An Analysis of Fertility Differentials among Caste Groups in Andhra Pradesh

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Abstract

In spite of low fertility levels and higher contraceptive use in the state of Andhra Pradesh, differentials are still discernible between the caste groups. Fertility has been much higher and contraceptive use much lower among scheduled caste and scheduled tribes compared to other castes. This paper examines the fertility differentials among caste groups in the context of characteristics and interaction hypotheses, using the second National Family Health Survey data. Multivariate analyses on cumulative fertility, birth intervals and contraceptive use show that differentials between the caste groups persist even after controlling for the other socioeconomic and demographic variables. However, the analyses of interaction effects of caste and other socioeconomic factors on fertility and contraceptive use show that the caste factor is not constant across the levels of other socio-economic factors. The caste differentials are notable in rural areas and at the lower levels of socio-economic status but in urban areas and at higher levels of socio-economic status, the differentials are narrows. This indicates with the improvement of socio-economic status, not only will fertility decline with a corresponding increase in the use of contraception, but also the differences in fertility and contraceptive use between caste groups will disappear.

Introduction

Now there is clear evidence that fertility transition is in progress in Andhra Pradesh. While the Total Fertility Rate (TFR) was about 5.5 children per woman in the 1960s, it has since then reduced to 2.2 in 2002 (according to the recent Sample Registration System estimates), or to 2.25 in 1996–1998 (according to the Second National Family Health Survey). Fertility transitions in other countries have shown that fertility differentials typically diverge early in the transition and reconverge (though rarely completely) towards the end of the transition as fertility approaches the replacement level. As the state of Andhra Pradesh has approached replacement fertility, fertility differentials have become small. However, in spite of low fertility levels in the state,

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differentials are still discernible between the caste groups and the differentials tend to be considerably larger than fertility differentials by residence, education or religion (IIPS and ORC Macro, 2000a: 60). Fertility has been much higher among Scheduled Caste and Tribes[1] (SC/ST groups) as compared to that of other caste (non–SC/ST) groups. According to the Second National Family Health Survey (NFHS-2), conducted in 1998–1999, the total fertility rate is 0.75 children higher among scheduled tribe women, 0.51 children higher among scheduled caste women than among women in the 'other' castes (2.00). This paper therefore, first examines whether the caste differentials in fertility are caused by variations in the socio-economic characteristics or whether caste *per se* is responsible for the fertility differentials; and secondly, whether the caste differentials in fertility exist at each stage of socio-economic status and whether these are of the same order and direction, using the Second National Family Health Survey data of Andhra Pradesh.

Background

Andhra Pradesh was the first state in independent India to be formed on a purely linguistic basis. It is the fourth largest state in India by area and fifth largest by population. According to the 2001 Census, Andhra Pradesh had a population of 76.21 million, which accounts for 7.41 per cent of India's population and covers 8.37 per cent of the total land area. The population of the state has more than doubled its size, from 35.98 million in 1961 to 76.21 million in 2001. The increase in population was so much conspicuous during the 1981–1991 period with the addition of 13 million that could be compared to the increase of 12 million in the first half of the twentieth century. The decadal growth rate increased from 20.90 per cent in 1961–1971 to 23.10 per cent in 1971–1981 and 24.20 per cent in 1981–1991. In recent years, however, the state has attracted the attention of population scientists due to lowest growth rate of population and rapid fertility decline during the last decade. The decade of 1991–2001 witnessed a dramatic decline in the growth rate and the third lowest growth rate of population among the major Indian states, higher than Kerala and Tamil Nadu. The percentage decadal growth has declined from 24.20 during 1981–1991 to 14.59 during 1991–2001 (Table 1). The average annual exponential growth rate has declined from its highest ever annual growth of 2.17 per cent in 1981–1991 to 1.36 per cent during 1991–2001, while the slowdown in the population growth for the country as a whole was from 2.16 to 1.97 per cent, respectively (Kumar and Sharma, 2006). This is largely due to the high pace of demographic transition (James and Subramanian, 2003).

The crude birth rate in the state has come down from 34.8 per one thousand population in 1971 to 20.7 in 2002, whereas the crude death rate has declined from 14.6 to a low of 8.1 in the same period. The infant mortality rate has registered significant decline from 106 per one thousand live births in 1971 to 62 in 2002. During the period, the total fertility rate of the state has declined from 4.6 to 2.2. Of the two-child decline in a span of three decades, more than one child decline is accounted in the last one decade (for detailed discussion on fertility transition in Andhra Pradesh, *see* Balasubramanian, 1999; James, 1999; James and Subramanian, 2003; Ramachandran and Ramesh, 2005). Fertility continues to decline further in the state. According to the preliminary findings of the latest third round of National Family Health Survey (NFHS-3), 2005–2006, the TFR for the three years preceding the survey was 1.79 (IIPS and MOH&FW, 2006), which is even lower than that of

Kerala and Tamil Nadu. The total fertility rate is down from 2.25 children per woman at the time of NFHS-2, a decline of 20 per cent in approximately eight years. The decline in fertility in the state was largely attained through contraceptive use and particularly through female sterilization (James and Subramanian, 2003).

Table 1: Population Trends and Distribution by Cast Groups in Andhra Pradesh, 1961-2001

Year/Period	Total	Scheduled Caste	Scheduled Tribe	Others
Population				
1961	35983447	4973616	1324368	29685463
1971	43502708	5774548	1657657	36070503
1981	53549673	7961730	3176001	42411942
1991	66508008	10592066	4199481	51716461
2001	76210007	12339496	5024104	58846407
Percentage Distribution				
1961	100	13.82	3.68	82.50
1971	100	13.27	3.81	82.92
1981	100	14.87	5.93	79.20
1991	100	15.93	6.31	77.76
2001	100	16.19	6.59	77.22
Percentage Increase				
1961–1971	20.90	16.10	25.17	21.51
1971–1981	23.10	37.88	91.60	17.58
1981–1991	24.20	33.04	32.23	21.94
1991–2001	14.59	16.50	19.64	13.79
1961–2001	111.79	148.10	279.36	98.23
Annual Growth Rate (exponential) per cent				
1961–1971	1.90	1.49	2.24	1.95
1971–1981	2.08	3.21	6.50	1.62
1981–1991	2.17	2.85	2.79	1.98
1991–2001	1.36	1.53	1.79	1.29
1961–2001	1.88	2.27	3.33	1.71

Source: Computed from the population given in India, Registrar General, India (various years).

The contraceptive prevalence rate is moderately high, with 60 per cent of currently married women using some method contraception. Most of this, 57 points or 96 per cent of current contraceptive prevalence is contribution of male or female sterilization. The median age at the time of sterilization was 23.5 years and about 64 per cent of sterilized women undergoing sterilization before the age of 25. On the other hand, the median age at marriage in the state is 15.4 and most of women (76 per cent) age 20–49 marry before the legal minimum age at marriage of 18 years (IIPS and ORC Macro, 2000a: 38, 92 and 96). Thus, sizable proportions of women in Andhra Pradesh marry before the legal age of 18, have a child soon after marriage, and complete family building and undergo sterilization before age 25. This indicates that the age patterns of childbearing in the state are restricted to very young ages of women, leading to a compression of reproductive spans and this has not been seen elsewhere in the world (Padmadas *et al.,* 2004; 2005). Son preference (women who have reached their desired number of sons are more likely than those who have not to adopt sterilization) and other cultural factors (individual identities in kinship and social networks) seem to play an important role in early sterilization in the state (Basu, 1999; Säävälä, 1999; Padmadas *et al.,* 2004).

Trends and Differentials of Population Growth and Fertility among Caste Groups

According to 2001 Census, the scheduled caste and tribes together account for about a quarter of state's population — 16.19 per cent were classified as scheduled caste and 6.59 per cent as scheduled tribes (India, Registrar General, 2004). Nearly 80 per cent of the scheduled castes and 90 per cent of scheduled tribes live in the rural areas. The population of the scheduled castes in the state has increased from 4.97 million in 1961 to 12.33 million in 2001 and the scheduled tribes increased from 1.32 million to 5.02 million during the same period. Over the last four decades (1961–2001), the scheduled tribe population increased by 279 per cent compared to an overall increase of 112 per cent; the scheduled caste growth (148 per cent) has been marginally higher than average, and non-SC/ST growth marginally lower (98 per cent). The scheduled tribes experienced abnormally higher growth during 1971–1981, 6.50 annually, compared to 3.21 per cent for scheduled castes and 2.08 for total population. This is largely because of removal of 'area restriction' in identifying scheduled tribe populations in 1976 and at least partly because of infiltration of people (for example, the Lambada before the elections of 1977) officially in to the tribal fold (Maharatna, 2005:35). Thus, the share of the scheduled tribe population increased from 3.68 per cent in 1961 to 6.59 per cent in 2001 and the scheduled caste population increased from 13.82 per cent to 16.19 per cent during the same period (Table 1). In the absence of specific Census data, the Anantharaman commission made a rough estimate of the other backward class (OBC)[2] population could be around 45 per cent in 1981 (Rao *et al.,* 1998: 98–99) and the NFHS-2 also estimates the same at 44.2 per cent (IIPS and ORC Macro, 2000a:34).

Estimates of different measures of fertility according to caste compiled from the two rounds of special surveys from the Sample Registration System (SRS 1979, 1984 Surveys) and National Family Health Surveys (NFHS-1 & 2) have been used to examine the differentials. The estimates of total fertility rate and cumulative fertility (CF computed as mean children ever born to women of age 40–49 at survey) given at different time points presented in Table 2 indicate that the scheduled caste and tribes (SC/ST) had higher fertility compared to that of the non-SC & STs in all the surveys, but the differences are found to be very small in 1978 survey. The 1984 SRS survey estimates of TFR for scheduled caste and scheduled tribes show an excess fertility over non-SC/STs by 13 and 23 per cent, respectively. On the other hand, the NFHS-1 & 2 estimates also show SC and ST fertility is higher than that of non-SC/ST fertility. The NFHS-2, 1996–1998 estimates of TFR for the three years preceding the survey show that the TFR of scheduled caste and scheduled tribes was higher than that of non-SC/ST by 26 and 38 per cent, respectively. Similarly, the mean number of children ever born for currently married women of age 15–49 for SC and ST is higher than that of non-SC/ST by 20 and 36 per cent, respectively (Table 2).

