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*Demographic Outcomes, Economic Development and Women's Agency**

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DEMOGRAPHIC OUTCOMES, ECONOMIC DEVELOPMENT AND WOMEN'S AGENCY*

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ABSTRACT

This paper examines the determinants of fertility, child mortality and gender bias in child mortality in India using district-level data from the 1981 census. The findings highlight the powerful effects of variables relating to women's agency (e.g. female literacy and female labour force participation) on mortality and fertility. Further, higher levels of female literacy and female labour force participation are associated with significantly lower levels of female disadvantage in child survival. In contrast, variables relating to the general level of development and modernization have relatively weak effects on demographic outcomes.

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DEMOGRAPHIC OUTCOMES, ECONOMIC DEVELOPMENT AND WOMEN'S AGENCY

Introduction

India is a country of striking demographic diversity. Even broad comparisons between different states within the country bring out enormous variations in basic demographic indicators. At one end of the scale, Kerala has demographic features that are more typical of a middle-income country than of a poor developing economy, including a life expectancy at birth of 72 years, an infant mortality of only 17 per 1,000 live births, a total fertility rate below the replacement level (1.8 in 1991), and a female-male ratio well above unity (1.04 in 1991). At the other end, the large north Indian states find themselves in the same league as the least developed countries of the world in terms of the same indicators. In Uttar Pradesh, for instance, the infant mortality rate is six times as high as in Kerala, the total fertility rate is as high as 5.1, and the female-male ratio (879 in 1991) is lower than that of any country in the world.[1]

India is also a country of rapid demographic change. As in many other developing countries, mortality rates in India have significantly declined in recent decades, e.g. the infant mortality rate has been reduced by about 50 per cent since 1961. The same period has seen

[1] The figures cited in this paragraph are taken from Drèze and Sen (1995), Statistical Appendix, and are based on Census and Sample Registration System data. A few countries of West Asia (e.g. Kuwait and the United Arab Emirates) actually have a lower female-male ratio than Uttar Pradesh, but this is due to exceptionally high levels of male in-migration.

a sustained decline in fertility, particularly in the South Indian states (in Tamil Nadu, for instance, the total fertility rate declined from 3.5 to 2.2 during the 1980s). There have also been significant changes in the relative survival chances of men and women.[2]

Apart from being of much interest in themselves, these interregional and intertemporal variations provide useful opportunities to study the determinants of demographic outcomes in India. This paper is an attempt to examine some of the relevant relationships based on a cross-section analysis of district-level data for 1981. A more detailed presentation and discussion of this analysis can be found in Guio (1994) and Murthi, Guio and Drèze (1995).[3]

1. Framework

The reference year for this analysis is 1981. For that year, a fair amount of district-level information is available from the 1981 census and related sources. Table la presents a list of the variables used along with their definitions. The relevant information is available for 296 districts, all located in 14 of India's 15 largest states (these 14 states had a total of 326 districts in 1981, and accounted for 94 per cent of the total population of India). The sample averages of the variables used in the analysis are presented in Table 1a, while the state averages are in Table lb.

The regressions presented below may be interpreted as the "reduced form" of a system

[2] On the latter, see e.g. Dyson (1988).

[3] For related analyses based on Indian district data, see Rosenzweig and Schultz (1982), Gulati (1992), Kishor (1993), Khemani (1994).

of simultaneous equations which determines three endogenous variables: the total fertility rate (TFR), the level of child mortality for both sexes combined (Q5), and the extent of female disadvantage in child survival (FD), as measured by the proportionate difference between female and male child mortality (or, more precisely, by $FD = [Q5_f - Q5_m]/Q5_f$, where $Q5_f$ and $Q5_m$ are the levels of female and male child mortality, respectively. The other variables listed in Table la are the independent variables.[4]

