Kim 2010; Jeffrey 1992; Pillai 2016). The northeastern region, Meghalaya, which has a matrilineal system, also shows the lowest son preference at parities 1 and 2 (Bhutia and Liarakou 2018; Chakraborty and Kim 2010; Roy 2018; Subba and Ghosh 2003). Previous studies have shown that secondary and higher levels of women's schooling are associated with weaker son preference (Bharati et al. 2011; Pande and Astone 2007; Radkar 2018). The matrilineal kinship structure may offer greater autonomy to women than the patrilocal kinship structure, resulting in lower son preference (Dyson and Moore 1983; Malhotra, Vanneman, and Kishor 1995; Singh, Ram, and Ranjan. 2007).

The difference in the percentage of women not desiring additional children among women with and without a son varies significantly across parity: differences are highest between parities one and two/three. Due to a growing acceptance of the two-child family in India (Vanneman, Desai, and Vikram 2012), the large majority of parity 1 women, irrespective of whether or not they have a son, report that they want an additional child.

On the contrary, a higher proportion of women of parities 2 or 3 or higher without a son want to have another child than women of the same parities with at least one son. Hence there is variation in son preference among women of parities 1 and 2, but there is no difference in son preference among women of parities 2 and 3 or higher.

Our indicator of son preference might be biased in populations where sex-selective abortions or differential female child mortality is high (Vanneman, Desai, and Vikram 2012). While the sex differentials in child mortality have narrowed considerably, there is evidence of sex-selective abortions in India (Saikia et al. 2021). This implies that the difference between the percentage of women with at least one son and the percentage of women without a son who do not want an additional child is likely to be biased downwards. While we include a number of auxiliary variables in our models, we could not include potential covariates of son preference such as income and exposure to media due to their unavailability in the 2011 Indian Population and Housing Census. A few studies have used variable reduction approaches (such as principal components analysis (PCA), or factor analysis) to reduce the number of model variables (Amoako Johnson et al. 2010; Baffour, Chandra, and Martinez 2019; Guha and Chandra 2021; Mendez-Luck et al. 2007) and make SAE more efficient. The variable reduction approaches are likely to be more effective when a large number of auxiliary variables are included in the model. For example, Guha and Chandra (2021) include 30 auxiliary variables in their models. Amoako Johnson et al. (2010) use PCA to derive composite indices of socio-economic development and access to healthcare services. We did not use PCA as we included only 9 auxiliary variables in our models. Future work may consider using variable reduction approaches to derive composite indices, such as socio-economic development of small-areas, for use in SAE.

Even as the Government of India and various state governments have launched a number of schemes to increase the value of female children, such as *Beti Bachao Beti Padhao* (‘Save the Girl Child, Educate the Girl Child’), *Sukanya Samriddhi Yojana* (savings scheme for female children), and *Ladli* (promoting female births), intra-state variation in son preference highlights clusters where a greater push may be needed to enforce policies to uniformly change the norms that propagate and reinforce son preference. For example, at parity 1, high-high spatial clusters of son preference were found in only three (northern, northeastern, and southeastern) of the five natural divisions of Rajasthan. Likewise, at parity 2, high-high spatial clusters of son preference were found in only two (Vindhya and Malwa) of the six natural divisions of Madhya Pradesh. Additionally, hotspots of heightened son preference were identified in areas that cross the borders of Punjab, Haryana, Rajasthan, Uttar Pradesh, and Madhya Pradesh. For example, at parity 1, northern Rajasthan, western Haryana, and southern Punjab were clearly hotspots of high son preference. At parity 2 the Malwa division of Madhya Pradesh, Southern Rajasthan, and Southeastern Rajasthan are hotspots of high son

preference. Likewise, the Vindhya division of Madhya Pradesh, eastern Uttar Pradesh, and southern Uttar Pradesh formed a cluster of heightened son preference. While these states may differ from each other in terms of administrative control, state borders are often porous in terms of culture and local norms. Similar findings are reported in a study of child marriage in India (McDougal et al. 2020). These findings call for the urgent implementation of geographically focused and targeted policy and program interventions. Policies and programs that account for local culture and normative values may be more effective than central or state-specific policies and programs. Our findings also call for a deeper understanding of local challenges to rolling out, delivering, and promoting programs aimed at curbing the social menace of son preference.

6. Conclusions

Our study demonstrates the power of SAE techniques for generating robust estimates of son preference at the district level. We combined NFHS-4 (a population-based representative household survey) data with the 2011 Indian census to produce reliable estimates of son preference in the districts of India, allowing us to examine spatial patterns at the district level. The estimates of son preference varied considerably between districts and within states. We were also able to identify local clusters of high-high son preference using novel geospatial techniques. Our findings suggest that son preference in India is no longer regional or state-specific but local, and call for a better understanding of the factors associated with son preference at the local level. The district-level estimates of son preference are crucial for effective and targeted interventions and programs that cater to local needs, rather than operating at the regional or state level.

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Appendix

Figure A-1: Direct-survey-based and model-based estimates of percentage of parity 1 women not desiring an additional child among women with and without a son, India, 2015–2016

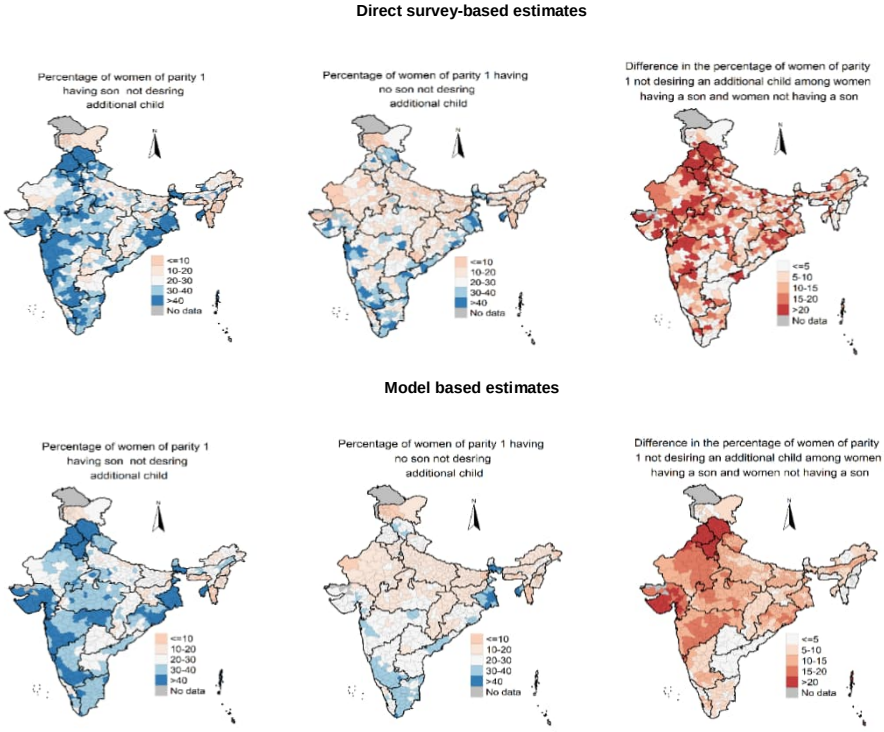
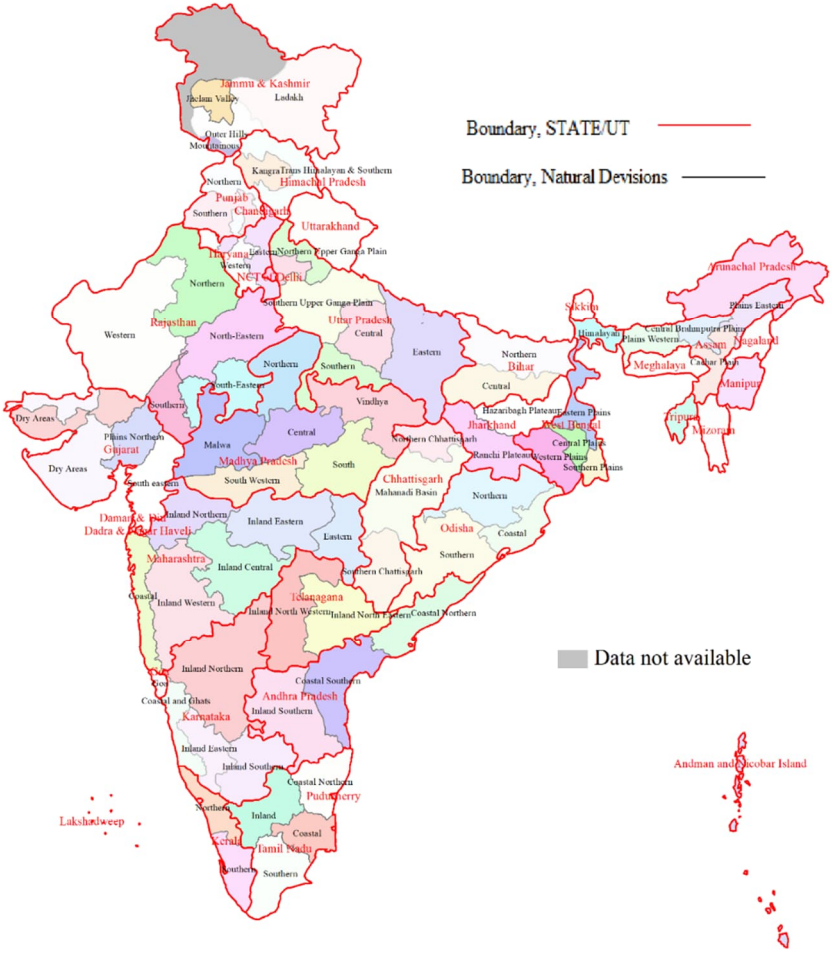