The mean number of children ever born to ever-married women of age 40–49 at the time of survey does not affect the interpretation of differentials. The pattern of differentials in the mean number of children ever born to women age 40–49, parallels the pattern of differentials in the TFR – suggesting that the pattern has prevailed over the past 20–30 years, though the degree of difference has changed somewhat. Comparing the TFR and mean children ever born to women age 40–49 (period and cohort fertility) of NFHS-2, it was found that the extent of fertility decline was 44 per

cent for the state during the last three decades or so. By caste/tribe, fertility has declined faster among women of other castes (45 per cent) followed by scheduled tribes (44 per cent), but somewhat slowly among scheduled caste women (42 per cent) indicating that fertility has fallen considerably faster among scheduled tribe women than the scheduled caste women. However, tribal fertility has almost never been lower than that of the SC people in Andhra Pradesh (Maharatna, 2005:155). Thus, fertility among all the caste groups is much lower than the high fertility levels of the past and thus, the process of fertility transition is in progress. On the other hand, age at marriage and use of contraception also varies substantially across the caste groups. The median age at first cohabitation for women age 20–49, ranges from 14.7 for scheduled caste women to 16.7 for women in 'other' category (IIPS and ORC Macro, 2000a:56). Contraceptive use is lowest (49 per cent) among women belonging to scheduled tribes and highest (64 per cent) among 'other' caste (Table 2).

Table 2: Trends and Differentials of Fertility and Contraceptive Use by Caste Groups in Andhra Pradesh

Year/ Indicator	Source	All	Caste/Tribe			Ratio[2]	
			Scheduled Caste	Scheduled Tribe	Others[1]	Scheduled Caste	Scheduled Tribe
Total Fertility Rate[3]							
1978*	SRS	3.77	3.78	4.39	3.73	1.01	1.18
1984	SRS	4.10	4.40	4.80	3.90	1.13	1.23
1989–1991	NFHS-1	2.59	2.61	3.74	2.52	1.04	1.48
1996–1998	NFHS-2	2.25	2.51	2.75	2.00	1.26	1.38
Cumulative Fertility[4]							
1989–1991	NFHS-1	4.05	4.32	(4.07)	4.00	1.08	1.02
1996–1998	NFHS-2	4.03	4.33	(4.95)	3.62	1.20	1.37
Per cent Difference between the Cumulative Fertility and Total Fertility Rate[5]							
1989–1991	NFHS-1	36.05	39.58	8.11	37.00	NA	NA
1996–1998	NFHS-2	44.17	42.03	44.44	44.75	NA	NA
Mean number of Children Ever Born[6]							
1989–1991	NFHS-1	2.72	2.94	2.95	2.67	1.10	1.10
1996–1998	NFHS-2	2.72	2.93	3.32	2.44	1.20	1.36
Use of Contraception (per cent)[7]							
1989–1991	NFHS-1	47.0	35.9	36.5	49.7	0.72	0.73
1996–1998	NFHS-2	59.6	52.2	48.5	63.6	0.82	0.76

Notes: (1) 'Non-scheduled caste/tribes' in case of SRS and NFHS-1; 'Not belonging to a scheduled caste, a scheduled tribe, or an other backward class' in case of NFHS-2; (2) Ratio: With values for 'others' as base; (3) Total fertility rates of NFHS-1&2 are for the three years preceding the survey to women age 15–49. Rates from SRS are for one calendar year; (4) Cumulative fertility — Mean number of children ever born (MCEB) to ever-married women age 40–49 years; (5) Calculated as the difference between cumulative fertility and total fertility rate, taken as a percentage of cumulative fertility; (6) Age-standardized MCEB, computed from data files for currently married women of age 15–49 years; **'*'** Weighted averages are computed from 1978 Rural and urban fertility estimates of India, Registrar General (1981); ( ) based on 25–49 cases; NA– Not Applicable; (7) For currently married women of age 15–49 only.

Sources: 1978 SRS Survey: India, Registrar General (1981); 1984 SRS Survey: India, Registrar General (1989); NFHS-1: PRC and IIPS (1994: 60 & 67); NFHS-2: IIPS and ORC Macro (2000a: 60).

Research Problem and Need for the Study

It has been generally observed that fertility differentials emerge during the early phase of transition, since some sections of society begin to control fertility but become narrow during the late phase of transition as the fertility of various sections converges to a low level. As the state of Andhra Pradesh has approached replacement fertility, fertility differentials have become small. However, our examination of the above data on fertility differentials in the state suggests that though the average level of fertility of the state is low, notable fertility differentials persist between the caste groups. Fertility has been much higher and contraceptive use much lower among Scheduled Caste and Scheduled Tribes compared to that of Other Backward Class (OBC) and 'Other' Caste category (OC). For OCs, fertility is below the replacement level and for OBCs fertility is nearer to the replacement. It must be noted here that higher fertility among women belonging to a particular caste may not necessarily be attributable to the caste factor *per se*. There are differences in characteristics such as, educational level, rural or urban residence, occupational distribution and income, many of which have a bearing on fertility. Therefore, some or all of the caste differentials (gross) in fertility could be on account of differentials in one or more of these factors (the Characteristics Hypothesis). It is, therefore, necessary to examine the characteristics hypothesis and ascertain whether observed differentials in fertility and contraceptive use by caste in Andhra Pradesh are caused by variations in characteristics or are the effects of caste *per se*. In order to do so, the magnitudes of net differentials after controlling or adjusting for the effects of socio-economic characteristics must be computed.

In the previous section, total fertility rate has been used to examine the fertility change and differentials among caste groups. Though the total fertility rate is a very useful indicator for monitoring the fertility change and to examine the differentials, this measure is not free from limitations. For example, the total fertility rates estimated from the NFHS-1 & 2 data refer to a reference period of three years prior to the date of survey and that might be affected by backward displacement of births, leading to overestimation of past fertility and underestimation of recent fertility, where as the SRS, in which births are recorded during the year in which they occur, is not[3]. Moreover, the total fertility rate does not reveal whether the decline is due to change in the timing of start of reproduction, in the spacing of births and/or in the proportion of women reaching higher parities (Ni Bhrolchain, 1987; United Nations, 1997; Bongaarts and Feeney, 1998). In these situations, examination of the family building patterns[4] in determining the decline in fertility is more appropriate for a meaningful analysis. This paper, therefore, assesses the net effects of caste factor on cumulative fertility (children ever born), family building process and contraceptive use controlling for other variables. Finally, this paper would also attempt to examine whether the caste differentials in fertility and contraceptive use exist at each stage of socio-economic status and whether these are of the same order and direction, using the NFHS-2 data.

Data and Methods

The analysis presented in this paper comes from the data of Second National Family Health Survey[5] (NFHS-2), a large-scale survey in the state of Andhra Pradesh, carried out during 1998–1999, along with other states of the country. The data collected

includes the basic demographic and socio-economic characteristics of each household, as well as, detailed reproductive history of ever-married women. In Andhra Pradesh, data were collected between 15 March 1999 and 23 June 1999, from a total of 3,872 households and 4,032 ever-married women aged 15–49 years. Out of 4,032 ever-married women interviewed, 3,695 were currently married. The household response rate was 99 per cent and eligible women's response rate was 98 per cent. The details of the study design, as well as, sampling frame and sample implementation are provided in the state NFHS report (IIPS and ORC Macro, 2000a). The NFHS-2 data provides information on caste/tribe and most of the women belonged to one of the four castes, namely, Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Class (OBC), and those who are neither SC nor ST nor OBC and are designated as 'others'. From this information, three categories of caste groups[6] are considered for the multivariate analysis. They are: SC and ST, OBC and 'other' caste. Out of 3695 currently married women, 726 are SC and 177 are ST (thus, 903 belong to SC/ST), 1,628 belong to OBC and 1,156 are OCs. The number of missing information on caste was quite small (out of 3,695 only 8). Therefore, these observations were not included in the analysis.

Methods of analysis: In order to estimate the magnitude of net differentials after controlling or adjusting for the effects of other socio-economic characteristics, different multivariate analyses have been carried out (details of the statistical techniques used and the need to use the specific techniques, with basic model are given in Appendix). First, the net effect of caste on cumulative fertility is estimated using the technique of Multiple Classification Analysis (MCA), children ever born is the dependent variable. In addition to the caste factor, the other socio-economic variables used as independent variables are: education (illiterate, literate but less than middle school, middle school and above), standard of living (high, medium, low, as measured by the NFHS-2, IIPS and ORC Macro, 2000a: 27–29), work status of woman (working, non-working), place of residence (rural, urban), and region of residence[7] (Coastal Andhra, Telengana and Rayalaseema). Besides socio-economic variables, years of marital duration has been introduced as a co-variate, since it plays a pivotal role in influencing the level of fertility. The analysis has been restricted to currently married women. This is followed by analysis of birth intervals across the caste groups.

In order to gain further insight into the differentials of fertility among caste groups, birth spacing patterns are explored using life table analysis by combining both open and closed intervals beginning during 1975–1994 period[8]. The analysis has been restricted to currently married women and for the second, third and fourth birth intervals[9]. Since, construction of life tables for the caste groups controlling for other variables becomes difficult, because the number of births in various sub-classes becomes small. Therefore, the proportional hazards model, which combines the features of life table and regression (Cox, 1972) has been adopted to estimate the net effect of the caste factor on the risk of the next birth, controlling for the effects of other variables. Apart from the above socio-economic variables used in MCA on cumulative fertility (children ever born), time period and other three demographic variables are used as controls. They are: age of the woman at the birth of the previous child (>20, 20–24, 25+ years), sex (male, female) and survival status of the previous child (survived >1 year, died as infant) and period or time period[10] (intervals

beginning during 1975–1979, 1980–1984, 1985–1989 and 1990–1994). Intervals of width 0, caused due to twin births are dropped from the analysis.

In order to assess the net effect of caste on contraceptive use, logistic regression analysis has been carried out and predicted percentages of contraceptive use are computed for each category and compared in a manner similar to the 'adjusted means' in multiple classification analysis (see Appendix for details). In addition to caste and other socio-economic variables (education, work status, standard of living, residence and regions), used in the case of the MCA for children ever born, two additional variables (experience of child loss and number of living children) are used in the logistic regression as independent variables. Although contraceptive use depends on the number of living children, separate analysis by number of living children would result in an excessively large number of tables. Therefore, the analysis is carried out for total sample and restricted to currently married women.