2. Poverty Estimates

The variable we have used to measure "poverty" requires comment. Poverty indicators at the district level are not available in India. However, Jain et al (1988) have computed 1972-3 poverty measures for the National Sample Survey "regicons", which are intermediate units between the state and the district. The 296 districts included in our analysis belong to 51 different regions, and the poverty indicator used for each district is the "Sen index" of poverty for the region in which the district in question is situated. This procedure involves the implicit assumption that intraregional variations in poverty are small. This is not implausible, since the NSS regions are meant to be relatively homogeneous in terms of agro-climatic and socioeconomic features.[5]

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[4] We have also examined the effects of other independent variables, e.g. relating to the structure of economic activity. But the variables for which data were available, other than those included in Table la, were found to have no significant effect on mortality, fertility or gender bias; nor does their inclusion affect the basic results presented in this appendix.

[5] An alternative approach is to carry out the entire analysis at the level of "regions" rather than that of districts. This approach has the advantage that it involves an accurate poverty indicator for each observation, but reducing the number of observations from 296 to 51 also entails a major loss of information. As it turns out,

Two further remarks are due concerning the poverty variable. First, the poverty estimates calculated by Jain et al (1988) relate to rural areas specifically. For want of information on the level of poverty in rural and urban areas combined, we have used these estimates, and also included a separate independent variable indicating the level of urbanization (see Table la). Second, the reference year for this variable is 1972-3 (rather than 1981, as with the other variables). This is the only year, prior to 1981, for which the relevant estimates are available. The use of 1972-3 as the reference year for the poverty variable seems legitimate, since the 1981 mortality estimates are based on birth and death information pertaining to the late 1970s, and since poverty levels in different regions during that period must have been quite close to those observed in 1972-3. As a matter of fact, the relative position of different regions in terms of poverty levels does seem to be reasonably stable in the short run. Replacing the Sen index for 1972-3 with the Sen index for 1987-8 (also available for NSS regions) has little effect on the results presented in this paper.[6]

3. Estimation Method

The regression equations were initially estimated by ordinary least squares. However, statistical tests indicate that the error terms are spatially correlated, i.e. the error terms of adjacent districts are correlated. We therefore present estimates based on a more general

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the main results obtained under this alternative approach are similar to those obtained on the basis of district-level analysis. In this appendix, we present the district-level results; the region-level results can be found in Murthi, Guio and Drèze (1995).

[6] To our knowledge, 1972-3 and 1987-8 are the only two years for which poverty indicators have been calculated for the NSS regions.

model in which the errors may be spatially correlated.[7] In this model, the error terms are assumed to have the following structure:

$$u = \lambda.W.u + e$$

where u_i is the error term for the ith observation, k is a scalar measure of the intensity of spatial correlation, and W is a matrix of spatial weights with entry "1" in row i and column j if districts i and j are adjacent, and "0" otherwise. Estimation is based on the principle of maximum likelihood. Interestingly, the choice of model (with or without spatial correlation) does not affect the broad conclusions of the analysis.

We found no evidence of non-linearity in the relationships, except in the equation for female disadvantage. Visual examination and non-parametric methods suggested that the relationship between female disadvantage and the individual independent variables follows a logistic pattern. We therefore used a logistic transformation of female disadvantage (FD) as defined earlier as the dependent variable in that regression equation.

4. Basic Results: Child Mortality and Gender Bias

Table 2 presents the main regression results. Apart from indicating the signs of different coefficients, and whether they are statistically significant at the 5% level, Table 2

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[7] For further details of this approach, see Anselin (1988). The method of estimation is fully described in Murthi, Guio and Drèze (1995). For a similar application of this method, see Kishor (1993).

makes it possible to assess the quantitative effects of different variables on child mortality and fertility (by combining the information given in Table 2 with the mean values presented in Table la). As far as child mortality is concerned, the following observations deserve explicit mention:

(1) Female literacy: Female literacy has a negative, large and statistically significant effect on child mortality. Female literacy also has a negative (and statistically significant) effect on FD, the extent of female disadvantage in child survival. The last result contrasts with the position, taken by several other researchers, according to which higher female literacy may be a tool of intensified discrimination against female children.[8]