Figure A-2: State map showing natural within-state divisions, 2017



Note: Map not to scale. Map created based on the natural divisions listed in the Sample Registration System Statistical Report 2017

Table A-1: Sample sizes in India's 640 districts, 2015–2016

	Average sample	Minimum sample	Maximum sample
Number of parity 1 women with son	83	29	332
Number of parity 1 women without son	63	18	265
Number of parity 2 women with at least one son	213	57	628
Number of parity 2 women without a son	36	11	114
Number of parity 3 or higher women with at least one son	286	19	1,002
Number of parity 3 or higher women without a son	18	1	51

Table A-2: Percentage variation explained by auxiliary variables for each outcome variable (Results based on OLS)

	R-square (%)
Percentage of parity 1 women with son not desiring an additional child	71.7
Percentage of parity 1 women without son not desiring an additional child	58.9
Percentage of parity 2 women with at least one son not desiring an additional child	83.2
Percentage of parity 2 women without a son not desiring an additional child	76.5
Percentage of parity 3 or higher women with at least one son not desiring an additional child	68.8
Percentage of parity 3 or higher women without a son not desiring an additional child	67.2

Table A-3: Model parameters for generalized linear models for percentage not desiring additional children among women of parities 1, 2, and 3 or more with and without son

	Parity-1		Parity-2		Parity 3 or more	
Characteristics	**With son**	**Without son**	**With son**	**Without son**	**With son**	**Without son**
Percent Muslim	–0.008 (–0.022,0.006)	–0.005 (–0.020,0.011)	0.010 (–0.002,0.023)	0.001 (–0.011,0.014)	–0.003 (–0.020,0.013)	0.010 (–0.002,0.023)
Percent urban	–0.001 (–0.011,0.009)	0.002 (–0.009,0.012)	–0.007 (–0.017,0.004)	–0.001 (–0.011,0.009)	–0.001 (–0.017,0.015)	–0.007 (–0.017,0.004)
Percent female workforce	–0.007 (–0.025,0.011)	–0.002 (–0.022,0.018)	0.001 (–0.017,0.019)	–0.003 (–0.021,0.015)	–0.010 (–0.038,0.017)	0.001 (–0.017,0.019)
Percent SC/ST	–0.007 (–0.017,0.004)	–0.004 (–0.016,0.007)	–0.003 (–0.013,0.006)	–0.007 (–0.016,0.003)	–0.009 (–0.022,0.004)	–0.003 (–0.013,0.006)
Literacy gap between men and women	–0.010 (–0.062,0.042)	–0.020 (–0.078,0.038)	–0.039 (–0.089,0.010)	–0.051 (–0.101,–0.002)	0.022 (–0.051,0.095)	–0.039 (–0.089,0.010)
TFR	–0.582 (–1.093,–0.071)	–0.431 (–0.989,0.128)	–0.590 (–1.098,–0.082)	–0.708 (–1.215,–0.201)	–0.581 (–1.310,0.149)	–0.590 (–1.098,–0.082)
Proportion female population	–0.078 (–0.299,0.143)	0.026 (–0.218,0.269)	0.114 (–0.111,0.339)	0.085 (–0.136,0.306)	–0.083 (–0.425,0.259)	0.114 (–0.111,0.339)
Percent female head	–0.030 (–0.075,0.014)	–0.004 (–0.051,0.042)	0.011 (–0.033,0.055)	0.004 (–0.038,0.046)	–0.033 (–0.090,0.023)	0.011 (–0.033,0.055)
Intercept	4.586 (–2.912,12.085)	0.750 (–7.497,8.997)	1.135 (–6.491,8.761)	2.536 (–5.003,10.075)	7.348 (–4.149,18.845)	1.135 (–6.491,8.761)

Table A-4: Within-state variation in estimates of son preference using direct-survey-based estimates and model-based estimates, 2015–2016

State	Survey-based estimates of son preference (percentage)			Coefficient of variation						
					D1s		D2s		D3s	
	D1s	D2s	D3s	Number of districts	Direct	Model	Direct	Model	Direct	Model
Andaman And Nicobar Islands	17.9	9.2	1.9	3	0.23	0.12	0.79	0.11	1.54	0.10
Andhra Pradesh	2.5	8.5	2.3	13	6.71	0.47	0.95	0.32	1.99	0.39
Arunachal Pradesh	6.8	24.6	20.6	16	1.14	0.36	0.46	0.26	0.62	0.26
Assam	10.3	25.2	16.7	27	0.62	0.20	0.37	0.11	0.82	0.16
Bihar	10.1	43.2	41.1	38	0.91	0.12	0.22	0.08	0.26	0.09
Chandigarh	14.3	45.6	33.6	1	–	–	–	–	–	–
Chhattisgarh	5.8	37.2	33.8	18	1.02	0.25	0.36	0.10	0.42	0.11
Dadra and Nagar Haveli	12.4	38.8	22.4	1	–	–	–	–	–	–
Daman and Diu	21.0	43.6	39.3	2	0.47	0.62	0.03	0.24	0.52	0.45
Goa	20.2	–0.6	12.8	2	0.13	0.10	55.15	12.08	0.09	0.05
Gujarat	19.2	37.3	35.7	26	0.64	0.18	0.37	0.17	0.53	0.19
Haryana	27.1	59.5	67.2	21	0.39	0.15	0.27	0.09	0.21	0.08
Himachal Pradesh	26.7	32.1	17.8	12	0.40	0.09	0.45	0.17	1.01	0.25
Jammu And Kashmir	6.3	31.8	25.1	22	1.48	0.27	0.45	0.16	0.43	0.26
Jharkhand	8.9	45.1	41.0	24	0.84	0.27	0.25	0.12	0.28	0.15
Karnataka	7.2	16.7	15.7	30	1.04	0.26	0.82	0.25	0.99	0.38
Kerala	3.8	1.7	1.4	14	2.75	0.96	1.25	0.55	2.15	0.70
Lakshadweep	–0.6	7.1	19.4	1	–	–	–	–	–	–
Madhya Pradesh	14.3	42.4	36.2	50	0.62	0.19	0.28	0.13	0.44	0.18
Maharashtra	14.2	26.5	20.9	35	0.67	0.12	0.50	0.19	0.69	0.21
Manipur	4.8	33.9	30.3	9	3.66	0.58	0.56	0.34	0.23	0.13
Meghalaya	1.2	1.2	15.5	7	–5.27	–1.33	2.44	2.46	0.85	0.65
Mizoram	1.1	15.6	13.3	8	3.22	0.31	0.77	0.19	0.49	0.57
Nagaland	2.7	14.0	13.1	11	–27.32	–2.15	1.17	0.22	1.00	0.47
Delhi	24.6	23.4	34.5	9	0.52	0.05	0.41	0.13	0.60	0.11
Odisha	14.5	30.8	19.6	30	0.77	0.26	0.34	0.19	0.60	0.26
Puducherry	–6.5	5.0	4.0	4	–3.03	–1.85	0.58	1.15	14.56	9.04
Punjab	33.6	48.3	43.7	20	0.36	0.06	0.25	0.06	0.43	0.08
Rajasthan	16.2	56.0	52.0	33	0.67	0.17	0.24	0.09	0.22	0.12
Sikkim	7.7	12.8	8.5	4	6.68	0.68	0.59	0.10	0.23	0.17
Tamil Nadu	5.9	8.2	2.4	32	1.75	0.30	0.74	0.25	3.15	0.74
Tripura	6.7	8.3	5.8	4	0.72	0.10	0.49	0.16	1.51	0.29
Uttar Pradesh	11.0	47.3	43.8	71	0.84	0.16	0.23	0.08	0.27	0.14
Uttarakhand	17.6	47.2	35.6	13	0.56	0.17	0.23	0.10	0.44	0.14
West Bengal	10.3	17.5	9.4	19	0.64	0.18	0.65	0.30	0.92	0.37
Telangana	3.7	9.4	3.9	10	6.64	1.20	0.98	0.30	2.55	0.55