Finally, to examine whether the caste differentials exist at each stage of socio-economic status and whether these are of the same order and direction, the interaction effects of caste and other socio-economic factors on fertility and contraceptive use were assessed[11]. As the emphasis is on caste factor, findings are discussed in detail on the net effect of caste and other socio-economic factors on the dependent variables. Other explanatory variables have been used only to substantiate the findings or to develop the model, and are not discussed in detail. Results are presented in four sections: the first section contains results from the analysis on cumulative marital fertility, followed by analysis of birth intervals and contraceptive use. Finally, in the fourth section, results from analysis of interaction effects of caste and other socio-economic variables on cumulative fertility (children ever born) and contraceptive use are presented.

Results

Analysis on Cumulative Fertility

As discussed earlier, fertility differentials by caste could plausibly be due to differences in socio-economic factors (characteristics hypothesis). Therefore, to ascertain whether observed fertility differentials among caste groups are caused by variations in characteristics or are the effects of caste *per se,* multiple classification analysis on cumulative marital fertility has been carried out, children ever born is the dependent variable. Along with the caste and other socio-economic variables (education, work status, standard of living, residence and regions of the state), years of marital duration has been used as a co-variate.

Net Effects of Caste on Children Ever Born

Table 3 provides the unadjusted and adjusted deviations in mean children ever born along with other caste and other socio-economic variables. The results of multiple classification analysis show that the unadjusted deviations by caste are large, the SC/STs showing fertility above the average (2.71) by 0.19 and the 'other' caste women below the average by 0.15. The pattern of differentials in children ever born among caste groups persists, even after controlling for socio-economic variables and covariate, though the gap narrows down. The adjusted mean number of children ever

born for SC/STs continues to be above average and for OC and OBCs are below the average. The SC/ST women have higher fertility than the average and the OC-OBC difference is much smaller in comparison to that of OC-SC/ST difference even after adjustment. This indicates that the observed (unadjusted) differences are not explained by the other socio-economic factors used in the analysis. Thus, the characteristics hypothesis does not gain support as far as SC/ST-OC differentials are concerned, that is, higher than average fertility among SC/ST is not explained by their relatively poorer socio-economic conditions. Among the other variables included in the analysis, standard of living and regions of the state have shown significant effects on children ever born i.e., Coastal Andhra women and women hailing from lower economic status tend to have higher fertility than average. Education, work status and residence has not shown any significant effect on cumulative fertility (Table 3).

Table 3: Unadjusted and Adjusted Deviations in Mean Number of Children Ever Born by Caste and Other Socio-economic (background) Characteristics, Andhra Pradesh, FHS-2, 1998–1999

Variable + Category	No. of Cases	Unadjusted Deviations	eta	Deviations Adjusted for Independents and Covariates	beta	Adjusted Mean[1]
Grand Mean	3670	2.71				
Caste/Tribe			0.067		0.043***	
Scheduled Caste/Tribe	899	0.19		0.14		2.85
Other Backward Class	1622	0.01		-0.04		2.67
Other Caste	1149	-0.16		-0.05		2.66
Education			0.235		0.028	
Illiterate	2296	0.32		0.04		2.75
Literate, < Middle	771	-0.30		-0.08		2.64
Middle School +	603	-0.82		-0.05		2.66
Work Status			0.101		0.023	
Non-working	1569	-0.22		0.05		2.76
Working	2101	0.16		-0.04		2.68
Standard of Living			0.072		0.069***	
Low	1300	0.13		0.11		2.82
Medium	1731	0.00		0.02		2.73
High	639	-0.26		-0.27		2.44
Residence			0.043		0.002	
Rural	2753	0.05		0.00		2.71
Urban	917	-0.14		0.01		2.72
Regions			0.080		0.104***	
Coastal Andhra	1598	-0.17		-0.22		2.49
Rayalaseema	661	0.06		0.12		2.83
Telengana	1412	0.16		0.19		2.91
Multiple R = 0.652		R^2 = 0.425				

Notes: For currently married women of age 15–49 only; Marital duration is used as a covariate; Level of significance: ***p ≤ 0.001; **p ≤ 0.01; *p ≤ 0.05.

In sum, the results of MCA presented in Table 3 show that the SC/ST fertility is above the average and the differentials in cumulative fertility by caste persist even after controlling for other socio-economic variables and co-variate, marital duration. Clearly, the characteristics hypothesis (controlling the socio-economic variables) alone does not explain differentials in cumulative marital fertility among caste groups

in Andhra Pradesh. Besides the socioe-conomic variables, specific factors such as, child mortality appears to be crucial in causing fertility differentials among caste groups[12]. Child mortality influences fertility desires and behaviour, that is, high infant mortality induces to have more children in order to ensure survival of at least a few in to adulthood. Particularly, as the fertility level approaches replacement level fertility, the role of child mortality becomes increasingly important. Hence, it is desirable to include child mortality as an independent variable along with the socio-economic variables in the analysis of cumulative marital fertility. However, this was not possible to include child mortality as an explanatory variable in the multiple classification analysis of children ever born because children ever born and child loss have a reciprocal effect (Alagarajan and Kulkarni, 1998). Therefore, this has been recognized as a limitation and child loss has been included in the following section on analysis of birth intervals, where this limitation does not arise.

Analysis of Birth Intervals

Although cumulative fertility or children ever born is considered as the dependent variable in the previous section, fertility is actually the outcome of a series of behaviours, decisions and events that may span a period of childbearing in the life of a woman extending over 30 years. Moreover, in developing settings, couples with large families have shorter birth intervals than those with smaller families. This suggests that the timing of births may be inversely related to completed or cumulative fertility. From a theoretical point of view also, timing of the first birth and the subsequent births are very important in fertility studies. Therefore, in this section, birth interval analysis was carried out to examine whether the family building process/timing of births varies across the caste groups and also to examine the magnitude of the caste effect on the risk of the next birth net of the effects of other factors. As discussed in data and methods, life table analysis has been carried out at first stage by combining the open and closed intervals of women for the second, third and the fourth birth intervals for the period beginning during 1975–1994.

Table 4: Median Birth Intervals and Proportion having Subsequent Birth within 60 Months by Caste, 1975–1994, Andhra Pradesh, NFHS-2, 1998–1999

Birth Interval/ Caste/Tribe	Median (in months)			Proportion had Next Birth within 60 Months		
	Second	Third	Fourth	Second	Third	Fourth
Scheduled Caste/Tribe	30.11	3 2.83	39.00	0.8617	0.7656	0.6223
Other Backward Class	30.50	34.19	47.00	0.8621	0.7429	0.5572
Other Caste	28.93	41.50	62.43	0.8738	0.5707	0.4975
All	29.87	35.23	46.04	0.8656	0.6939	0.5581

Note: For currently married women of age 15–49 only; Before 1975 and after 1995 are not considered due to truncation bias.

The results from the life table analysis of birth intervals among caste groups shows that the second median birth interval did not show much variation. However, the median third and fourth birth intervals among SC/ST and OBC's are shorter than that of OCs (Table 4). This indicates a tendency of OC women to space their higher order births and not to achieve higher parity. Further, there is no difference in the transition probabilities at second birth within 60 months between the caste groups. This

highlights the fact that most of the women in Andhra Pradesh, regardless of their caste, tend to go for the second birth. The difference in the timing of births between SC/ST and OC women is more noticeable at third and fourth births. However, there is not much difference in the transition probabilities between OBC and SC/STs at third birth. A large proportion of SC/ST (77 per cent) and OBC (74 per cent) women had their *third* birth within 60 months of the *second birth* compared to 57 per cent of OC women. About two-thirds of SC/ST women (62 per cent) have fourth birth within five years of the third compared to half (50 per cent) of OC women (Table 4).

Net Effects of Caste on Birth Intervals

The foregoing analysis i.e., life table approach on birth intervals assessed only the differentials among caste groups, without controlling for other variables. It is possible that the differentials by caste observed in the preceding analysis of birth intervals may, in part, be attributable to the fact that socio-economic characteristics also vary by caste. Therefore, to estimate the caste effect net of other important socio-economic and demographic variables, the Cox's regression or proportional hazard model has been adopted. The analysis has been carried out among currently married women and for second, third and the fourth birth intervals beginning during 1975–1994 period. The Cox regression estimates (beta values) for the effects of caste factor along with different categories of other variables on the risk of second, third and fourth births are shown in Table 5; exp (beta) gives the risk of the next birth for the category relative to the risk for the reference category.

The results of the Cox regression show that the caste effect is not significant for the second birth interval, that is, for the risk of the second birth, when other socio-economic and demographic variables are controlled. Thus, caste as such does not seem to be an important determinant of the risk of having the second birth. However, there is a significant effect of caste factor on the chances of having the third and fourth births. For example, controlling for the other socio-economic and demographic variables, the relative risk for the third birth is significantly higher for SC/ST and OBCs (RR [Risk Ratio] = 1.34 and 1.24, respectively) than the OC women. The SC/ST women have relatively greater chance (RR = 1.20) of having a birth after the third than OC women.

Among the other variables included in the model, age of the women at previous birth and survival status of the previous child have significant effect in all the three birth intervals. For all the three births, the risk of having the next birth is higher in case of the death of the previous child during infancy. The risk of having next birth was also significantly higher for the women of age below 20 at the preceding birth and the risk was significantly lower for women of ages above 25 as compared to 20–24 age group. The relative risk for the third and fourth births is significantly lower for women with less than middle school and for women with middle school and above level of education than the illiterate women. Women from medium and higher stratum of society have shown relatively higher risks (1.12 and 1.24 respectively) for second birth and lower risk for fourth birth (0.81 and 0.68 respectively) than the women from the lower stratum. Sex of the previous child shows significant effect only on third and fourth births, that is, the relative risk of having the next birth is higher if the previous birth was a female, than if it was a male. This indicates the effect of son preference specifically, at fourth birth.