It is worth noting that higher female literacy reduces child mortality, and anti-female bias in child survival, independently of male literacy. Male literacy also has a negative effect on child mortality (independently of female literacy), but the effect of male literacy is much smaller than that of female literacy, and is not statistically significant. Male literacy has a significant effect on the extent of gender bias in child survival, in the direction of enhancing female disadvantage.[9]

(2) Female labour force participation: Female labour force participation has no

[8] See e.g. Das Gupta (1987), Amin (1990), Basu (1992), Gupta et al (1993); for the opposite view, see Caldwell et al (1989) and Bourne and Walker (1991).

[9] Interestingly, the last statement remains true even if female literacy is dropped from the regression.

statistically significant effect on the absolute level of child mortality.[10] This is plausible, given the opposite effects of different links between female labour force participation and child mortality. For instance, greater involvement in remunerative employment gives women greater control over household resources, and this may be expected to have a positive influence on child health. On the other side, to the extent that female employment outside the home imposes a "double burden" on women, and reduces the time available for child care, it may also some have some negative effects on child survival.

Higher female labour force participation unambiguously reduces the extent of gender bias in child survival, and this effect is statistically significant. There are a number of possible reasons for this link, including that higher female labour force participation: (i) raises the status of women in society, and therefore the value attached to young girls; (ii) raises the returns to "investment" in girls; (iii) lowers dowry levels, and therefore reduces the costs of bringing up daughters; (iv) makes women less dependent on adult sons for security in old age, and therefore reduces boy preference; (v) raises the bargaining power of adult women, and their ability to resist male pressure to discriminate in favour of boys.[11]

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[10] In an earlier analysis of 1981 district data, Sunita Kishor (1993) found that female labour force participation has a positive and statistically significant effect on both female and male child mortality. The contrast between that result and our own may be due to the fact that, in the analysis presented here, the levels of poverty and female literacy are included as explanatory variables. Indeed, when examining the effects of female labour force participation on child mortality, it is important to control for the economic and social disadvantages that motivate many women to seek employment. For further discussion of these issues, see Guio (1994) and Murthi, Guio and Drèze (1995).

[11] Some of these hypotheses have been discussed by Miller (1981), Rosenzweig and Schultz (1982), Drèze and Sen (1989), Kishor (1993), among many others. For reviews of these and other studies, see Guio (1994) and Kishor (1994).

(3) Urbanization: Urbanization has a negative and statistically significant effect on child mortality. The effect on male mortality is larger than the effect on female mortality, so that urbanization is also associated with higher levels of female disadvantage in child survival, but this effect is not statistically significant.

4) Medical facilities: Medical facilities have essentially the same effects as urbanization: they reduce child mortality, and amplify the female disadvantage in child survival, but the last effect is not statistically significant.

(5) Poverty: As expected, higher levels of poverty are associated with higher levels of child mortality. Less evidently, there is a negative and statistically significant association between poverty and FD, i.e. higher levels of poverty go with lower levels of female disadvantage in child survival. This is consistent with the observation, made in a number of studies, that anti-female discrimination may be particularly strong among privileged classes.[12]

6) Scheduled tribes: A higher proportion of "scheduled tribes" in the population reduces the extent of anti-female bias in child survival, and this effect is statistically significant. It is interesting that this variable has a significant effect even after controlling for female labour force participation (which is generally higher among scheduled tribes than in the population as a whole). This suggests that tribal societies have other features that enhance the relative survival chances of female children. Examples of possibly relevant features are kinship systems and property rights.

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[12] For some relevant studies, see Miller (1981, 1993), Das Gupta (1987), Krishnaji (1987), Basu (1992), Dasgupta (1993).