Table A-5: District-level estimates of son preference, 2015–2016

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Jammu & Kashmir	Kupwara	1.6	0.9	26.0	18.0	43.0	29.8
Jammu & Kashmir	Badgam	3.1	–2.4	29.6	23.7	35.7	13.9
Jammu & Kashmir	Leh(Ladakh)	5.4	–12.8	28.3	13.4	20.8	8.9
Jammu & Kashmir	Kargil	4.4	8.8	27.1	8.3	24.9	31.7
Jammu & Kashmir	Punch	3.4	4.2	26.8	32.7	25.9	38.0
Jammu & Kashmir	Rajouri	4.2	2.5	27.7	35.6	25.8	42.7
Jammu & Kashmir	Kathua	6.7	14.5	29.3	42.3	25.1	42.4
Jammu & Kashmir	Baramula	6.1	9.7	35.6	38.2	29.0	24.1
Jammu & Kashmir	Bandipore	6.1	0.8	33.3	36.3	26.2	18.4
Jammu & Kashmir	Srinagar	6.7	7.2	27.3	6.4	16.7	11.6
Jammu & Kashmir	Ganderbal	5.6	9.2	32.6	38.6	28.2	12.0
Jammu & Kashmir	Pulwama	5.5	7.3	34.2	43.5	27.2	15.5
Jammu & Kashmir	Shupiyan	7.7	17.5	32.4	60.1	21.6	26.8
Jammu & Kashmir	Anantnag	3.8	0.7	29.8	33.9	30.2	15.9
Jammu & Kashmir	Kulgam	6.3	0.5	33.8	47.6	25.3	43.4
Jammu & Kashmir	Doda	5.6	–1.2	39.2	24.2	34.5	22.0
Jammu & Kashmir	Ramban	4.4	–3.9	37.7	36.1	40.8	49.1
Jammu & Kashmir	Kishtwar	5.7	10.9	37.7	17.8	34.7	26.3
Jammu & Kashmir	Udhampur	5.0	20.2	34.0	40.9	31.3	32.4
Jammu & Kashmir	Reasi	4.2	2.0	31.7	39.1	33.7	30.3
Jammu & Kashmir	Jammu	4.4	5.1	19.8	23.8	15.8	43.5
Jammu & Kashmir	Samba	5.2	9.5	21.8	15.2	16.9	34.6
Himachal Pradesh	Chamba	24.5	30.3	39.6	59.7	22.1	40.1
Himachal Pradesh	Kangra	25.2	21.0	24.2	35.1	11.0	3.2
Himachal Pradesh	Lahul & Spiti	29.3	31.0	33.5	8.8	18.0	2.8
Himachal Pradesh	Kullu	30.4	37.3	32.7	22.3	18.0	4.9
Himachal Pradesh	Mandi	27.0	27.2	29.7	29.7	15.0	46.6
Himachal Pradesh	Hamirpur	22.6	24.6	22.5	18.4	8.6	3.8
Himachal Pradesh	Una	26.4	54.3	25.5	30.9	12.9	–4.2
Himachal Pradesh	Bilaspur	26.5	26.9	26.9	23.6	14.0	26.6
Himachal Pradesh	Solan	30.1	15.6	29.2	40.3	16.5	13.8
Himachal Pradesh	Sirmaur	28.3	12.3	34.4	42.0	20.9	21.0
Himachal Pradesh	Shimla	30.1	29.9	26.4	25.7	14.5	22.0
Himachal Pradesh	Kinnaur	29.6	19.8	32.6	20.7	17.5	8.5
Punjab	Gurdaspur	31.9	21.5	47.5	43.6	41.8	44.7
Punjab	Kapurthala	30.8	24.7	46.0	60.2	40.1	40.7
Punjab	Jalandhar	29.2	7.9	43.2	49.5	37.9	10.2
Punjab	Hoshiarpur	29.7	16.6	43.5	21.5	35.7	29.9
Punjab	Shahid Bhagat Singh Nagar	28.0	31.7	50.3	51.4	40.9	26.5
Punjab	Fatehgarh Sahib	34.3	30.6	45.9	41.6	41.2	42.7
Punjab	Ludhiana	33.7	42.9	46.5	48.8	41.6	74.8
Punjab	Moga	31.5	34.8	46.9	63.1	43.2	42.5
Punjab	Firozpur	32.1	24.1	53.8	47.8	47.7	70.1
Punjab	Muktsar	32.0	26.5	53.1	53.8	47.4	41.3
Punjab	Faridkot	33.2	56.9	51.6	83.4	46.7	56.8
Punjab	Bathinda	33.7	45.4	52.0	51.6	46.9	43.3
Punjab	Mansa	32.7	21.0	53.0	46.5	48.9	51.9
Punjab	Patiala	34.1	44.0	51.2	43.2	45.0	76.3
Punjab	Amritsar	31.5	31.7	47.1	56.4	42.2	24.5
Punjab	Tarn Taran	27.9	30.4	51.6	50.7	46.5	41.1
Punjab	Rupnagar	32.8	34.2	50.7	40.9	43.0	41.3
Punjab	Sahibzada Ajit Singh Nagar	33.8	32.0	47.0	48.0	43.2	22.5
Punjab	Sangrur	33.7	36.9	48.1	36.8	43.8	18.2
Punjab	Barnala	33.9	46.5	48.9	39.2	44.2	68.7
Chandigarh	Chandigarh	14.3	14.3	45.6	45.6	33.5	33.5
Uttarakhand	Uttarkashi	18.0	17.0	58.6	66.9	49.8	14.6
Uttarakhand	Chamoli	14.7	3.5	48.3	54.7	37.0	51.9
Uttarakhand	Rudraprayag	13.3	13.0	48.3	54.2	34.3	37.1
Uttarakhand	Tehri Garhwal	13.5	27.2	53.1	39.9	39.6	45.0
Uttarakhand	Dehradun	18.1	20.1	41.1	33.9	35.1	21.7
Uttarakhand	Garhwal	11.7	9.9	44.8	48.9	31.4	5.5
Uttarakhand	Pithoragarh	12.6	13.6	46.0	46.8	34.8	55.0

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Uttarakhand	Bageshwar	12.9	17.7	49.6	45.6	36.8	40.1
Uttarakhand	Almora	11.6	25.5	47.7	60.9	33.4	58.6
Uttarakhand	Champawat	16.1	0.0	55.0	63.6	44.8	64.0
Uttarakhand	Nainital	17.3	5.3	43.9	30.5	36.3	35.8
Uttarakhand	Udham Singh Nagar	18.3	22.4	51.5	40.0	42.5	35.7
Uttarakhand	Hardwar	17.3	20.2	53.4	55.4	46.2	37.2
Haryana	Panchkula	27.4	33.7	46.7	36.2	55.7	60.4
Haryana	Ambala	26.1	18.7	44.8	63.5	52.4	29.6
Haryana	Yamunanagar	27.2	35.1	48.3	72.2	54.9	71.4
Haryana	Kurukshetra	27.8	21.7	49.2	59.5	56.6	80.2
Haryana	Kaithal	26.7	32.3	57.2	70.1	62.8	70.9
Haryana	Karnal	26.7	–2.4	52.1	39.7	58.8	61.6
Haryana	Panipat	25.3	17.7	56.0	65.4	63.0	59.7
Haryana	Sonipat	26.3	35.6	54.0	76.4	60.6	59.4
Haryana	Jind	26.6	38.5	58.3	74.3	63.5	75.6
Haryana	Fatehabad	26.2	35.6	55.2	75.5	61.1	68.6
Haryana	Sirsa	27.6	19.9	53.1	62.4	58.7	66.8
Haryana	Hisar	26.5	34.2	57.1	73.2	62.2	81.6
Haryana	Bhiwani	27.6	24.9	58.8	67.4	61.9	71.4
Haryana	Rohtak	26.4	37.8	51.6	46.4	57.0	74.0
Haryana	Jhajjar	26.3	38.2	53.8	57.2	59.1	43.3
Haryana	Mahendragarh	28.8	29.5	59.3	64.6	61.4	59.3
Haryana	Rewari	26.0	36.8	55.7	52.0	60.0	63.3
Haryana	Gurgaon	26.5	32.4	49.1	42.2	57.3	96.2
Haryana	Mewat	10.4	15.0	56.1	13.5	73.1	65.1
Haryana	Faridabad	24.6	21.0	52.8	51.9	60.9	66.3
Haryana	Palwal	21.1	14.4	68.0	63.3	72.4	79.2
Nct Of Delhi	North West	24.4	33.7	25.9	32.1	33.2	44.6
Nct Of Delhi	North	23.5	29.8	22.5	15.8	29.0	17.5
Nct Of Delhi	North East	23.2	–0.6	28.2	39.7	33.5	46.3
Nct Of Delhi	East	23.3	23.3	21.5	26.9	29.6	14.7
Nct Of Delhi	New Delhi	25.3	20.7	20.7	7.6	28.3	23.4
Nct Of Delhi	Central	21.3	26.6	19.1	27.0	23.2	35.3
Nct Of Delhi	West	23.7	12.0	22.9	22.0	30.8	6.4
Nct Of Delhi	South West	25.1	26.3	24.3	14.8	32.6	63.1
Nct Of Delhi	South	24.1	42.1	26.3	25.6	33.4	22.3
Rajasthan	Ganganagar	20.2	18.4	44.0	40.0	40.7	47.1
Rajasthan	Hanumangarh	19.8	35.2	49.6	64.4	44.3	38.4
Rajasthan	Bikaner	15.9	8.2	55.4	49.5	54.6	37.5
Rajasthan	Churu	16.0	25.5	54.4	61.0	50.2	57.1
Rajasthan	Jhunjhunun	16.9	6.6	49.7	56.1	42.4	72.6
Rajasthan	Alwar	17.4	36.3	56.8	53.2	51.6	73.3
Rajasthan	Bharatpur	15.4	3.2	60.8	67.5	58.0	67.1
Rajasthan	Dhaulpur	13.9	0.9	60.3	55.0	61.2	65.4
Rajasthan	Karauli	14.9	6.8	61.3	45.6	59.9	77.7
Rajasthan	Sawai Madhopur	17.1	20.8	61.5	82.8	56.0	41.8
Rajasthan	Dausa	15.6	12.5	58.6	76.8	56.8	42.5
Rajasthan	Jaipur	18.5	11.3	47.7	48.5	43.5	50.6
Rajasthan	Sikar	17.2	8.8	52.4	57.7	45.2	53.4
Rajasthan	Nagaur	15.6	9.9	59.1	59.0	54.5	34.9
Rajasthan	Jodhpur	15.4	11.3	58.1	39.2	55.8	45.0
Rajasthan	Jaisalmer	12.7	18.9	62.7	55.5	65.9	60.8
Rajasthan	Barmer	12.7	15.8	62.8	40.1	66.3	59.4
Rajasthan	Jalor	13.4	12.0	62.3	54.5	62.7	55.3
Rajasthan	Sirohi	12.3	13.5	58.1	52.1	56.6	46.9
Rajasthan	Pali	14.7	–4.0	57.6	47.7	52.6	39.0
Rajasthan	Ajmer	15.1	13.4	55.2	43.2	49.4	49.8
Rajasthan	Tonk	17.8	22.9	58.8	78.7	52.7	59.6
Rajasthan	Bundi	18.5	21.6	56.4	80.7	50.0	42.2
Rajasthan	Bhilwara	16.1	27.5	57.5	76.9	52.5	67.6
Rajasthan	Rajsamand	14.6	–1.6	58.1	40.2	53.3	44.7
Rajasthan	Dungarpur	9.4	11.1	51.7	33.6	54.9	51.8