Table 5: Estimated Regression Coefficients and Relative Risk Ratios from Cox Proportional Hazards Model for Second, Third and Fourth Birth Intervals by Caste and Other Background Characteristics, 1975–1994, Andhra Pradesh, NFHS-2, 1998–1999

Birth Interval/	Values of β coefficients			Values of Relative Risk Ratios		
Variable + Category	Second	Third	Fourth	Second	Third	Fourth
Caste/Tribe [a]						
Scheduled Caste/Tribe	-0.027	0.290	0.186	0.973	1.336***	1.204*
Other Backward Class	-0.058	0.214	-0.070	0.943	1.239**	0.933
Education [b]						
Literate, < Middle	0.092	-0.184	-0.215	1.096	0.832*	0.807*
Middle School +	0.018	-0.435	-0.243	1.018	0.647***	0.784
Work Status [c]						
Working	-0.037	0.039	-0.092	0.964	1.039	0.912
Standard of Living [d]						
Medium	0.117	-0.069	-0.213	1.125*	0.933	0.808**
High	0.213	-0.137	-0.384	1.237*	0.872	0.681**
Age of the Women at Previous Birth[e]						
Below 20	0.240	0.229	0.171	1.272***	1.258***	1.186*
25+	-0.549	-0.321	-0.151	0.577***	0.725**	0.860*
Sex of the Previous Child[f]						
Female	0.050	0.083	0.249	1.051	1.087	1.283***
Survival Status of the Previous Child [g]						
Died as Infant	0.414	0.482	0.508	1.513***	1.619***	1.661***
Time Period [h]						
1975–1979	-0.002	0.543	0.951	0.998	1.721***	2.589***
1980–1984	0.103	0.392	0.593	1.108*	1.480***	1.810***
1985–1989	0.024	0.407	0.436	1.025	1.502***	1.547***
Residence [i]						
Urban	-0.028	0.176	0.082	0.972	1.193	1.086
Regions [j]						
Rayalaseema	0.083	0.188	0.550	1.086	1.207*	1.734***
Telengana	0.043	0.376	0.582	1.044	1.457***	1.789***
Total No. of Cases	2238	1973	1393			
No. of Events	2092	1454	819			
No. of Censored Cases	146	519	574			
–2 Log Likelihood	28742	20182	11015			
Chi-square	112	300	220			
Degrees of Freedom	17	17	17			

Note: This analysis has been carried out for currently married women of age 15–49 only; Before 1975 and after 1995 are not considered due to truncation bias; Reference categories: [a] Other caste, [b] Illiterate, [c] Non-working, [d] Low household standard of living, [e] 20–24 years, [f] Male, [g] Survived, >1 year, [h] Intervals beginning during 1990–1994, [i] Rural, [j] Coastal Andhra, respectively; Level of significance: ***p ≤ 0.001; **p ≤ 0.01; *p ≤ 0.05.

The risk of having the third and fourth births was higher for women from Rayalaseema and Telengana as compared to Coastal Andhra region. The results for period variable show that there has been a declining period trend in the hazard rates for having third and fourth births between the time periods 1975–1979 to 1985–1989 (as compared to 1990–1994) and the risk of having a third and fourth births started to decline from 1975 and continued to the date of the survey, which is a further evidence of fertility decline in the state. Residence and work status do not show any significant effects on the risk of subsequent births.

Net Effects of Caste on Contraceptive Use

Despite the higher levels of contraceptive use in the state, notable differentials persist between the caste groups. Contraceptive use much lower among SC and ST compared to other caste groups (Table 2). As discussed earlier, differentials by caste could plausibly be due to differences in socio-economic factors (characteristics hypothesis). Therefore, to ascertain whether observed differentials in contraceptive use among caste groups are caused by variations in characteristics or are the effects of caste *per se,* the logistic regression analysis has been carried out. Along with the caste other socio-economic variables (education, work status, standard of living, residence and regions of the state), used in the case of MCA for children ever born, two additional demographic variables, number of living children and child loss are included as independent variables and only currently married women are included in the analysis.

Table 6 shows the logistic coefficients and odds ratios along with unadjusted and adjusted contraceptive prevalence rates according to caste and other selected background characteristics. The unadjusted rates are ordinary contraceptive prevalence rates computed separately for each category and the adjusted rates are obtained by logistic regression in conjunction with multiple classification analysis in the manner described earlier. The results show that the inclination to use contraception is significantly less (odds=0.63) among SC and ST than OCs. There is no significant difference between OBCs and OCs. The OC–SC/ST and OC–OBC differences in the percentage of contraceptive use between the unadjusted and adjusted figures narrows down slightly. It has been reduced slightly from 12 percentage points in unadjusted to 11 points after adjustment. However, the difference between the women of OC–OBC is not significant. Overall, the logistic regression indicates that use of contraception is significantly lower for SC/ST women than OC women, even after controlling for the socio-economic and demographic variables.

Of the other variables, education, standard of living, work status, number of living children and regions of the state have significant net effect; literate women, working women and women with medium and high standard of living had higher propensity of using any contraceptive method when compared to illiterate women, house wives and women from low standard of living, respectively. As compared to women with two children, women with one or no children have significantly less use of contraception and those with three or more children show significantly higher use. Lower use of contraception is found for women of Rayalaseema and Telengana regions than for women of Coastal Andhra region. Residence and child loss showed no significant effect.

In sum, the preceding analyses on cumulative fertility (children ever born), birth intervals (timing of births) and contraceptive use were examined the effect of caste after controlling for the effects of other socio-economic and demographic factors. It was found that differentials among caste groups persist, even after controlling for the socio-economic and demographic factors. Thus, the characteristics hypothesis does not seem to explain the fertility differentials among the caste groups in Andhra Pradesh. This calls for further analysis of interaction effects of caste and other socio-economic factors, that is, the Interaction Hypothesis. It is hypothesized here that the higher the socio-economic status, the lower the fertility and the narrower the difference in fertility between SC/ST and OC. The lower the socio-economic status,

the higher the fertility and the greater the difference in fertility between SC/ST and OC.

Table 6: Logistic Regression Coefficients, Unadjusted and Adjusted Percentage of Currently Married Women Using Contraception by Caste and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable/Category	Regression Coefficient β	Exp (β)	% of Women Using Contraception	
			Unadjusted	Adjusted[1]
Caste/Tribe				
Scheduled Caste/Tribe	-0.463	0.629***	51.5	49.9
Other Backward Class	0.100	1.106	61.3	63.6
Other Caste®	0.000	1.000	63.5	61.3
Education				
Illiterate®	0.000	1.000	58.8	55.5
Literate, < Middle	0.411	1.508**	64.2	65.3
Middle School +	0.481	1.618**	56.9	67.3
Work Status				
Non-working®	0.000	1.000	59.1	53.7
Working	0.403	1.496***	60.0	63.8
Standard of Living				
Low®	0.000	1.000	52.9	52.2
Medium	0.337	1.401**	61.2	60.0
High	0.877	2.403***	69.0	72.3
Number of Living Children				
0	-5.169	0.006***	1.8	1.8
1	-2.766	0.063***	16.4	16.7
2 ®	0.000	1.000	74.9	76.2
3	0.917	2.503***	86.2	89.1
4+	0.396	1.485**	76.8	83.1
Experience of Child Loss				
No®	0.000	1.000	57.2	59.0
Yes	0.112	1.118	67.7	61.7
Residence				
Rural®	0.000	1.000	58.4	58.9
Urban	0.113	1.120	63.4	61.6
Regions				
Coastal Andhra ®	0.000	1.000	63.3	67.9
Rayalaseema	-0.671	0.511***	53.1	52.0
Telengana	-0.662	0.516***	58.5	53.2
All (Grand Mean)	59.600			
Constant	0. 718			
–2 Log Likelihood	3111.700			
Chi – Square	1839.690			
Number of Cases	3670			

Notes: [1]The adjusted (predicted) values of per cent contraceptive use have been computed from the logistic regression coefficients. These are the predicted values after controlling for the effects of other variables; ® – Reference Category; Level of Significance: ***p ≤ 0.001; **p ≤ 0.05; *p ≤ 0.01

Analysis of Interaction Effects

Though caste differences are seen after controlling for the socio-economic and demographic factors, this does not necessarily mean that there is a constant caste effect and the differentials persist at each level of socio-economic characteristics. For example, previous research on "religion and fertility" has observed the existence of interactions among religious groups and that the religious differences may not remain

constant at various levels of socio-economic factors. Convergence in differentials was noted with a rise in socio-economic conditions. In Bangladesh, Chaudhury (1984) observed that fertility of Muslim women was higher than that of Hindu women at low level of education. However, at higher level of education, the order reversed, that is, fertility of Hindus was higher than that of Muslims. In India also, Iyer (2002) and Alagarajan (2003) have shown this to hold true in Karnataka and in Kerala, respectively. They argue that religion *per se* has no effect on fertility but the religious difference in fertility can be explained through the difference in socio-economic factors and their differential (interaction) effects on the religious communities. In the case of Andhra Pradesh, which is experiencing a transition to replacement level fertility, it would be of interest to see if this is be the case among caste groups also. Therefore, the interaction effects of caste and socio-economic variables have been examined on cumulative fertility (children ever born) and contraceptive use. For this purpose, the following reformulated explanatory variables representing combinations of caste with other socio-economic variables (education, level of standard of living and residence) have been used. They are:

Caste x Education (Categorized into 3 x 3 = 9 categories) as: SC/ST–Illiterate, OBC–Illiterate, OC–Illiterate; SC/ST–Literate, <middle school, OBC–Literate, <middle school, OC–Literate, <middle school; SC/ST–Middle school and above, OBC–Middle school and above, OC–Middle school and above level of education

Caste x Standard of Living (SOL) index (Categorized in to 3 x 3 = 9) as: SC/ST–Low level of SOL, OBC–Low level of SOL, OC–Low level of SOL; SC/ST–Middle level of SOL, OBC– Middle level of SOL, OC– Middle level of SOL; SC/ST–High level of SOL, OBC–High level of SOL, OC–High level of SOL

Caste x Residence (Categorized into 3 x 2 = 6) as: SC/ST–Rural, OBC–Rural, OC–Rural; SC/ST–Urban, OBC–Urban, OC–Urban

Caste and Fertility by Socio-economic Status

In order to assess the interaction effect and to see if any interaction terms are significant between caste and socio-economic variables on cumulative fertility (children ever born), analysis of variance (ANOVA) was carried out at first stage with the socio-economic variables as explanatory variables and duration of marriage as a covariate. The results of ANOVA (Table 7) showed that among the main effects, caste, standard of living and regions have significant influence. Among the two-way interactions, 'caste and residence' interaction is highly significant but none of the other two-way interactions involving caste has a significant effect on children ever born.