It is also worth noting that the absolute level of child mortality seems to be relatively low in districts with a high proportion of scheduled tribes, even after controlling for poverty and literacy. This is consistent with the common notion that tribal lifestyles have some healthy aspects (e.g. relatively low levels of crowding and pollution). But the precise basis of this statistical association requires further investigation.

(7) Scheduled castes: There is no significant association between the proportion of scheduled castes in the population and the extent of female disadvantage in child survival. This is in line with the fact that female-male ratios among scheduled castes, which used to be higher than average, are now very similar to those of the population as a whole.[13] In contrast with the corresponding finding for scheduled tribes, child mortality levels among scheduled castes appear to be comparatively high, even after controlling for poverty and literacy (but this association is not statistically significant).

(8) Regional "dummies":[14] Even after controlling for the other variables, the southern region has considerably lower levels of child mortality. This is particularly the case for girls, so much so that female children have a survival advantage over boys in that region (see Table lb). In both respects (child mortality and gender bias), the contrast between the southern region and the rest of the country is statistically significant.

The particular demographic features of south India, including the relatively favourable

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[13] See Agnihotri (1994) and Drèze and Sen (1995), chapter 7.

[14] In the regressions presented in Table 2, the "control" region is northern India, consisting of Haryana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh.

survival chances of female children, have been much discussed in the literature. The findings presented in Table 2 suggest that the demographic contrast between south India and the rest of the country cannot be explained entirely in terms of female literacy, female labour force participation, and other variables included in the regression. This is consistent with the view that differences in kinship systems, property rights, and related features of the economy and society not captured in this analysis (for lack of adequate statistical information), play an important role in this north-south contrast.[15]

5. Fertility

Table 2 includes further results relating to the determinants of the total fertility rate (TFR). Female literacy and female labour force participation have a negative and statistically significant effect on TFR. Fertility is also significantly lower in the southern region, and in districts with a high proportion of scheduled tribes. None of the other variables is statistically significant.

6. Discussion

The findings summarised in this note sharply bring out the role of women's agency and empowerment in reducing mortality, fertility and gender inequality.

[15] On these different influences, see the studies cited in Guio (1994) and Drèze and Sen (1995); also Alaka Basu (1992), Sunita Kishor (1993), Satish Agnihotri (1994), and Bina Agarwal (1994), among other recent contributions. The persistence of regional influences on relative survival chances, even after controlling for a wide range of district characteristics on which quantitative data are available, has been noted earlier by Sunita Kishor (1993).

Consider, for instance, the determinants of gender bias in child mortality rates. It is rather striking that, while the variables directly relating to women's agency (specifically, the female literacy rate and female labour force participation) have a strong and statistically significant negative impact on female disadvantage (FD), those relating to the general level of economic development and modernization in the society as a whole (e.g. poverty, urbanization, male literacy and medical facilities) do nothing to improve the relative survival chances of girls vis-a-vis boys. In fact, to the extent that these variables do have a statistically significant influence on female disadvantage, this influence turns out to go in the "wrong" direction in each case, i.e. higher levels of male literacy and lower levels of poverty are both associated with a larger female disadvantage. In so far as a positive connection does exist in India between the level of development and reduced gender bias in survival, it seems to work through variables that are directly related to women's agency, such as female literacy and female labour force participation. [16]

Similarly, while indicators of development such as male literacy, reduced poverty, urbanization and the spread of medical facilities do have positive effects on absolute levels of child survival, these effects are relatively small compared with the powerful effect of female literacy. This point is illustrated in Table 3, which indicates how the predicted values

[16] In the light of these findings, the decline of India's female-male ratio since 1901 (on which see Drèze and Sen, 1995, and the literature cited there) may not be much of a mystery. There has been much progress, in the intervening years, in terms of general development, but comparatively little expansion of women's agency. There is little evidence, for instance, of a substantial increase in female labour force participation over time, and while female literacy has slowly increased, the crude female literacy rate remained as low as 22 per cent in 1981. The fact that, taken together, these different developments have gone hand in hand with a decline in the female-male-ratio is quite consistent with the cross-section findings summarised in this paper.

of Q5 and FD respond to changes in female literacy when the other variables are kept at their mean value (and similarly with male literacy and poverty). It can be seen that the influence of female literacy on child mortality is quite large, in comparison with that of male literacy or poverty.