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Rajasthan	Banswara	9.9	11.6	52.2	64.3	56.7	62.8
Rajasthan	Chittaurgarh	18.8	34.5	57.2	48.6	49.1	45.3
Rajasthan	Kota	18.4	17.3	44.9	45.7	40.5	36.2
Rajasthan	Baran	17.5	11.9	56.7	54.2	52.4	60.5
Rajasthan	Jhalawar	18.6	36.3	57.9	55.8	52.8	59.5
Rajasthan	Udaipur	12.3	21.0	54.4	73.4	53.9	47.8
Rajasthan	Pratapgarh	11.9	15.1	53.6	46.2	54.2	57.6
Uttar Pradesh	Saharanpur	11.9	23.1	43.2	47.3	37.4	53.3
Uttar Pradesh	Muzaffarnagar	11.7	14.4	47.0	38.0	41.2	63.2
Uttar Pradesh	Bijnor	10.8	8.6	43.1	49.1	38.5	69.1
Uttar Pradesh	Moradabad	10.1	15.1	45.0	57.2	43.6	38.4
Uttar Pradesh	Rampur	10.2	–12.2	45.4	53.8	42.6	68.3
Uttar Pradesh	Jyotiba Phule Nagar	11.3	26.6	49.1	44.4	44.4	38.2
Uttar Pradesh	Meerut	11.6	10.8	42.8	38.4	35.8	42.8
Uttar Pradesh	Baghpat	13.1	25.1	49.8	45.0	43.7	32.9
Uttar Pradesh	Ghaziabad	12.1	19.6	41.6	39.4	35.6	42.2
Uttar Pradesh	Gautam Buddha Nagar	12.7	13.3	45.0	41.3	40.8	41.6
Uttar Pradesh	Bulandshahr	10.4	–1.6	49.8	50.9	45.2	53.1
Uttar Pradesh	Aligarh	10.5	7.6	49.2	50.3	45.5	51.0
Uttar Pradesh	Mahamaya Nagar	11.2	30.0	50.3	43.1	46.7	42.5
Uttar Pradesh	Mathura	11.3	22.5	53.1	54.9	51.6	55.2
Uttar Pradesh	Agra	10.6	15.7	46.7	58.7	43.7	49.1
Uttar Pradesh	Firozabad	11.5	10.7	47.8	40.2	44.2	42.4
Uttar Pradesh	Mainpuri	11.6	27.1	46.9	48.9	45.3	24.2
Uttar Pradesh	Budaun	6.9	4.3	47.1	38.3	55.5	43.6
Uttar Pradesh	Bareilly	10.5	14.7	48.1	46.7	45.9	42.6
Uttar Pradesh	Pilibhit	12.4	2.6	50.5	59.5	46.4	37.0
Uttar Pradesh	Shahjahanpur	9.5	10.3	48.5	23.9	50.9	45.8
Uttar Pradesh	Kheri	9.5	1.9	46.3	54.1	47.6	58.4
Uttar Pradesh	Sitapur	8.8	15.7	46.5	54.1	49.9	50.9
Uttar Pradesh	Hardoi	9.0	7.4	47.9	49.9	50.1	39.2
Uttar Pradesh	Unnao	10.8	15.7	45.0	60.9	41.1	22.3
Uttar Pradesh	Lucknow	12.0	1.5	34.0	38.8	28.2	35.7
Uttar Pradesh	Rae Bareli	10.6	2.7	46.0	56.4	40.9	35.8
Uttar Pradesh	Farrukhabad	10.9	17.8	47.8	53.8	45.5	47.0
Uttar Pradesh	Kannauj	11.4	–0.7	47.0	58.4	44.3	60.3
Uttar Pradesh	Etawah	12.6	6.1	43.9	44.9	40.7	60.0
Uttar Pradesh	Auraiya	12.3	11.9	43.6	39.7	41.7	52.7
Uttar Pradesh	Kanpur Dehat	13.4	18.1	44.8	37.8	40.8	27.8
Uttar Pradesh	Kanpur Nagar	13.5	18.2	31.7	30.8	27.5	50.2
Uttar Pradesh	Jalaun	13.5	27.3	47.7	46.9	44.1	58.1
Uttar Pradesh	Jhansi	13.7	15.2	46.0	54.4	39.8	47.0
Uttar Pradesh	Lalitpur	11.5	–12.4	52.9	53.5	52.1	50.4
Uttar Pradesh	Hamirpur	13.6	15.7	52.1	38.5	48.9	33.1
Uttar Pradesh	Mahoba	12.6	11.1	51.3	67.9	50.0	54.2
Uttar Pradesh	Banda	10.1	–6.0	52.2	66.9	54.3	42.3
Uttar Pradesh	Chitrakoot	9.0	13.3	51.0	41.0	56.4	59.0
Uttar Pradesh	Fatehpur	11.2	15.1	48.0	81.0	44.2	48.2
Uttar Pradesh	Pratapgarh	9.2	7.8	45.2	34.6	37.1	23.1
Uttar Pradesh	Kaushambi	7.5	5.6	47.4	35.5	52.5	38.3
Uttar Pradesh	Allahabad	9.7	2.1	47.1	46.2	43.2	40.5
Uttar Pradesh	Bara Banki	10.0	9.6	46.1	58.7	46.6	24.4
Uttar Pradesh	Faizabad	10.2	2.4	44.1	51.2	38.9	52.7
Uttar Pradesh	Ambedkar Nagar	11.4	24.1	43.6	57.8	36.6	38.9
Uttar Pradesh	Sultanpur	9.7	–3.9	45.6	29.5	39.5	26.9
Uttar Pradesh	Bahraich	8.1	10.3	46.5	34.9	52.6	62.6
Uttar Pradesh	Shrawasti	8.4	8.2	48.5	34.4	55.5	65.4
Uttar Pradesh	Balrampur	7.5	7.0	46.2	16.8	51.4	42.4
Uttar Pradesh	Gonda	9.7	17.9	49.6	45.7	49.1	44.1
Uttar Pradesh	Siddharthnagar	6.6	5.4	46.3	43.5	49.8	68.6
Uttar Pradesh	Basti	9.5	23.0	47.0	27.0	43.8	37.4
Uttar Pradesh	Sant Kabir Nagar	8.9	1.8	47.7	49.2	43.7	34.3

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Uttar Pradesh	Mahrajganj	10.9	7.5	52.5	65.2	49.6	59.5
Uttar Pradesh	Gorakhpur	11.8	16.4	46.9	42.5	38.3	36.1
Uttar Pradesh	Kushinagar	11.0	19.6	51.2	54.8	47.0	46.3
Uttar Pradesh	Deoria	8.7	11.3	45.9	49.2	38.8	33.5
Uttar Pradesh	Azamgarh	7.5	6.4	41.9	40.7	35.5	46.9
Uttar Pradesh	Mau	8.9	1.3	43.4	44.6	37.6	25.0
Uttar Pradesh	Ballia	11.8	17.7	47.5	52.1	42.2	34.1
Uttar Pradesh	Jaunpur	7.7	6.6	44.7	38.2	37.5	31.3
Uttar Pradesh	Ghazipur	9.8	–0.7	47.1	48.5	41.7	41.0
Uttar Pradesh	Chandauli	11.4	12.0	48.2	41.1	44.5	33.9
Uttar Pradesh	Varanasi	12.2	11.1	42.8	38.8	35.1	30.4
Uttar Pradesh	Sant Ravidas Nagar (Bhadohi)	8.4	7.4	48.7	50.0	43.5	41.8
Uttar Pradesh	Mirzapur	9.7	4.8	48.6	39.5	47.9	51.0
Uttar Pradesh	Sonbhadra	9.6	7.5	48.6	48.1	50.1	34.2
Uttar Pradesh	Etah	11.1	7.4	51.6	55.9	49.2	34.9
Uttar Pradesh	Kanshiram Nagar	8.2	5.6	50.2	53.4	53.7	56.5
Bihar	Pashchim Champaran	9.6	20.1	42.2	37.4	46.8	40.0
Bihar	Purba Champaran	9.9	0.5	43.1	29.0	46.8	23.8
Bihar	Sheohar	9.2	19.1	40.1	31.2	46.4	40.9
Bihar	Sitamarhi	10.0	16.9	42.0	47.9	46.2	52.5
Bihar	Madhubani	11.5	9.2	45.9	57.6	43.7	41.6
Bihar	Supaul	10.2	1.0	44.9	53.1	48.0	64.3
Bihar	Araria	9.3	18.4	38.4	36.9	40.3	42.9
Bihar	Kishanganj	6.8	8.0	30.0	37.3	32.2	25.1
Bihar	Purnia	8.5	–14.4	36.6	55.3	41.0	42.6
Bihar	Katihar	8.4	17.1	34.8	43.5	38.4	30.5
Bihar	Madhepura	10.4	19.7	43.9	39.8	47.3	44.2
Bihar	Saharsa	10.0	11.8	44.2	42.5	48.2	57.8
Bihar	Darbhanga	9.2	12.0	41.0	44.9	41.2	36.2
Bihar	Muzaffarpur	11.5	9.2	42.0	41.0	41.2	37.9
Bihar	Gopalganj	8.1	–1.6	38.9	28.8	33.3	27.8
Bihar	Siwan	9.9	20.6	40.9	46.8	33.2	40.0
Bihar	Saran	9.9	12.3	43.4	50.6	38.2	31.6
Bihar	Vaishali	11.6	3.1	42.6	23.2	41.9	24.5
Bihar	Samastipur	10.9	16.8	43.0	27.5	43.2	43.0
Bihar	Begusarai	10.8	33.9	41.4	54.9	41.6	52.7
Bihar	Khagaria	9.9	7.2	41.5	44.9	47.2	54.2
Bihar	Bhagalpur	12.4	0.8	43.1	36.9	41.2	40.3
Bihar	Banka	11.4	24.3	44.6	33.6	44.4	36.6
Bihar	Munger	12.6	–1.5	42.8	40.4	40.0	47.1
Bihar	Lakhisarai	10.1	–0.1	43.7	47.8	45.6	52.9
Bihar	Sheikhpura	9.1	–1.3	42.9	53.5	45.1	74.6
Bihar	Nalanda	10.4	14.9	44.4	42.9	43.3	33.0
Bihar	Patna	11.6	1.6	41.7	46.9	37.5	47.8
Bihar	Bhojpur	10.4	6.4	45.7	38.3	42.8	31.1
Bihar	Buxar	11.3	19.1	45.6	48.6	42.6	53.6
Bihar	Kaimur (Bhabua)	10.1	–1.6	43.3	38.1	43.9	39.5
Bihar	Rohtas	12.3	14.9	44.4	42.3	40.6	40.3
Bihar	Aurangabad	10.5	11.7	43.3	40.9	43.0	40.8
Bihar	Gaya	10.1	8.1	41.6	59.9	41.9	51.0
Bihar	Nawada	11.0	10.9	43.5	49.6	40.9	37.9
Bihar	Jamui	11.4	8.5	46.4	39.3	44.9	49.5
Bihar	Jehanabad	12.0	19.3	46.4	52.0	42.7	47.9
Bihar	Arwal	10.5	15.9	45.9	25.0	44.0	32.6
Sikkim	North District	2.4	–11.4	13.9	6.3	10.3	9.0
Sikkim	West District	2.3	–5.4	13.6	11.5	9.5	8.5
Sikkim	South District	2.7	14.2	12.9	23.8	8.5	11.4
Sikkim	East District	0.0	9.9	11.0	9.8	6.9	6.4
Arunachal Pradesh	Tawang	7.1	1.9	26.6	18.6	26.0	16.3
Arunachal Pradesh	West Kameng	8.6	21.1	29.4	15.5	27.8	4.2
Arunachal Pradesh	East Kameng	2.3	9.5	17.4	5.1	27.7	23.5