The analysis of variance framework using sums of squares gives only whether an interaction effect is significant or not. In spite of this, to see the *direction* and *quantum of interaction effect,* it is desirable to estimate the effects for various combinations of categorized explanatory variables and to compare the effects of one variable at different levels of another. Therefore, the effect of these new interaction variables (caste x education, caste x level of standard of living and caste x residence) on cumulative fertility is assessed using multiple classification analysis. The MCA gives the adjusted means for each of the nine categories of the variable 'caste x

education'. The adjusted means for the three caste groups can be compared at different levels of education. If the pattern of adjusted means remains the same at each level of education, one could say there is no interaction. But if adjusted means differ either in degree or in direction, interaction is indicated. The analysis has been restricted to currently married women. Since caste and socio-economic variables are categorized, only one interaction is examined at a time[13]. Thus, three sets of analyses (Caste x education interaction, Caste x standard of living interaction, Caste x residence interaction) have been performed separately and presented in Tables 8 – 10. They are:

1. *Caste x Education Interaction:* other socio-economic variables (work status, standard of living, residence and regions) as explanatory variables and marital duration is used as a covariate

2. *Caste x Standard of Living Interaction:* other socio-economic variables (education, work status, residence and regions) as explanatory variables and marital duration is used as a covariate

3. *Caste x Residence (current) Interaction:* other socio-economic variables (education, work status, standard of living and regions) as explanatory variables and marital duration is used as a covariate

Table 7: Analysis of Variance for Children Ever Born, Andhra Pradesh, NFHS-2, 1998–1999

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Covariate: Marital Duration	5240.00	1	5240.00	2613.93	0.000
Main Effects	232.56	10	23.26	11.60	0.000
Caste	20.67	2	10.33	5.16	0.006
Education	6.84	2	3.42	1.71	0.182
Work status	4.67	1	4.67	2.33	0.127
Standard of Living (SLI)	38.21	2	19.10	9.53	0.000
Residence	0.05	1	0.05	0.02	0.877
Region	129.43	2	64.71	32.28	0.000
Two–way Interactions	137.65	41	3.36	1.68	0.005
Caste x Education	5.26	4	1.32	0.66	0.622
Caste x Work status	3.68	2	1.84	0.92	0.399
Caste x SLI	15.51	4	3.88	1.94	0.102
Caste x Residence	19.33	2	9.67	4.82	0.008
Caste x Regions	10.13	4	2.53	1.26	0.282
Education x Work status	2.63	2	1.31	0.66	0.520
Education x SLI	10.96	4	2.74	1.37	0.243
Education x Residence	8.00	2	4.00	1.99	0.136
Education x Region	10.86	4	2.72	1.35	0.248
Work status x SLI	0.44	2	0.22	0.11	0.896
Work status x Residence	5.94	1	5.94	2.96	0.085
Work status x Regions	10.63	2	5.32	2.65	0.071
SLI x Residence	1.16	2	0.58	0.29	0.750
SLI x Regions	3.14	4	0.79	0.39	0.815
Residence x Regions	11.40	2	5.70	2.84	0.058
Explained	5610.21	52	107.89	53.819	0.000
Residual	7252.90	3618	2.01		
Total	12863.10	3670	3.51		

Note: For currently married women of age 15–49 only.

Table 8: Unadjusted and Adjusted Deviations in Mean Number of Children Ever Born by Caste and Different Levels of Education and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable + Category	N	Unadjusted Deviations	eta	Deviations Adjusted for Independents and Covariates	beta	Adjusted Mean
Grand Mean	3670	2.71				
Caste x Education			0.241		0.057*	
SC/ST – Illiterate	698	0.43		0.21		2.92
OBC – Illiterate	1112	0.29		-0.02		2.69
OC – Illiterate	486	0.22		-0.01		2.70
SC/ST – Lit. < middle	140	-0.43		0.00		2.71
OBC – Lit. < middle	308	-0.40		-0.07		2.65
OC – Lit. < middle	323	-0.14		-0.15		2.56
SC/ST–middle school +	62	-1.16		-0.05		2.66
OBC – middle school +	202	-0.91		-0.08		2.64
OC – middle school +	340	-0.71		-0.08		2.63
Work status			0.101		0.023	
Non-working	1569	-0.22		0.05		2.76
Working	2101	0.16		-0.04		2.68
Standard of Living			0.072		0.070***	
Low	1300	0.13		0.11		2.82
Medium	1731	0.00		0.02		2.74
High	639	-0.26		-0.28		2.44
Residence			0.043		0.001	
Rural	2753	0.05		0.00		2.71
Urban	917	-0.14		0.00		2.72
Regions			0.080		0.103***	
Coastal Andhra	1598	-0.17		-0.22		2.50
Rayalaseema	661	0.06		0.12		2.83
Telengana	1412	0.16		0.19		2.90
Multiple R = 0.652		$R^2 = 0.426$				

Notes: SC/ST: Scheduled caste/tribe; OBC: Other backward class; OC: 'Other' caste; For currently married women of age 15–49 only Marital duration is used as a covariate; Level of significance: ***p ≤ 0.001; **p ≤ 0.01; *p ≤ 0.05

Caste and Fertility by Level of Education

Table 8 provides the unadjusted and adjusted relationship between the caste and fertility (children ever born) within different levels of education. The results of MCA show that SC/STs have 0.22 (2.92 – 2.70) more children than OCs at the lower level of education (illiterate) and this difference is reduced to 0.15 (2.71 – 2.56) children at the less than middle school level of education. At the middle school and above levels of education, there is virtually no difference in fertility between the caste groups. The OBC-OC difference is quite small at each level of education. Thus, the difference in fertility is wider at lower levels of education and the gap narrows and (almost) converges at higher level of education. The findings of higher fertility for SC/STs than for OCs at lower levels of education and lower fertility for SC/ST than OCs, or the convergence in OC–SC/ST fertility at higher levels of education, points out that, with the improvement in educational levels, SC/STs will have as few children as OCs. These findings are in accordance with the hypothesized relationship between caste–

education and fertility. Thus, the results showed the existence of interaction effect between caste and education. However, the analysis of variance (Table 7) showed this effect as insignificant.

Caste and Fertility by Level of Standard of Living

The results of interaction effect of caste and standard of living on cumulative fertility (Table 9) show that the difference in mean children ever born between SC/ST and OCs was negligible (2.95 – 2.87 = 0.08) at the lower level of standard of living and this difference increased to 0.23 (2.90 – 2.67) children at the middle level of standard of living. At the higher level of standard of living, the SC/ST-OC difference narrowed to 0.13 (2.49 – 2.36), showing some interaction. The OC-OBC difference is quite small at each level of standard of living (Table 9). The pattern is not clear as in the 'caste x education' interaction and, the analysis of variance also did not show significant interaction effect between caste and standard of living (Table 7).

Table 9: Unadjusted and Adjusted Deviations in Mean Number of Children Ever Born by Caste and Different Levels of Standard of Living (Index) and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable + Category	N	Unadjusted Deviations	eta	Deviations Adjusted for Independents and Covariates	beta	Adjusted Mean
Grand Mean	3670	2.71				
Caste x Level of Standard of Living (SOL)			0.086		0.094***	
SC/ST – Low SOL	543	0.26		0.24		2.95
OBC – Low SOL	574	0.07		0.04		2.76
OC – Low SOL	184	-0.08		0.15		2.87
SC/ST– Medium OL	331	0.10		0.18		2.90
OBC – Medium SOL	835	0.03		-0.02		2.69
OC – Medium SOL	566	-0.10		-0.04		2.67
SC/ST– High SOL	26	-0.38		-0.23		2.49
OBC – High SOL	212	-0.24		-0.25		2.47
OC – High SOL	400	-0.27		-0.35		2.36
Education			0.235		0.026	
Illiterate	2296	0.32		0.04		2.75
Literate, < Middle	771	-0.30		-0.08		2.64
Middle School +	603	-0.82		-0.05		2.67
Work Status			0.101		0.022	
Non-working	1569	-0.22		0.05		2.76
Working	2101	0.16		-0.04		2.68
Residence			0.043		0.002	
Rural	2753	0.05		0.00		2.71
Urban	917	-0.14		0.01		2.72
Regions			0.080		0.105***	
Coastal Andhra	1598	-0.17		-0.22		2.49
Rayalaseema	661	0.06		0.12		2.83
Telengana	1412	0.16		0.20		2.91
Multiple R = 0.652		R^2 = 0.426				

Notes: See Table 8

Caste and Fertility by Residence

The results of interaction effects of caste and residence on cumulative fertility (Table 10) reveal that the effect of rural–urban residence on fertility being negative for

SC/ST and positive for OC, that is, in urban areas SC/ST fertility is lower but for OC fertility is higher. The results of MCA show that the SC/STs have 0.32 (2.88 – 2.56) more children than OCs in rural areas. But, this picture is reversed completely in urban areas and the SC/STs have fewer children (0.13) than OCs. The results clearly show the existence of interaction effect for caste and residence. The difference is wider in rural areas and the gap narrows and converges in urban areas. Thus, there is a strong 'caste x residence' interaction effect. This is confirmed by the analysis of variance, which shows this interaction effect to be highly significant (Table 7). As noted earlier, the analysis of variance shows that 'caste x work status' and 'caste x region' interactions are not significant. Therefore, these interactions are not examined. In sum, the results show that in rural areas and at the lower levels of socio-economic status (education and standard of living), fertility is relatively high and SC/STs have higher fertility than OCs. But this situation is reversed completely in urban areas and at the higher levels of education and standard of living, where the level of fertility is low and SC/STs also have lower fertility than OCs. Thus, this indicates that in Andhra Pradesh, the caste effect on fertility is not constant across various levels of other socio-economic factors.