The same point also emerges in connection with the determinants of fertility. In fact, in this case, none of the variables relating to the general level of development and modernization is statistically significant. By contrast, female literacy and female labour force participation appear to be crucial determinants of the total fertility rate. As shown in Table 3, for instance, female literacy alone is a considerable force in reducing fertility. Here again, the message seems to be that some variables relating to women's agency (in this case, female literacy) often play a much more important role in demographic outcomes than variables relating to the general level of development.

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TABLE 1a Variable Definitions and Sample Summary Statistics

Variable	Definition	Mean	St. Deviation
TFR	Total fertility rate, 1981	5.02	0.95
Q5	Under-five mortality rate, 1981: probability that a child will die before the fifth birthday (x 1,000)	156.91	42.84
FD	Female disadvantage in child survival, 1981, defined as $FD=(Q5_f - Q5_m)/Q5_f$ (%)	5.36	10.74
Female literacy	Crude female literacy rate, 1981 (%)	22.08	13.71
Male literacy	Crude male literacy rate, 1981 (%)	44.77	12.20
Female labour force participation	Proportion of "main workers" in the female population, 1981(%)	14.54	10.49
Urbanization	Proportion of the population living in urban areas, 1981 (%)	19.81	12.02
Poverty	Sen index of rural poverty, 1972-3, for the "region" in which the district is situated (x 100)	17.60	8.50
Medical facilities	Proportion of villages with some medical facilities(%)	21.36	20.50
Scheduled castes	Proportion of scheduled-caste persons in the population, 1981 (%)	16.01	6.95
Scheduled tribes	Proportion of scheduled-tribe persons in the population, 1981 (%)	8.04	13.51
SOUTH	Dummy variable, with value 1 for districts in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu	0.23	0.41
EAST	Dummy variable, with value 1 for districts in Bihar, Orissa and West Bengal	0.16	0.37
WEST	Dummy variable, with value 1 for districts in Gujarat and Maharashtra	0.14	0.35

Sources: See Drèze and Murthi (forthcoming). Most of the information is derived from 1981 census data. The Sen index of rural poverty is taken from Jain et al (1988).

TABLE 1b: State-level averages of the regression variables

	TFR	Q5	FD	Female literacy	Male literacy	Female labour force participation	Urbanization	Medical facilities	Poverty	Scheduled Caste	Scheduled Tribe
Andhra Pradesh	4.35	138.6	-6.2	19.4	38.4	27.5	22.8	25.9	15.8	15.0	6.4
Bihar	5.24	141.1	14.4	13.4	37.6	8.6	11.6	18.1	24.8	14.9	1.8
Gujarat	4.80	126.1	6.2	30.9	53.1	10.7	28.2	28.2	15.5	7.4	11.0
Haryana	5.40	139.0	17.5	21.5	48.0	4.5	21.4	58.2	3.7	18.9	0.0
Karnataka	4.68	142.3	-3.4	27.1	48.0	19.9	24.5	13.4	14.5	14.2	5.1
Kerala	3.40	81.2	-10.5	66.0	75.4	13.1	17.9	95.8	20.9	10.4	0.9
Madhya Pradesh	5.57	202.9	4.4	14.5	38.5	20.3	19.6	5.8	19.3	14.9	21.1
Maharashtra	4.34	155.7	-2.0	31.8	56.4	26.2	26.2	18.3	25.1	7.3	10.1
Orissa	4.81	175.7	-4.2	18.9	44.9	11.8	11.6	10.8	37.8	14.2	24.9
Punjab	3.26	110.6	10.6	33.4	47.4	2.4	26.7	26.8	3.8	26.7	0.0
Rajasthan	6.05	174.6	9.8	10.5	34.4	9.6	19.2	16.7	13.2	16.7	14.2
Tamil Nadu	3.92	126.8	-2.8	35.7	58.5	22.7	32.3	32.6	17.6	17.6	1.1
Uttar Pradesh	5.89	185.6	15.3	14.7	50.2	8.0	17.3	11.8	13.0	20.8	0.5
West Bengal	4.57	123.0	1.0	28.2	46.6	7.1	23.3	15.2	28.4	22.9	7.2