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Arunachal Pradesh	Papum Pare	4.1	3.4	21.9	18.1	17.6	11.9
Arunachal Pradesh	Upper Subansiri	3.9	12.9	16.8	13.6	20.1	24.2
Arunachal Pradesh	West Siang	6.7	15.6	22.1	39.4	22.7	35.2
Arunachal Pradesh	East Siang	7.3	9.3	23.3	17.5	17.6	30.3
Arunachal Pradesh	Upper Siang	7.0	6.0	23.5	14.6	26.7	–0.2
Arunachal Pradesh	Changlang	8.2	3.9	34.8	45.8	37.2	29.9
Arunachal Pradesh	Tirap	3.5	–4.0	20.6	27.1	34.8	31.2
Arunachal Pradesh	Lower Subansiri	4.2	6.7	16.9	23.3	13.3	38.9
Arunachal Pradesh	Kurung Kumey	3.0	1.7	15.0	16.2	25.0	21.8
Arunachal Pradesh	Dibang Valley	5.6	–3.0	18.9	30.2	19.5	66.5
Arunachal Pradesh	Lower Dibang Valley	7.9	3.3	28.6	23.1	26.7	13.0
Arunachal Pradesh	Lohit	8.4	3.8	33.7	34.7	33.7	24.0
Arunachal Pradesh	Anjaw	5.0	0.8	23.0	29.8	30.2	35.8
Nagaland	Mon	0.4	–0.4	14.5	46.1	24.3	4.5
Nagaland	Mokokchung	1.0	19.1	9.0	3.2	4.0	23.3
Nagaland	Zunheboto	–0.8	–10.6	9.9	3.0	9.7	34.3
Nagaland	Wokha	0.7	–20.2	13.1	22.3	6.6	26.1
Nagaland	Dimapur	0.2	6.9	18.5	13.7	11.5	18.4
Nagaland	Phek	–1.0	2.9	12.7	–8.1	13.4	9.4
Nagaland	Tuensang	–1.0	–5.8	11.4	17.8	20.2	–5.5
Nagaland	Longleng	–1.0	6.7	9.1	20.2	15.5	–0.4
Nagaland	Kiphire	–1.3	–9.2	13.0	–2.9	22.8	31.5
Nagaland	Kohima	–1.8	12.6	13.4	17.0	9.0	18.1
Nagaland	Peren	–0.1	–6.6	15.3	7.6	18.9	–3.8
Manipur	Senapati	1.8	5.9	21.5	–2.7	33.0	41.4
Manipur	Tamenglong	1.0	–2.7	20.0	35.0	34.4	38.1
Manipur	Churachandpur	0.4	–1.7	15.6	19.5	28.1	34.0
Manipur	Bishnupur	3.5	10.1	39.0	34.4	40.6	30.2
Manipur	Thoubal	3.0	10.3	36.3	42.7	40.7	32.4
Manipur	Imphal West	1.7	3.1	34.3	43.6	32.1	28.5
Manipur	Imphal East	2.6	4.4	33.8	29.6	31.9	32.5
Manipur	Ukhrul	0.7	–4.8	17.1	25.7	30.0	45.5
Manipur	Chandel	1.6	–8.4	22.9	12.6	30.8	18.9
Mizoram	Mamit	1.9	5.4	13.6	17.0	23.6	23.3
Mizoram	Kolasib	1.6	–1.8	11.9	7.4	13.2	8.7
Mizoram	Aizawl	0.6	–0.6	9.0	27.6	3.7	15.6
Mizoram	Champhai	1.5	5.8	9.9	3.6	10.8	13.5
Mizoram	Serchhip	1.8	–6.6	10.1	6.7	7.6	6.7
Mizoram	Lunglei	2.0	–1.7	13.8	–0.1	17.2	10.1
Mizoram	Lawngtlai	1.9	3.7	15.5	13.3	31.5	17.7
Mizoram	Saiha	1.2	8.2	11.3	19.6	17.2	29.3
Tripura	West Tripura	7.7	7.6	7.1	9.5	4.6	–0.2
Tripura	South Tripura	8.8	2.5	9.4	6.2	7.3	–3.8
Tripura	Dhalai	7.1	5.3	10.5	14.9	9.5	17.8
Tripura	North Tripura	7.3	15.5	8.7	5.1	6.6	14.2
Meghalaya	West Garo Hills	0.8	–3.6	11.2	–4.6	25.9	49.6
Meghalaya	East Garo Hills	0.4	–11.8	10.8	7.4	28.6	9.2
Meghalaya	South Garo Hills	–0.3	–8.2	9.8	11.4	32.9	25.0
Meghalaya	West Khasi Hills	–2.7	–9.5	–0.3	–1.2	20.5	21.3
Meghalaya	Ribhoi	–1.0	4.9	4.4	15.2	22.2	19.6
Meghalaya	East Khasi Hills	–5.2	16.5	–3.2	–1.0	3.0	–2.8
Meghalaya	Jaintia Hills	–5.0	–1.4	–9.8	–4.3	1.0	12.2
Assam	Kokrajhar	9.4	13.9	27.6	34.9	20.5	7.0
Assam	Dhubri	7.9	–2.1	27.2	31.2	20.1	21.9
Assam	Goalpara	7.9	9.4	22.3	42.8	16.1	36.2
Assam	Barpeta	9.5	7.3	27.6	29.5	18.8	8.1
Assam	Morigaon	8.8	8.1	23.7	31.1	18.3	11.9
Assam	Nagaon	9.9	20.8	25.1	12.3	17.4	12.7
Assam	Sonitpur	11.0	5.3	28.5	16.6	20.2	14.3
Assam	Lakhimpur	10.1	6.4	26.2	36.4	19.2	43.4
Assam	Dhemaji	8.6	13.7	26.2	30.2	22.9	19.3
Assam	Tinsukia	13.3	7.7	30.6	30.9	20.6	22.5