Table 10: Unadjusted and Adjusted Deviations in Mean Number of Children Ever Born by Caste and Rural–urban Residence and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable + Category	N	Unadjusted Deviations	eta	Deviations Adjusted for Independents and Covariates	beta	Adjusted Mean
Grand Mean	3670	2.71				
Caste x Residence			0.090		0.064***	
SC/ST – Rural	786	0.22		0.16		2.88
OBC – Rural	1233	0.09		0.00		2.71
OC – Rural	734	-0.21		-0.15		2.56
SC/ST – Urban	114	-0.07		-0.02		2.70
OBC – Urban	388	-0.24		-0.16		2.55
OC – Urban	415	-0.06		0.12		2.83
Education			0.235		0.028	
Illiterate	2296	0.32		0.04		2.75
Literate, <Middle	771	-0.30		-0.07		2.64
Middle School +	603	-0.82		-0.06		2.65
Work Status			0.101		0.024	
Non-working	1569	-0.22		0.05		2.77
Working	2101	0.16		-0.04		2.67
Standard of living			0.072		0.069***	
Low	1300	0.13		0.10		2.81
Medium	1731	0.00		0.03		2.74
High	639	-0.26		-0.27		2.44
Regions			0.080		0.099***	
Coastal Andhra	1598	-0.17		-0.21		2.50
Rayalaseema	661	0.06		0.12		2.84
Telengana	1412	0.16		0.18		2.89
Multiple R = 0.654		R^2 = 0.428				

Notes: See Table 8

Caste and Contraceptive Use by Socio-economic Status

Use of contraception also varies substantially across the caste groups and contraceptive use is lowest among women belonging to SC/ST and highest among 'other caste' (Table 6). As observed in the earlier section, if improvement in the socio-economic status is associated with the reduction of fertility and the narrowing of the difference in fertility between SC/ST and OC, we would also expect to find the use of contraception to rise and so narrowing the difference in the practice of contraception between SC/ST and OC, with the increased socio-economic status. Therefore, the interaction effects of caste and other socio-economic variables on contraceptive use were assessed in this section. To assess the interaction effect between caste and socio-economic variables on contraceptive use, logistic regression analysis has been carried out and only one interaction is examined at a time. To interpret the results of the interaction effects of caste and other socio-economic variables (caste x education, caste x standard of living and caste x residence) on contraceptive use, along with the logistic co-efficients, the predicted values of the probabilities of contraceptive use (expressed as percentages) are used and presented in Tables 11 – 13. The logistic co-efficients are log odds and differences between logistic coefficients for two caste groups give an idea of the differences in the propensity to use contraception. First, the coefficients for SC/STs and OBCs are compared to the coefficient for OC at each level of the socio-economic variable used. The test for the equality of regression coefficients is applied to see if the coefficient for SC/ST differs from the coefficient for OCs at each level of socio-economic variable. Similarly the equality of the OC–OBC coefficient is examined. As discussed earlier, though the contraceptive use depends on the number of living children, analysis of interactions by number of living children is not possible, since the number of women in some categories becomes very small. Therefore, the analysis has been carried out for the total sample of all currently married women. However, number of living children is used as an independent variable in the multivariate analysis.

Caste and Contraceptive Use by Level of Education

The logistic regression results (Table 11) on the use of contraception by caste groups within different levels of education show that at lower levels of education (among illiterates), OC women tend to use contraception more frequently than SC/STs and the difference is found to be statistically significant. However, this difference in use of contraception between SC/ST and OCs is not found to be statistically significant among literates (below middle school and middle school and above levels of education). The OC-SC/ST difference in the logistic coefficient drop from 0.69 (= 0.00–[–0.69]) for illiterate women to negligible, about 0.11 [= (0.10–[–0.01]) and (0.16 – 0.05)] among literate women below middle or above middle levels of education, respectively. On the other hand, the OC– OBC differences in the logistic coefficients also vary by the level of education. The OC-OBC gap in the logistic coefficient narrows from 0.12 (= 0.00 – [–0.12]) for illiterate women to –0.30 (=0.10 – [0.40]) at the below middle level and further down to –0.43 (= 0.16 – [0.59]) at the middle and above level of education. Thus, the OC-OBC gap narrows down with a change in the direction at below middle level of schooling. The predicted percentages of contraceptive use for the three caste groups at different level of education also show that the OC-SC/ST gap narrows from 17 percentage points among illiterate women to less than 3 points for women with below middle school or middle and

above level of education. On the other hand, the OC-OBC differences change in direction (greater propensity to use contraception among OC illiterates than among OBC illiterates, but the converse hold among literate women). However, the OC-OBC differences are quite small below 10 per cent.

Table 11: Logistic Regression Coefficients, Unadjusted and Adjusted Percentages of Currently Married Women Using Contraception by Caste and Different Levels of Education and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable/Category	Regression Coefficient β	Exp (β)	% of Women Using Contraception	
			Unadjusted	Adjusted[1]
Caste x Education				
SC/ST – Illiterate	-0.689	0.502***	51.5	44.4
OBC – Illiterate	-0.119	0.888	60.8	58.6
OC – Illiterate®	0.000	1.000	64.4	61.4
SC/ST – Lit. < Middle	-0.006	0.994	55.0	61.3
OBC – Lit. < Middle	0.403	1.496*	65.6	70.4
OC – Lit. < Middle	0.096	1.100	67.0	63.7
SC/ST–Middle School +	0.053	1.054	43.5	62.7
OBC – Middle School +	0.590	1.805*	57.4	74.2
OC – Middle School +	0.162	1.176	59.0	65.2
Work Status				
Non-working®	0.000	1.000	59.1	53.7
Working	0.417	1.517	60.0	63.8
Standard of Living				
Low®	0.000	1.000	52.9	51.9
Medium	0.325	1.385***	61.2	59.9
High	0.909	2.481***	69.0	72.8
Number of Living Children				
0	-5.184	0.006***	1.8	1.8
1	-2.781	0.062***	16.4	16.7
2 ®	0.000	1.000	74.9	76.4
3	0.925	2.522***	86.2	89.1
4+	0.403	1.496***	76.8	82.9
Experience of Child Loss				
No®	0.000	1.000	57.2	59.0
Yes	0.110	1.117	67.7	61.6
Residence				
Rural®	0.000	1.000	58.4	59.0
Urban	0.106	1.112	63.4	61.5
Regions				
Coastal Andhra ®	0.000	1.000	63.3	68.0
Rayalaseema	-0.663	0.515***	53.1	52.3
Telengana	-0.640	0.527***	58.5	52.9
All (Grand Mean)	59.600			
Constant	0.878			
–2 Log likelihood	3109.23			
Chi – Square	1842.13			
Number of cases	3670			

Notes: SC/ST: Scheduled caste/tribe; OBC: Other backward class; OC: Other caste; [1]The adjusted (predicted) values of per cent contraceptive use have been computed from the logistic regression coefficients. These are the predicted values after controlling for the effects of other variables; ® – Reference category; Level of significance: ***p ≤ 0.001; **p ≤ 0.05; *p ≤ 0.01

Caste and Contraceptive Use by Level of Standard of Living

The results reveal that use of contraception is lower for SC/ST and OBC than OCs at middle and lower levels of standard of living. However, at the higher levels of standard of living, the use of contraception was higher for OBCs and lower for SC/STs than OCs. The OC-SC/ST difference in the logistic coefficient rises from 0.38 (= 0.0 – [–0.38]) at the low level of standard of living, to 0.56 (= 0.55 – [–0.01]) at the middle level and narrows down to 0.11 (= 0.87 – 0.76) at the high level. This indicates some interaction between caste and standard of living, a rise and then a decline in the caste differential. However, the difference at the middle and higher levels of standard of living is not significant. The predicted percentages of contraceptive use also show that the OC-SC/ST gap widens from 9 points at the lowest level of standard of living to 13 points at the medium level but then closes at the high level. Thus, the OC-SC/ST gap widens at middle levels of standard of living and narrows at higher level. A similar picture is seen among OBCs but the differences are small. Over all, the results show some interaction between caste and standard of living; OC-SC/ST differences widen at medium level of standard of living and narrow down at high standard of living. On the other hand, the OC-OBC differences change in direction and show greater propensity to use contraception among OCs than among OBCs at middle level of standard of living, but the converse hold at high level of standard of living (Table 12).

Caste and Contraceptive Use by Rural–urban Residence

The results of interaction effects of caste and rural-urban residence on contraceptive use (Table 13) reveal that the use of contraception for OCs is significantly higher than for SC/STs in rural areas. However, the OC-SC/ST differences are quite small and not significant in urban areas. On the other hand, the OC-OBC differences change in direction and show greater propensity to use contraception among OC than among OBC in rural areas, but the converse hold in urban areas. The OC-SC/ST and OC-OBC difference in the logistic coefficient narrows from 0.71 (= 0.00–[–0.71]) for rural women to –0.10 (= –0.43–[–0.33]) for urban women. However, the difference between OC-SC/ST in rural areas is not significant. The OC-OBC gap in the logistic coefficient narrows from 0.20 (= 0.00 – [–0.20]) for rural women to –0.10 (=-0.43 – [0.33]) for urban women. The predicted percentages of contraceptive use for the three caste groups in rural and urban areas also show that the OC-SC/ST and OC-OBC gap narrows and converges in urban areas. Thus, there is a clear 'caste x residence' interaction in contraceptive use.

The unadjusted percentage use of contraception by caste and other socio-economic variables according to number of living children (Table 14) also show that the contraceptive use rises with socio-economic status even when parity is considered. High parity OC women tend to practice contraception more frequently than their SC/ST and OBC counterparts in rural areas and at the lower levels of standard of living and education. However, this situation changes in urban areas and at the higher levels of education and standard of living. The use of contraception among SC/ST and OBC women with three children is higher than among their OC counterparts. For low parity women, there is negligible difference in the use of contraception between the OC and the OBC (Table 14).