TABLE 2: Maximum Likelihood Estimates

Independent variable	Dependent variable		
	FD	Q5	TFR
Constant	0.857 (3.00)*	205.822 (14.37)*	6.594 (23.10)*
Female literacy	-0.036 (-4.46)*	-0.873 (-2.45)*	-0.031 (-4.28)*
Male literacy	0.015 (1.97)*	-0.489 (-1.40)	-0.005 (-0.70)
Female labour force participation	-0.020 (-3.85)*	0.440 (1.82)	-0.017 (-3.57)*
Urbanization	0.005 (1.73)	-0.310 (-2.40)*	-3.9E-04 (-0.15)
Medical facilities	0.005 (1.84)	-0.246 (-2.23)*	-0.002 (-1.04)
Poverty	-0.021 (-3.13)*	0.535 (1.76)	0.007 (1.14)
Scheduled castes	-0.007 (-1.13)	0.548 (1.89)	-0.007 (-1.23)
Scheduled tribes	-0.014 (-3.96)*	-0.598 (-3.57)*	-0.011 (-3.40)*
SOUTH	-0.820 (-4.91)*	-41.504 (-3.85)*	-0.548 (2.60)*
EAST	0.154 (0.81)	-38.080 (-2.91)*	-0.254 (-0.99)
WEST	-0.148 (-0.87)	-12.245 (-1.32)	-0.379 (-2.06)*
λ	0.610 (11.00)*	0.836 (28.07)*	0.821 (25.95)*
Mean squared error	0.39	15.15	0.31
Adjusted R^2	0.81	0.87	0.89
Log likelihood	-190.80	-1310.26	-155.95
Sample size	296	296	296

<u>Note</u>: Asymptotic t-ratios in brackets. *Significant at 5% level.

TABLE 3

Effects of selected independent variables (female literacy, male literacy and poverty) on child mortality (Q5), female disadvantage (FD) and fertility (TFR)

Assumed level of independent variable (%)	Predicted values of Q5, FD and TFR, when the female literacy rate takes the value indicated in the first column			Predicted values of Q5, FD and TFR, when the male literacy rate takes the value indicated in the first column			Predicted values of Q5, FD and TFR, when the proportion of the population below the poverty line takes the value indicated in the first column[@]		
	Q5	FD	TFR	Q5	FD	TFR	Q5	FD	TFR
10	166.4	10.7	5.38	172.9	-2.0	5.18	151.5	9.8	4.79
20	157.7	5.9	5.07	168.0	-0.1	5.13	152.7	8.5	4.85
30	149.0	1.1	4.76	163.1	1.8	5.08	153.8	7.1	4.91
40	140.2	-3.3	4.45	158.2	3.9	5.03	154.9	5.8	4.97
50	131.5	-7.1	4.15	153.3	5.9	4.98	156.0	4.4	5.03
60	122.8	-10.3	3.84	148.4	8.0	4.93	157.2	3.1	5.09
70	114.0	-12.8	3.53	143.5	10.1	4.88	158.3	1.8	5.15
80	105.3	-14.8	3.22	138.7	12.2	4.83	159.5	0.5	5.21

[a] For convenience of interpretation, the "Sen index" has been replaced, in this table, by the "head-count ratio" (ie. the proportion of the population below the poverty line). The figures presented in these columns are based on the same regressions as in Table 3, with the Sen index replaced by the head-count ratio.

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