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Assam	Dibrugarh	13.6	8.9	26.3	41.0	16.8	1.9
Assam	Sivasagar	13.4	18.4	24.3	25.3	15.6	7.3
Assam	Jorhat	12.6	6.8	22.1	35.9	14.3	2.0
Assam	Golaghat	12.7	12.2	25.4	26.8	17.2	–4.4
Assam	Karbi Anglong	7.4	10.3	26.5	16.6	24.3	50.3
Assam	Dima Hasao	6.0	–1.1	21.6	9.7	19.3	26.1
Assam	Cachar	9.6	2.8	25.7	32.7	17.2	19.8
Assam	Karimganj	7.7	16.7	27.8	21.2	20.1	38.4
Assam	Hailakandi	9.1	16.0	29.5	35.8	20.3	48.2
Assam	Bongaigaon	8.9	12.5	25.6	19.9	17.1	23.9
Assam	Chirang	8.5	11.0	25.9	24.0	20.6	15.7
Assam	Kamrup	12.2	27.1	24.9	3.8	14.8	26.0
Assam	Kamrup Metropolitan	9.9	6.5	16.8	16.5	10.8	13.3
Assam	Nalbari	12.7	9.4	24.5	22.6	14.5	13.6
Assam	Baksa	10.9	7.5	26.5	25.7	18.3	–9.9
Assam	Darrang	10.0	9.8	28.3	23.1	20.5	8.7
Assam	Udalguri	10.5	7.1	27.4	17.3	19.7	17.3
West Bengal	Darjiling	6.9	7.2	13.7	2.9	6.7	4.5
West Bengal	Jalpaiguri	7.4	19.4	16.5	6.1	8.8	9.3
West Bengal	Koch Bihar	10.4	1.9	17.1	15.4	8.8	7.4
West Bengal	Uttar Dinajpur	10.4	16.8	26.2	30.8	14.2	22.2
West Bengal	Dakshin Dinajpur	11.3	8.5	16.5	5.4	8.0	8.7
West Bengal	Maldah	11.3	0.7	20.9	19.2	10.5	6.4
West Bengal	Murshidabad	13.1	8.2	18.5	15.7	7.5	16.4
West Bengal	Birbhum	11.3	5.3	19.3	17.5	9.1	11.2
West Bengal	Barddhaman	9.5	1.1	16.3	28.0	8.1	0.4
West Bengal	Nadia	11.6	14.6	13.4	15.6	6.9	5.7
West Bengal	North 24 Parganas	9.9	7.2	12.1	16.5	5.9	–1.0
West Bengal	Hugli	10.5	17.6	13.7	7.5	6.7	16.2
West Bengal	Bankura	11.7	24.1	23.2	26.7	13.0	14.1
West Bengal	Puruliya	10.6	13.7	33.5	54.5	19.5	23.1
West Bengal	Haora	9.0	4.1	13.6	10.5	7.1	1.8
West Bengal	Kolkata	6.9	6.8	10.1	14.4	5.2	–6.2
West Bengal	South 24 Parganas	11.7	13.8	18.0	15.5	9.1	10.4
West Bengal	Paschim Medinipur	11.0	10.6	18.4	15.1	10.5	24.4
West Bengal	Purba Medinipur	14.3	17.2	16.6	20.2	10.0	0.8
Jharkhand	Garhwa	7.8	9.6	49.5	49.1	54.3	56.6
Jharkhand	Chatra	7.3	8.2	46.5	52.5	49.5	61.9
Jharkhand	Kodarma	7.8	7.6	52.3	34.7	52.5	51.5
Jharkhand	Giridih	8.1	18.1	52.6	51.7	52.7	48.6
Jharkhand	Deoghar	8.7	–0.4	51.4	55.6	51.3	66.3
Jharkhand	Godda	7.5	18.7	48.7	47.6	50.7	39.7
Jharkhand	Sahibganj	5.6	–2.4	41.4	33.8	45.9	39.0
Jharkhand	Pakur	5.3	3.0	38.5	34.0	41.8	34.3
Jharkhand	Dhanbad	10.3	15.5	43.2	46.2	39.5	29.6
Jharkhand	Bokaro	11.4	9.4	46.0	49.1	41.6	42.1
Jharkhand	Lohardaga	6.2	–0.6	39.4	29.3	39.6	42.0
Jharkhand	Purbi Singhbhum	9.7	7.0	36.5	19.0	31.6	22.1
Jharkhand	Palamu	9.2	8.9	48.9	47.6	49.6	22.1
Jharkhand	Latehar	4.8	4.2	41.5	34.0	49.9	64.9
Jharkhand	Hazaribagh	9.7	1.2	46.7	47.2	43.4	53.8
Jharkhand	Ramgarh	11.7	13.0	42.9	55.3	37.8	44.2
Jharkhand	Dumka	8.0	15.8	46.2	49.6	43.3	41.5
Jharkhand	Jamtara	8.7	–4.0	48.0	33.1	46.8	53.8
Jharkhand	Ranchi	9.9	11.2	38.0	42.7	32.6	28.4
Jharkhand	Khunti	6.1	10.1	38.8	40.5	36.7	47.5
Jharkhand	Gumla	5.6	17.9	39.2	69.7	41.4	32.4
Jharkhand	Simdega	5.2	7.8	34.8	35.2	38.2	50.0
Jharkhand	Pashchimi Singhbhum	4.2	3.9	41.4	51.7	41.3	33.1
Jharkhand	Saraikela–Kharsawan	9.0	4.2	45.4	48.6	40.9	47.4

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Odisha	Bargarh	15.2	7.7	31.3	43.6	19.7	38.4
Odisha	Jharsuguda	13.2	12.6	27.3	22.5	16.5	18.3
Odisha	Sambalpur	12.6	22.6	27.9	29.6	16.3	7.6
Odisha	Debagarh	13.4	5.2	32.7	48.6	20.6	23.2
Odisha	Sundargarh	10.3	13.8	27.6	37.8	17.5	14.4
Odisha	Kendujhar	11.0	16.9	34.7	25.9	23.1	15.9
Odisha	Mayurbhanj	10.2	27.0	34.2	34.0	21.3	21.1
Odisha	Baleshwar	15.3	16.9	29.6	21.7	18.2	9.7
Odisha	Bhadrak	14.5	7.0	28.3	15.1	17.9	6.3
Odisha	Kendrapara	14.6	10.9	25.1	41.3	14.4	26.2
Odisha	Jagatsinghapur	17.4	30.9	23.2	33.4	13.6	2.0
Odisha	Cuttack	15.6	11.1	24.3	10.4	14.9	10.9
Odisha	Jajapur	14.5	9.2	26.8	27.8	16.7	–3.9
Odisha	Dhenkanal	15.1	27.3	28.9	31.5	18.2	30.8
Odisha	Anugul	14.9	23.7	31.2	24.8	20.0	18.5
Odisha	Nayagarh	18.0	22.1	31.8	17.5	21.1	19.8
Odisha	Khordha	14.5	13.5	22.8	15.7	14.5	7.5
Odisha	Puri	18.0	31.8	25.5	29.9	15.2	11.3
Odisha	Ganjam	12.6	3.3	34.5	26.8	19.6	9.0
Odisha	Gajapati	7.8	14.5	36.3	22.4	23.5	16.7
Odisha	Kandhamal	9.1	13.7	39.4	36.2	25.9	41.2
Odisha	Baudh	13.3	10.8	42.4	37.8	29.0	28.5
Odisha	Subarnapur	15.7	7.0	36.3	33.3	23.7	31.0
Odisha	Balangir	12.8	–5.4	39.7	40.0	27.1	29.0
Odisha	Nuapada	11.3	–0.5	43.9	49.9	31.0	38.8
Odisha	Kalahandi	11.8	15.8	43.4	55.2	30.7	46.1
Odisha	Rayagada	6.8	0.8	35.8	41.9	24.5	28.2
Odisha	Nabarangapur	7.5	7.4	39.7	50.5	32.3	42.4
Odisha	Koraput	8.1	–5.7	38.7	35.6	27.3	36.2
Odisha	Malkangiri	5.9	8.9	36.6	39.3	30.4	19.5
Chhattisgarh	Koriya	7.6	9.9	34.9	40.3	32.9	33.4
Chhattisgarh	Surguja	7.8	1.5	37.4	42.1	38.5	45.0
Chhattisgarh	Jashpur	8.1	24.0	33.5	49.1	32.4	49.9
Chhattisgarh	Raigarh	9.7	14.5	34.9	32.2	31.1	47.5
Chhattisgarh	Korba	7.3	10.0	35.1	40.8	32.8	30.9
Chhattisgarh	Janjgir – Champa	9.4	13.6	39.4	55.4	34.8	20.3
Chhattisgarh	Bilaspur	7.5	–3.1	39.6	35.5	37.7	34.9
Chhattisgarh	Kabeerdham	8.4	1.6	45.6	29.9	42.7	56.4
Chhattisgarh	Rajnandgaon	7.8	1.1	33.6	18.8	30.5	16.4
Chhattisgarh	Durg	9.9	–6.5	32.7	31.7	28.9	29.9
Chhattisgarh	Raipur	8.6	9.0	36.3	35.8	32.6	26.0
Chhattisgarh	Mahasamund	9.4	16.6	37.0	46.6	32.3	36.8
Chhattisgarh	Dhamtari	10.3	0.8	32.5	47.1	27.2	18.8
Chhattisgarh	Uttar Bastar Kanker	7.1	7.7	31.9	12.5	28.7	13.8
Chhattisgarh	Bastar	6.3	6.3	35.2	45.8	33.2	62.1
Chhattisgarh	Narayanpur	3.7	6.1	31.2	19.0	35.9	21.3
Chhattisgarh	Dakshin Bastar Dantewada	5.0	6.3	31.9	40.8	31.9	27.6
Chhattisgarh	Bijapur	4.2	18.7	32.1	11.4	35.9	29.0
Madhya Pradesh	Sheopur	13.2	14.6	53.9	58.4	47.6	53.2
Madhya Pradesh	Morena	14.6	30.4	54.4	54.5	47.9	55.9
Madhya Pradesh	Bhind	14.7	17.2	50.6	52.8	44.4	79.2
Madhya Pradesh	Gwalior	15.0	4.1	40.8	42.4	33.0	42.7
Madhya Pradesh	Datia	17.1	38.1	51.6	51.6	42.7	55.7
Madhya Pradesh	Shivpuri	13.9	17.4	55.8	71.4	49.1	64.6
Madhya Pradesh	Tikamgarh	15.6	6.7	51.6	49.7	44.4	59.3
Madhya Pradesh	Chhatarpur	14.3	3.4	50.8	51.3	44.5	48.6
Madhya Pradesh	Panna	12.6	20.9	49.6	38.2	43.4	20.3
Madhya Pradesh	Sagar	14.9	5.8	45.7	47.5	37.3	21.6
Madhya Pradesh	Damoh	13.8	12.0	47.8	34.8	39.7	20.9
Madhya Pradesh	Satna	14.5	19.6	46.0	42.6	36.4	24.8
Madhya Pradesh	Rewa	14.2	17.5	46.6	66.5	36.4	31.5
Madhya Pradesh	Umaria	12.0	4.0	45.6	43.9	37.3	53.0