Table 12: Logistic Regression Coefficients, Unadjusted and Adjusted Percentages of Currently Married Women Using Contraception by Caste and Different Levels of Standard of Living (Index) and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable/Category	Regression Coefficient β	Exp (β)	% of Women Using Contraception	
			Unadjusted	Adjusted
Caste x Level of Standard of Living (SOL)				
SC/ST – Low SOL	-0.380	0.684*	49.0	41.7
OBC – Low SOL	0.253	1.288	56.6	57.4
OC – Low SOL®	0.000	1.000	53.0	51.1
SC/ST– Medium SOL	-0.009	0.991	55.3	50.9
OBC – Medium SOL	0.461	1.586*	61.6	62.3
OC – Medium SOL	0.546	1.727*	64.0	64.3
SC/ST– High SOL	0.760	2.139	55.6	69.1
OBC – High SOL	1.282	3.602***	73.1	79.0
OC – High SOL	0.866	2.378**	67.8	71.3
Education				
Illiterate®	0.000	1.000	58.8	55.6
Literate, < Middle	0.401	1.493***	64.2	65.1
Middle School +	0.493	1.637***	56.9	67.2
Work Status				
Non-working®	0.000	1.000	59.1	53.8
Working	0.413	1.511***	60.0	63.8
Number of Living Children				
0	-5.176	0.006***	1.8	1.8
1	-2.765	0.063***	16.4	16.9
2 ®	0.000	1.000	74.9	76.3
3	0.920	2.510***	86.2	89.0
4+	0.403	1.496***	76.8	82.8
Experience of Child Loss				
No®	0.000	1.000	57.2	59.0
Yes	0.108	1.114	67.7	61.6
Residence				
Rural®	0.000	1.000	58.4	59.0
Urban	0.107	1.113	63.4	61.5
Regions				
Coastal Andhra ®	0.000	1.000	63.3	68.3
Rayalaseema	-0.676	0.509***	53.1	52.3
Telengana	-0.665	0.514***	58.5	52.5
All (Grand Mean)	59.600			
Constant	0.613			
–2 Log likelihood	3111.700			
Chi – Square	1839.69			
Number of cases	3670			

Notes: See Table 11

Table 13: Logistic Regression Coefficients, Unadjusted and Adjusted Percentage of Currently Married Women Using Contraception by Caste and Rural–urban Residence and Other Background Characteristics, Andhra Pradesh, NFHS-2, 1998–1999

Variable/Category	Regression Coefficient β	Exp (β)	% of Women Using Contraception	
			Unadjusted	Adjusted
Caste x Residence				
SC/ST – Rural	-0.709	0.492***	50.3	48.1
OBC – Rural	-0.205	0.814	59.2	60.6
OC – Rural®	0.000	1.000	65.5	65.3
SC/ST – Urban	-0.333	0.716	59.6	57.5
OBC – Urban	0.326	1.386*	67.9	72.3
OC – Urban	-0.431	0.650*	60.0	55.1
Education				
Illiterate®			58.8	55.5
Literate, < middle	0.411	1.509***	64.2	65.3
Middle school +	0.502	1.652***	56.9	67.3
Work Status				
Non-working®	0.000	1.000	59.1	53.7
Working	0.419	1.520***	60.0	63.8
Standard of Living				
Low®	0.000	1.000	52.9	52.2
Medium	0.318	1.374***	61.2	60.0
High	0.875	2.398***	69.0	72.3
Number of Living Children				
0	-5.179	0.006***	1.8	1.8
1	-2.775	0.062***	16.4	16.7
2 ®	0.000	1.000	74.9	76.2
3	0.933	2.542***	86.2	89.1
4+	0.429	1.536***	76.8	83.1
Experience of Child Loss				
No®	0.000	1.000	57.2	59.0
Yes	0.112	1.119	67.7	61.7
Regions				
Coastal Andhra®	0.000	1.000	63.3	67.9
Rayalaseema	-0.669	0.512***	53.1	52.0
Telengana	-0.622	0.537***	58.5	53.2
All (Grand Mean)	59.600			
Constant	0.899			
-2 Log likelihood	3098.41			
Chi – Square	1852.95			
Number of cases	3670			

Notes: See Table 11

Table 14: Percentage (unadjusted) Distribution of Currently Married Women Using Contraception for the Three Caste Groups at Various Levels of Socio-economic Variables, NFHS-2, 1998–1999, Andhra Pradesh

Explanatory Variables	Women with One Living Children			Women with Two Living Children			Women with Three Living Children		
	SC/ST	OBC	OC	SC/ST	OBC	OC	SC/ST	OBC	OC
Education									
Illiterate	7.3	14.6	22.8	51.7	70.7	78.9	78.4	84.7	87.0
Literate,<middle	9.4	9.8	10.2	72.5	83.6	85.6	92.9	97.4	87.5
Middle school +	(7.7)	28.3	28.6	(85.7)	82.1	80.6	100.0	96.2	91.3
Standard of Living									
Low	8.0	15.9	6.7	56.1	74.3	76.7	79.1	85.0	90.0
Medium	7.7	14.3	25.3	62.8	74.4	80.8	82.5	87.7	85.8
High	–	29.0	27.4	(71.4)	83.3	84.7	(100.0)	96.2	90.2
Residence									
Rural	7.1	14.8	17.3	57.2	73.8	85.1	78.1	86.2	90.6
Urban	(14.3)	24.2	30.6	74.0	81.3	74.0	94.1	93.5	84.1
Total	7.8	16.7	21.7	59.1	76.0	81.6	80.9	87.9	88.3

Notes: For currently married women of age 15–49 only; SC/ST: Scheduled caste/tribe; OBC: Other backward class; OC: Other caste; '( )' based on 25–49 cases.

In sum, the results of the analysis of the interaction effects between caste and other socio-economic variables show a clear interaction between 'caste and residence', that is, greater propensity to use contraception among OC than among SC/ST and OBCs in rural areas, but the converse hold in urban areas. In the case of education and standard of living also a similar pattern of interaction is observed but not as clearly. The OC-SC/ST and OC-OBC differences widen at middle level and narrow down at higher levels of education and standard of living. The OC-OBC difference in contraceptive use is small at all levels with only a mild interaction seen. This is consistent with the observation in the analysis of children ever born, in earlier section that showed a narrowing down of OC-SC/ST differentials in children ever born in urban areas and at higher levels of socio-economic status.

Summary and Conclusions

The South Indian state of Andhra Pradesh defies the conventional wisdom that socio-economic development is necessary for rapid fertility decline. Despite the slow progress in socio-economic development, the state has experienced fertility transition after Kerala and Tamil Nadu (Ramachandran and Ramesh, 2005). A few researchers have studied the Andhra Pradesh's scene in order to identify the causes of the fertility transition (Balasubramanian, 1999; James, 1999; Ramachandran *et al.,* 2000; James and Subramanian, 2003 among others). The explanations given that are: the family planning programme in the state was well-organized and a much wider reach of mass media than in the rest of the country facilitated a speedier diffusion of innovative behaviour; and high aspirations, caused probably by mass media and social reforms, contributed to demand for a higher quality of children leading to quality-quantity trade off.

Though the average level of fertility of the state of Andhra Pradesh is low and contraceptive use is high, notable differentials persist between the caste groups. Fertility has been much higher and contraceptive use much lower among SC and ST

compared to other caste groups. This paper has examined the differentials in fertility and contraceptive use among caste groups in the context of characteristics and interaction hypotheses. That is, whether the caste differentials in fertility and contraceptive use are caused by variations in characteristics or are the effects of caste *per se;* and whether the differentials exist at each stage of socio-economic status and whether these are of the same order and direction, using the second National Family Health Survey data.

Results of multivariate analyses of the NFHS-2 data on cumulative fertility (children ever born), birth intervals (timing of births) and contraceptive use showed that differentials among caste groups persist even after controlling for other socio-economic and demographic variables. Fertility among SC/STs is higher than that of OBC and 'other' caste women. The OC-OBC differences are small but the OC-SC/ST differences are large. Further, the life table analysis of spacing between births based on the fertility histories of women reveal that the SC/ST women showed considerably shorter birth intervals after the second than the women from OBC and other caste groups, clearly showing a greater tendency of SC/ST women to have higher order births early. Probabilities of progressions to third and fourth birth are also higher for SC/STs than for OBC and OC. The proportional hazard analyses also clearly show that differentials by caste persist even after controlling for the other socio-economic and demographic variables for third and fourth birth intervals. The SC/ST and OBC women have higher propensity to progress to third and fourth births than OC women. The logistic regression analyses on contraceptive use also showed significant differentials among caste groups. Moreover, the differentials among caste groups are seen at various stages of the family building process (age at marriage and age at first birth), and family size desires and fertility regulation (Ramesh, 2003). The SC/ST fertility gap is the result of a lower age at marriage and a higher marital fertility among SC/STs compared to OC and OBCs. Thus, the characteristics hypothesis that is, socio-economic differences contributing to fertility differences has been negated in this study.

Table 15: Summary Results of Interaction Effects on Mean Children Ever Born and Contraceptive Use

Caste/Tribe and Other Variable Category	Mean Children Ever Born (adjusted)[a]			Contraceptive Use (adjusted)[b]		
	Scheduled Caste/Tribe	Other Backward Class	Other Caste	Scheduled Caste/Tribe	Other Backward Class	Other Caste
Education						
Illiterate	2.92	2.69	2.70	44.4***	58.6	61.4
Literate, <Middle	2.71	2.64	2.56	61.3	70.4*	63.7
Middle School +	2.66	2.64	2.63	62.7	74.2*	65.2
Standard of Living						
Low	2.95	2.76	2.87	41.7*	57.4	51.1
Medium	2.90	2.69	2.67	50.9	62.3*	64.3*
High	2.49	2.47	2.36	69.1	79.0***	71.3**
Residence						
Rural	2.88	2.71	2.56	48.1***	60.6	65.3
Urban	2.70	2.55	2.83	57.5	72.3*	55.1*

Source: [a]. Tables 8, 9 and 10; [b]. Tables 11, 12 and 13; *, **, ***: The coefficient for the specified caste and other variable (education/standard of living/residence) category is significantly different from the coefficient for OC at the same category of the other variable at the 10 per cent, five per cent, and one per cent level, respectively.