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Madhya Pradesh	Neemuch	18.6	6.6	50.8	25.4	35.2	5.8
Madhya Pradesh	Mandsaur	18.2	28.3	51.6	32.8	37.3	–1.0
Madhya Pradesh	Ratlam	13.5	11.5	46.8	46.7	36.2	15.2
Madhya Pradesh	Ujjain	16.0	23.0	47.2	48.0	34.5	33.3
Madhya Pradesh	Shajapur	16.9	11.0	55.2	60.0	45.4	40.0
Madhya Pradesh	Dewas	15.4	16.6	48.1	49.1	38.0	42.8
Madhya Pradesh	Dhar	12.2	15.9	45.6	49.8	37.5	47.9
Madhya Pradesh	Indore	13.8	13.2	34.7	21.5	26.7	36.8
Madhya Pradesh	Khargone (West Nimar)	13.5	7.3	46.0	44.2	37.2	66.7
Madhya Pradesh	Barwani	7.9	3.2	40.7	35.9	41.1	44.8
Madhya Pradesh	Rajgarh	15.9	24.1	52.9	79.0	43.9	58.3
Madhya Pradesh	Vidisha	13.7	21.3	49.2	48.5	43.9	55.8
Madhya Pradesh	Bhopal	14.4	19.0	32.9	15.0	24.8	24.9
Madhya Pradesh	Sehore	15.9	8.7	50.2	50.8	41.2	49.5
Madhya Pradesh	Raisen	14.0	10.3	45.6	52.0	40.6	39.8
Madhya Pradesh	Betul	14.1	21.2	38.0	37.8	29.0	32.5
Madhya Pradesh	Harda	14.7	14.6	43.8	58.9	35.3	38.5
Madhya Pradesh	Hoshangabad	14.9	17.1	41.2	28.0	33.2	21.8
Madhya Pradesh	Katni	12.9	12.1	46.2	38.8	36.9	31.2
Madhya Pradesh	Jabalpur	13.9	8.8	33.8	25.8	24.3	17.6
Madhya Pradesh	Narsimhapur	16.6	19.0	41.5	55.2	32.6	24.7
Madhya Pradesh	Dindori	9.8	13.1	43.6	44.7	34.1	21.0
Madhya Pradesh	Mandla	11.5	2.8	41.3	50.6	28.9	29.0
Madhya Pradesh	Chhindwara	14.0	4.5	37.8	33.4	27.2	33.4
Madhya Pradesh	Seoni	15.0	21.9	38.3	36.8	26.5	33.8
Madhya Pradesh	Balaghat	14.9	8.4	37.1	32.9	24.3	10.8
Madhya Pradesh	Guna	13.5	32.2	52.6	60.3	47.7	44.4
Madhya Pradesh	Ashoknagar	14.1	7.0	54.2	53.5	48.4	52.2
Madhya Pradesh	Shahdol	11.5	–1.1	42.6	52.8	34.1	22.7
Madhya Pradesh	Anuppur	11.4	13.5	42.4	62.0	32.4	37.6
Madhya Pradesh	Sidhi	10.3	6.5	47.4	49.2	41.6	37.8
Madhya Pradesh	Singrauli	10.2	14.6	51.2	34.8	48.9	42.2
Madhya Pradesh	Jhabua	6.1	1.1	41.8	30.9	44.7	21.3
Madhya Pradesh	Alirajpur	5.1	12.4	36.1	54.1	42.5	48.9
Madhya Pradesh	Khandwa (East Nimar)	12.3	12.5	46.8	36.6	39.2	56.9
Madhya Pradesh	Burhanpur	13.4	6.3	42.2	46.7	32.9	42.5
Gujarat	Kachchh	19.2	22.4	46.1	31.2	41.9	26.4
Gujarat	Banas Kantha	19.8	19.6	54.5	67.5	50.3	70.5
Gujarat	Patan	20.3	0.1	48.9	35.4	44.2	79.9
Gujarat	Mahesana	23.1	27.1	38.9	50.5	34.2	57.6
Gujarat	Sabar Kantha	19.0	36.7	46.1	48.0	42.6	53.6
Gujarat	Gandhinagar	21.3	30.2	38.5	40.2	34.0	32.2
Gujarat	Ahmadabad	19.3	10.0	32.6	31.4	29.6	26.8
Gujarat	Surendranagar	21.6	27.6	47.6	60.0	43.8	60.3
Gujarat	Rajkot	22.6	7.9	34.9	24.8	32.6	37.0
Gujarat	Jamnagar	21.9	10.1	40.5	36.7	36.4	21.8
Gujarat	Porbandar	21.2	29.0	38.7	42.8	35.0	14.1
Gujarat	Junagadh	23.4	–0.3	40.7	56.0	35.2	41.3
Gujarat	Amreli	24.4	21.9	40.4	56.8	36.4	50.1
Gujarat	Bhavnagar	22.2	31.4	45.2	40.3	41.2	38.8
Gujarat	Anand	21.3	15.8	40.1	13.5	32.7	67.1
Gujarat	Kheda	20.9	49.1	43.8	59.8	38.1	35.3
Gujarat	Panch Mahals	17.5	23.1	49.1	50.9	45.8	29.6
Gujarat	Dohad	9.9	13.1	43.5	34.2	51.4	25.0
Gujarat	Vadodara	19.1	–0.9	35.5	40.8	31.9	23.7
Gujarat	Narmada	15.7	15.0	37.2	45.8	35.0	28.9
Gujarat	Bharuch	20.1	24.3	34.2	27.6	27.0	18.9
Gujarat	The Dangs	10.3	23.0	33.8	24.5	40.4	23.7
Gujarat	Navsari	19.2	13.4	27.5	30.3	22.8	7.1
Gujarat	Valsad	17.7	14.8	33.3	48.3	31.9	38.1
Gujarat	Surat	22.0	40.4	33.3	31.1	31.6	40.8
Gujarat	Tapi	16.5	5.0	29.7	6.4	25.7	3.2

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Daman & Diu	Diu	9.6	11.5	36.6	44.8	23.3	21.5
Daman & Diu	Daman	24.8	22.9	51.4	43.2	45.0	46.8
Dadra & Nagar Haveli	Dadra & Nagar Haveli	12.4	12.4	38.8	38.8	22.3	22.3
Maharashtra	Nandurbar	10.1	18.5	34.9	40.4	30.2	18.0
Maharashtra	Dhule	12.8	29.6	33.2	33.2	25.6	29.4
Maharashtra	Jalgaon	14.5	28.4	32.9	41.1	24.9	40.7
Maharashtra	Buldana	17.1	18.9	33.7	29.3	25.0	11.0
Maharashtra	Akola	15.0	9.8	25.7	28.7	20.1	17.1
Maharashtra	Washim	17.0	22.9	34.0	32.5	25.5	38.5
Maharashtra	Amravati	14.9	3.7	23.8	17.1	18.8	22.5
Maharashtra	Wardha	16.1	19.3	23.4	9.6	18.7	–0.1
Maharashtra	Nagpur	11.6	1.6	20.9	32.2	17.0	11.3
Maharashtra	Bhandara	15.9	34.3	26.9	22.4	18.7	6.9
Maharashtra	Gondiya	14.9	8.6	28.3	22.6	20.5	17.9
Maharashtra	Gadchiroli	14.3	18.8	30.9	–1.1	21.9	8.5
Maharashtra	Chandrapur	14.2	2.9	26.8	14.6	20.0	28.5
Maharashtra	Yavatmal	16.1	11.2	30.4	22.6	22.1	13.8
Maharashtra	Nanded	15.7	4.3	38.3	31.7	28.8	14.9
Maharashtra	Hingoli	16.0	7.3	40.2	72.7	31.6	60.2
Maharashtra	Parbhani	15.8	3.3	40.7	40.2	30.9	23.4
Maharashtra	Jalna	14.8	14.9	43.3	58.9	34.0	49.7
Maharashtra	Aurangabad	15.2	23.0	36.4	48.2	27.1	57.4
Maharashtra	Nashik	13.5	27.4	29.7	36.3	23.6	20.9
Maharashtra	Thane	11.7	17.6	25.5	9.6	21.5	14.1
Maharashtra	Mumbai Suburban	11.8	13.5	21.9	30.4	17.7	22.9
Maharashtra	Mumbai	12.1	12.0	20.8	20.3	15.6	4.7
Maharashtra	Raigarh	14.2	2.6	27.3	7.3	20.2	–3.8
Maharashtra	Pune	14.0	6.6	24.5	24.8	19.8	8.6
Maharashtra	Ahmadnagar	15.4	3.8	32.8	14.3	26.1	28.6
Maharashtra	Bid	17.9	24.9	38.9	33.5	30.4	24.7
Maharashtra	Latur	15.8	4.1	34.9	56.9	27.9	37.0
Maharashtra	Osmanabad	17.1	6.7	35.0	37.5	27.5	41.5
Maharashtra	Solapur	15.6	25.9	34.2	36.5	25.3	45.2
Maharashtra	Satara	15.8	14.1	27.4	28.6	19.1	24.7
Maharashtra	Ratnagiri	11.6	10.3	28.4	25.8	16.4	2.6
Maharashtra	Sindhudurg	14.7	30.6	24.7	25.4	16.1	7.6
Maharashtra	Kolhapur	15.3	4.1	28.0	31.2	20.1	34.9
Maharashtra	Sangli	15.4	28.2	28.3	51.7	20.9	25.6
Telangana	Adilabad	2.0	0.9	13.2	18.9	4.7	16.9
Telangana	Nizamabad	1.6	–0.1	13.0	9.5	2.8	–3.4
Telangana	Karimnagar	3.3	8.9	12.7	–2.9	4.7	4.4
Telangana	Medak	2.2	–9.9	14.8	6.9	6.1	–0.1
Telangana	Hyderabad	–2.8	14.8	4.6	26.1	–0.1	–1.5
Telangana	Rangareddy	–0.2	6.4	9.8	3.5	5.3	1.9
Telangana	Mahbubnagar	1.9	–6.4	15.9	35.0	6.6	25.9
Telangana	Nalgonda	3.2	2.0	14.0	5.5	5.5	–7.8
Telangana	Warangal	3.0	14.9	12.4	5.2	4.3	–3.7
Telangana	Khammam	1.1	–16.1	7.6	10.2	0.7	8.1
Andhra Pradesh	Srikakulam	2.4	9.7	12.7	7.7	3.7	3.1
Andhra Pradesh	Vizianagaram	2.4	–8.1	12.5	5.1	4.2	–0.5
Andhra Pradesh	Visakhapatnam	0.2	7.4	9.5	5.4	3.2	–3.1
Andhra Pradesh	East Godavari	0.6	–10.3	5.5	4.0	1.5	–2.6
Andhra Pradesh	West Godavari	1.9	22.4	5.3	6.3	1.4	2.3
Andhra Pradesh	Krishna	1.4	21.6	6.4	–0.9	1.8	–4.6
Andhra Pradesh	Guntur	1.9	–16.7	8.8	10.9	2.6	–3.0
Andhra Pradesh	Prakasam	3.2	–7.2	13.0	15.2	4.8	5.3
Andhra Pradesh	Sri Potti Sriramulu Nellore	1.2	–5.5	8.0	6.6	2.3	6.4
Andhra Pradesh	Y.S.R.	2.1	8.7	13.6	8.2	5.0	12.1
Andhra Pradesh	Kurnool	2.2	–5.1	14.5	22.3	4.5	14.8
Andhra Pradesh	Anantapur	3.3	–7.4	13.1	36.7	4.5	12.5
Andhra Pradesh	Chittoor	2.3	15.5	10.4	6.0	3.2	0.0

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Karnataka	Belgaum	10.5	17.5	23.7	41.8	19.4	36.2
Karnataka	Bagalkot	6.5	–2.9	24.7	29.2	21.1	35.6
Karnataka	Bijapur	9.7	22.5	27.5	27.5	23.3	20.7
Karnataka	Bidar	9.7	9.9	22.2	45.5	20.8	13.1
Karnataka	Raichur	6.1	8.4	23.5	42.3	19.6	43.9
Karnataka	Koppal	6.6	17.3	24.2	10.8	20.2	30.2
Karnataka	Gadag	8.1	17.4	22.6	46.9	16.1	19.7
Karnataka	Dharwad	7.7	17.4	17.3	48.6	13.1	12.4
Karnataka	Uttara Kannada	10.5	13.3	16.1	3.0	11.6	3.7
Karnataka	Haveri	9.7	10.2	18.5	17.2	15.4	35.0
Karnataka	Bellary	5.4	13.9	20.5	14.6	18.9	23.5
Karnataka	Chitradurga	9.4	12.4	17.6	24.1	13.8	23.9
Karnataka	Davanagere	8.2	9.4	16.1	16.1	12.7	9.8
Karnataka	Shimoga	9.6	–2.4	14.8	–5.0	10.9	5.4
Karnataka	Udupi	2.0	–1.4	7.6	2.2	–0.5	13.2
Karnataka	Chikmagalur	10.6	–4.9	14.9	6.7	11.1	–8.8
Karnataka	Tumkur	11.5	7.1	18.6	18.2	13.1	13.6
Karnataka	Bangalore	8.3	2.1	12.7	9.8	11.2	4.9
Karnataka	Mandya	10.1	10.0	18.3	–0.9	12.5	–8.6
Karnataka	Hassan	12.5	12.5	18.3	11.8	13.0	1.0
Karnataka	Dakshina Kannada	7.1	–2.5	11.0	10.3	4.5	–15.0
Karnataka	Kodagu	11.1	23.7	12.7	–0.6	9.1	21.2
Karnataka	Mysore	9.0	8.0	14.4	4.8	10.4	5.2
Karnataka	Chamarajanagar	8.8	0.6	14.8	8.9	11.0	4.0
Karnataka	Gulbarga	8.0	–11.2	24.5	27.7	22.2	25.6
Karnataka	Yadgir	5.3	1.3	24.1	20.0	24.1	29.0
Karnataka	Kolar	10.0	9.9	17.8	28.1	14.2	16.0
Karnataka	Chikkaballapura	10.7	22.5	18.9	8.8	14.9	7.3
Karnataka	Bangalore Rural	11.3	21.1	17.4	13.3	12.8	10.9
Karnataka	Ramanagara	9.7	0.7	17.7	21.4	12.8	0.6
Goa	North Goa	21.8	18.5	1.0	–3.8	12.6	12.9
Goa	South Goa	19.1	22.4	–0.8	4.0	11.7	11.4
Lakshadweep	Lakshadweep	–0.5	–0.5	7.1	7.1	19.4	19.4
Kerala	Kasaragod	0.6	–3.0	4.8	14.1	3.2	6.4
Kerala	Kannur	–2.8	–10.0	1.5	10.6	1.5	5.6
Kerala	Wayanad	6.1	4.7	7.9	20.2	8.3	19.3
Kerala	Kozhikode	0.0	2.8	3.6	2.8	3.6	1.6
Kerala	Malappuram	–0.5	5.5	–1.4	9.3	–1.9	1.2
Kerala	Palakkad	3.2	13.7	6.2	–3.6	5.8	–1.3
Kerala	Thrissur	10.0	12.5	4.1	1.1	3.1	0.0
Kerala	Ernakulam	7.0	29.8	8.9	2.8	12.5	–4.6
Kerala	Idukki	10.2	23.5	10.4	9.5	13.4	–1.6
Kerala	Kottayam	9.6	–1.9	8.7	10.2	12.9	–6.8
Kerala	Alappuzha	3.9	–7.9	6.3	2.4	8.2	–5.5
Kerala	Pathanamthitta	6.6	–0.9	5.3	2.6	6.5	44.5
Kerala	Kollam	2.8	–1.1	5.2	–0.9	5.8	12.6
Kerala	Thiruvananthapuram	3.5	–7.5	6.2	–3.5	6.7	18.1
Tamil Nadu	Thiruvallur	3.6	–5.2	8.3	7.6	3.2	–2.2
Tamil Nadu	Chennai	2.1	13.5	6.0	2.4	2.4	–2.0
Tamil Nadu	Kancheepuram	4.9	10.5	8.3	7.2	2.4	–6.1
Tamil Nadu	Vellore	4.4	0.7	9.6	8.0	2.5	8.3
Tamil Nadu	Tiruvannamalai	7.4	8.0	13.1	12.6	4.0	–4.0
Tamil Nadu	Viluppuram	7.2	10.7	13.0	24.5	3.9	4.9
Tamil Nadu	Salem	7.1	16.2	12.4	13.2	5.0	5.7
Tamil Nadu	Namakkal	7.2	7.5	11.6	5.6	3.8	–10.1
Tamil Nadu	Erode	7.0	12.7	12.0	3.5	3.7	–4.4
Tamil Nadu	The Nilgiris	2.1	7.9	6.2	–0.2	–2.1	9.9
Tamil Nadu	Dindigul	6.6	20.5	11.8	9.0	3.5	–1.6
Tamil Nadu	Karur	6.5	3.6	12.6	18.1	3.1	3.8
Tamil Nadu	Tiruchirappalli	4.6	0.1	9.0	31.7	2.1	7.4
Tamil Nadu	Perambalur	4.7	–12.9	10.0	21.2	0.6	–9.8
Tamil Nadu	Ariyalur	7.3	21.1	14.0	19.0	3.0	1.8

Table A-5: (Continued)

State	District	Parity 1 (Model)	Parity 1 (Direct)	Parity 2 (Model)	Parity 2 (Direct)	Parity 3 or more (Model)	Parity 3 or more (Direct)
Tamil Nadu	Cuddalore	5.6	13.6	10.5	17.4	2.7	12.3
Tamil Nadu	Nagapattinam	4.1	14.3	6.5	8.6	–1.0	4.2
Tamil Nadu	Thiruvarur	4.7	5.9	6.6	3.8	–0.8	–4.8
Tamil Nadu	Thanjavur	4.1	14.8	7.8	11.1	0.2	5.3
Tamil Nadu	Pudukkottai	6.3	9.7	12.0	18.6	2.4	3.8
Tamil Nadu	Sivaganga	5.3	–8.3	11.1	5.8	1.7	0.6
Tamil Nadu	Madurai	4.9	5.8	9.8	8.9	3.2	–4.9
Tamil Nadu	Theni	5.9	14.8	11.4	4.7	2.8	12.7
Tamil Nadu	Virudhunagar	5.2	–3.9	10.9	11.9	2.9	11.5
Tamil Nadu	Ramanathapuram	6.1	–6.3	9.9	–0.2	0.7	4.4
Tamil Nadu	Thoothukkudi	3.9	2.1	7.2	7.9	0.8	–0.5
Tamil Nadu	Tirunelveli	5.1	–2.7	9.4	4.7	1.3	–4.1
Tamil Nadu	Kanniyakumari	2.3	–6.8	4.9	1.6	0.8	–3.6
Tamil Nadu	Dharmapuri	8.0	16.3	14.4	13.2	5.4	16.2
Tamil Nadu	Krishnagiri	7.2	–10.4	12.5	11.1	4.4	4.1
Tamil Nadu	Coimbatore	4.4	–2.9	8.0	3.6	2.9	–3.7
Tamil Nadu	Tiruppur	6.0	0.7	10.6	5.5	3.5	20.0
Puducherry	Yanam	–1.6	11.3	7.4	2.7	3.8	5.6
Puducherry	Puducherry	0.6	–5.5	9.8	3.6	3.7	4.4
Puducherry	Mahe	–13.3	–5.6	–3.7	5.5	–6.7	–11.4
Puducherry	Karaikal	0.1	–14.4	8.1	9.7	1.5	3.6
Andaman & Nicobar Islands	Nicobars	24.0	18.1	48.4	26.6	55.7	5.6
Andaman & Nicobar Islands	North & Middle Andaman	30.2	12.4	44.2	5.5	49.9	17.5
Andaman & Nicobar Islands	South Andaman	28.5	19.5	39.1	10.0	45.2	–3.0