Results from analysis of interaction effects showed a strong interaction between 'caste and residence' on the cumulative fertility. The interaction effects of 'caste and residence' on cumulative fertility reveal that the SC/STs fertility is lower in urban areas than in rural areas but for OCs fertility is higher in urban areas. In other words, the difference is wider in rural areas and the gap narrows and converges in urban areas. For caste and education, the interaction effect is mild, that is, there exist the SC/ST–OC difference at primary level of schooling and narrows at middle school and above levels of education. Looking at the use of contraception by caste groups with different levels of socio-economic status, we find no significance in the use of contraception between SC/ST and OCs in urban areas and at higher levels of education and standard of living. However, in rural areas and at lower levels of education and standard of living, the use of contraception among OCs is significantly higher than for SC/STs. Thus, the analysis of interaction effects showed that the caste effect is not constant across the levels of other socio-economic factors. The caste differentials are notable at lower level of socio-economic status but at higher levels of socioeconomic status, the differentials are narrows. What are the implications? From these findings, one may tend to conclude that with the improvement of socio-economic status, not only will fertility decline with a corresponding increase in the use of contraception, but also the differences in fertility and contraceptive use between caste groups will disappear.

Endnotes

1. Scheduled Castes (SC) and scheduled Tribes (ST) are castes and tribes that the Government of India officially recognizes as socially and economically backward and in need of special protection from injustice and exploitation.

2. Other Backward Classes (OBC) are castes and communities that have been designated by the Government of India as socially and educationally backward and in need of protection from social injustice.

3. However, comparing the NFHS-1 and SRS estimates of fertility, Narasimhan *et al*. (1997) concluded that both are probably underestimates.

4. Family building process can be viewed as a series of stages through which women successively move, from marriage to first birth, first to second birth and so on, until they reach their completed family size (Rodriguez and Hobcraft, 1980:8). Such stages can be better judged by parity progression ratios and birth intervals, where the former indicate the proportion of women who move from one stage to another and the latter indicate the timing of births.

5. The NFHS-2 is a demographic and health survey collected as part of the Demographic and Health Survey (DHS) program, which is funded primarily by the United States Agency for International Development (USAID). The national survey covered a representative stratified random sample of about 95,000 women aged 15–49 years from the 26 states of India (IIPS and ORC Macro, 2000). Subsequent survey, the NFHS-3 carried out in 2005–06, for which data are yet to become available for India and for the state of Andhra Pradesh.

6. Though the religious differences persist among caste groups, the number of women belonging to non-Hindu religions is not sufficiently large (12.4 per cent of women belong to non-Hindu religions) for further classification of caste groups by religion. Therefore, for a meaningful analysis, women are classified by caste rather than by religion and caste. Further, the sample of individual categories of scheduled caste and scheduled tribes are very small for meaningful multivariate analysis. Therefore, both categories are combined.

7. Fertility differentials by caste could, at least in part, be attributable to spatial variation. Therefore, it becomes necessary to control the region effect. The state is divided into 23 districts and distributed into three regions: Coastal Andhra Pradesh (comprises the nine districts of Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore), Telangana (consists of ten districts: Mahaboobnagar, Rangareddi, Hyderabad, Medak, Nizamabad, Adilabad, Karimnagar, Warangal, Khammam and Nalgonda), and Rayalaseema (Four districts of Chittoor, Cuddapah, Kurnool and Anantapur). Coastal Andhra covers 34 per cent of the total land area of the state and the other two regions Telengana and Rayalaseema cover 42 and 24 per cent of the area, respectively. These three regions differed considerably in terms of both socio-economic indicators, with Telangana lagging behind the other two regions. The lowest Total Fertility Rate (TFR) is observed in the Coastal region (2.12), followed by Rayalaseema (2.75) and Telengana (2.89) regions (Ramachandran and Ramesh, 2005).

8. Since, intervals beginning during the period prior to 1975 and after 1995 are not large and truncation bias (Trussell *et al*., 1985) seriously affects these.

9. The NFHS-2 data do not allow an examination of the first birth interval. It was found that in 19 per cent of cases, the date of first birth was within seven months of marriage (Ramesh, 2003). The number of fifth and higher order births are too small for further analysis of differentials.

10. Investigation of period or time period will provide some evidence of the demand for subsequent births over a period of years and also helps to investigate the evidence of recent fertility decline in the state.

11. In the case of birth intervals, the number of women in each category becomes very small for various parities. Therefore, the interaction variables could not be examined.

12. Child mortality varies among caste groups in Andhra Pradesh. The NFHS-2 estimates of infant mortality rate during 1988–1998 are: 95 for SC, 104 for ST, 70 for OBC, and 47 for OC compared to the average of 71. Under-five mortality rate are: 122, 116, 90 and 65 for SC, ST, OBC and OC, respectively compared to the average of 91 (IIPS and ORC Macro, 2000a: 120).

13. Inclusion of two interaction variables in a single analysis brings in multi-colinearity. For example, if 'caste X education' and 'caste X residence' are included in a single MCA, the matrix becomes singular and hence both cannot be examined in one analysis.

Appendix

Brief Description of Statistical Techniques Used for Analysis

Details of the statistical techniques used for the analysis of data and the need to use the specific techniques and basic model have been briefly provided in the following lines.

Multiple Classification Analysis

Multiple Classification Analysis (MCA) combines the features of analysis of variance and multiple regression (*Andrews et al.,* 1973). This technique is useful to assess the effects of a number of *categorized* explanatory variables on a numeric dependent variable. The explanatory variables could be interrelated or associated and one could obtain the net effects. Basic model is like the model of Analysis of Variance with multi-way classification.

$$Y_{ijk...} = \mu + \alpha_{i.} + \beta_j + \gamma_k + ... + e_{ijk..,}$$

Where $Y_{ijk...}$is the value of the dependent variable, μ is the grand mean, α_i, β_j, $\gamma_{k...}$ are the effects of factors α, β, γ, … at levels i, j, k,…, respectively and $e_{ijk...}$ is the error term. One or more covariates can also be incorporated in the model.

MCA gives unadjusted and adjusted means of the dependent variable for each category. The unadjusted are raw means that one gets directly from the data. The adjusted means like predicted values in regression controlled for other factors/independent variables. For each of the factor or variable two summary measures, η (eta) and β (beta) are calculated. The *eta* value indicates the gross effect of the factor on the dependent variable and the *beta* value indicates the strength of the adjusted effect (adjusted for covariates and other factors). These are derived from the sums of squares in the analysis of variance table as:

$(eta)^2$ = [Sum of squares for the factor]/[Total sum of squares], and

$(beta)^2$= [Sum of squares for the factor after adjusting effects of other factors and covariates]/[Total sum of squares]

The dependent variable (children ever born) is numeric and the explanatory variables (caste, education, work status, standard of living, residence and regions) are categorical. Therefore, the technique of multiple classification analysis has been adopted to assess the relative influences of caste factor of women on the dependent variable.

Life Table Analysis

The interval between i^{th} and $(i+1)^{th}$ birth is called $(i+1)^{th}$ closed birth interval. However, if $(i+1)^{th}$ birth has not taken place by the date of the survey, the interval between survey date and i^{th} birth is called open birth interval. It is known that an analysis of closed birth intervals, though useful to examine the tempo of childbearing, does not reflect parity progression. A life table, that can be constructed by pooling closed and open birth intervals (treating open birth interval as censored observation),

is a better way of examining the family building process (Srinivasan, 1980; Rodriguez and Hobcraft, 1980). Therefore, in order to determine the level and tempo of fertility, the life table technique has been used by combining the closed intervals of women who had a birth of a particular birth order, and open intervals of women who have not experienced the same birth order at the time of survey. The parity transition or quantum aspect of fertility is indicated by the proportion of women who have a child within a given period while; the tempo aspect is indicated by the median birth interval i.e., the date by which half of the women had the next birth.

Proportional Hazards Model

In order to see the relative effects of caste factor on birth intervals and to evaluate the moving and stopping behaviour of women, the proportional hazards model, which combines the features of life table and regression (Cox, 1972), has been adopted. This technique makes it possible to calculate the risk of having a subsequent birth in a particular group, relative to that of a reference group, whilst controlling for other pertinent variables. Like the standard life table, it is assumed that there is hazard (or risk) at each duration 't', of the occurrence of the end-point event (a birth). The hazard function is the product of underlying duration-dependent risk λ_0 (t) and covariates (z) expressed as exp (ß z). It is assumed that the duration specific rates or risks for a given individual's characteristic are proportional. This is defined as:

$$\lambda(Z;t) = \lambda_0(t)\exp(\beta' Z)$$

$$= \lambda_0(t)\exp\left\{\sum_{j=0}^{k}\beta_j Z_j\right\}$$

Where λ(z; t) is the hazard of failure for an individual with covariate z at time t. $\lambda_0(t)$ is the unspecified baseline hazard when z=0, called reference group. ß is a column vector of unknown parameters to be estimated in the model.

The term exp (ßz) is the relative hazard function or relative risk associated with having the characteristic z. Therefore, the hazard function enables one to estimate the relative risks of other groups in relation to the baseline group (reference group). When there is no covariate present in the model, then exp (ßz) is unity. Values greater than unity indicate that the relative risk of having birth is greater (i.e., the birth interval is shorter) for that group compared with reference group, whereas values less than unity indicate a decrease in the risk (i.e., the birth interval is longer).

Logistic Regression Analysis

Owing to the dichotomous nature of the dependent variable, contraceptive use (using or not using), the technique of logistic regression has been adopted. The logistic regression technique can be used to assess the influence of certain variables on the probability of occurrence of an event. The logit of the probability of occurrence, p, is expressed as a function of a set of explanatory variables {Xi} as –

$$\text{logit}(p) = \log(p/1-p)) = \beta 0 + \Sigma \beta i\ Xi$$

where {βi}are the regression coefficients to be estimated

The logit regression coefficient for a category of a variable is interpreted in relation to the reference category; exp(coefficient for a category) gives the 'odds ratio', ratio of odds for the specified category to the odds for the reference category. For a more meaningful interpretation of results, predicted probabilities of the occurrence of an event can be computed for each category holding the other numerical variables constant at the mean values and the other categorized variables at population distributions in a manner similar to the computation of 'adjusted means' in Multiple Classification Analysis. In the present analysis, such predicted probabilities have been computed and expressed in percentage terms as 'adjusted percentages' (*see* Retherford and Choe, 1993; Ramesh *et al*., 1996; Alagarajan, 2003; Sivakami and Kulkarni, 2003 for a more detailed explanation of how to use multiple classification analysis in conjunction with logit regression). Only those observations with valid values for all the variables in the analysis are included.

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