Fertility Decline under Seemingly Unfavourable Conditions: A Study on the Orissa State of India

Harihar Sahoo

Paper to be presented in XXVI IUSSP International Population Conference Session 142: 'Poverty and Fertility Linkages' on 01 October 2009, 8:30am-10:00am in the room 'Karam 2'.

Fertility Decline under Seemingly Unfavourable Conditions: A Study on the Orissa State of India[1]

Harihar Sahoo

Abstract. Orissa, one of the extremely backward states of India with high infant mortality, extreme poverty, low female literacy and very low level of industrialization and urbanization, has shown an impressive fertility decline in the last two decades. This anomaly calls for an in-depth understanding of the fertility transition of the state, in particular of the family building process and fertility differentials. An analysis of the Period Parity Progression Ratios computed from the fertility histories obtained in the National Family Health Survey III shows a high progression up to the second birth, but a gradual decline after that. Results of Multiple Classification Analysis show notable net effects of various socio-economic factors on mean children ever born. Thus, though transition at low levels of socio-economic development suggests a fall in the thresholds for fertility decline from levels presumed to be required in the past, the roles of socio-economic factors can not be negated.

Keywords: Fertility, Anomaly, Family Building Process, Socioeconomic factors, Orissa

Introduction:

An unprecedented rise in population has been considered a serious challenge to the development efforts by the less developed world. To control population growth, India became the first country in the world to officially announce a family planning programme in 1951. But even after about half a century the population growth is continuing at a rapid pace. Over the last few decades, both fertility and mortality rates fell, but the decline of fertility was not large enough to offset that of mortality until recently. The declining fertility trend is more visible since the mid 1980's. But the rate of decline is very slow,

[1] The author is highly indebted to Professor P.M. Kulkarni, Centre for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University, New Delhi, India for his invaluable suggestions, comments and guidance.

therefore the country has still a long way to go to attain post transitional low fertility as the Total Fertility Rate (TFR) in 2004 is still 2.9 per woman (Registrar General, India, 2006b). Therefore, it can be argued that India is now in the second phase of fertility transition when birth rates decline but remain significantly higher than death rates, resulting in a continued population growth. Fertility has declined throughout the country at varying levels and at different speeds from state to state. Some states are more advanced in their decline in population growth rates, especially the southern states; Kerala reported 0.9 percent annual growth rate during 1991-2001, followed by Tamil Nadu (1.1 percent) and Andhra Pradesh (1.3 percent) while Bihar and Rajasthan show 2.5 percent of annual growth rate of population (Registrar General and Census Commissioner, 2001).

India shows a very high degree of diversity in the demographic processes especially in fertility. The TFR varied from 1.7 in Kerala to 4.4 in Uttar Pradesh in 2004 (Registrar General, India, 2006b). At the one extreme, socially or economically developed states like Kerala and Goa have reached replacement level fertility while less developed states like Bihar, Rajasthan, Madhya Pradesh and Uttar Pradesh are growing at a fast rate. However, Orissa, one of the extremely backward states of India, shows an anomaly. In 2004, the level of infant mortality rate (IMR) at 77 in Orissa is very high and the Crude Death Rate at 9.6 is significantly higher than the national level whereas the CBR at 22.7 is below the national average 24.1 (Registrar General, India, 2006b). The literacy rate in Orissa is 63 percent which is near the national level (Registrar General and Census Commissioner, 2001). About two-fifths of the population (39.9 percent) lives below poverty line in contrast to 21.8 percent at the national level (Government of India, 2007). The economy is primarily agrarian; only 35 percent of workers in Orissa are engaged in activities outside agriculture and a very small proportion, 15 percent, of population of the state lives in urban areas. A substantial proportion, 22 percent of the population belongs to various tribes, identified as “Scheduled Tribes” in Orissa (Registrar General, India, 2001).

Therefore the question arises: why do couples in Orissa opt for lower fertility when infant mortality is high, health facilities in terms of health manpower and infrastructure are not so developed, per capita income is lower than the national average and female literacy is low? These call for an in-depth understanding of the fertility pattern of the state. Therefore, this study attempts to take stock of the fertility patterns, differentials and family building processes in Orissa. With this general background, the specific objectives of the present study are as follows:

1. To study the fertility trends and dynamics of family building process in Orissa.
2. To understand the nature of fertility differentials by background characteristics in Orissa

Materials and Methods:

The study is based on well known existing data sets: Census, Sample Registration System (SRS), Family Welfare Year Book and the National Family Health Surveys (NFHS). The data through census is available on a decennial basis. SRS gives annual series of data on demographic indicators like fertility and mortality. There have been three rounds of NFHS carried out during 1992-93, 1998-99 and 2005-06. These rounds give enormous amount of information on the demographic, health and social indicators. NFHS III is the latest of these, becomes the major source of data for most of the analysis.

Regional variations in fertility in the state have been discussed. First, rural-urban differences are presented followed by inter-districts variations. Socio-economic determinants of fertility at the district level have been examined with the help Multiple Linear Regression. The TFR has been regressed on infant mortality, literacy, percent of workers outside agriculture and urbanization.

To study whether the family building process varies over time in Orissa, Period Parity Progression Ratio (PPPR) analysis has been carried out. The National Family Health Survey (NFHS) provides information about the fertility histories for all the women in the sample that make it possible to analyze the family building process. Women's parity is defined as the number of children that she has ever borne and a Parity Progression Ratio

(PPR) is defined as the proportion of women of a specified parity who eventually move to the next parity during their lifetime. Though the concept of parity is normally defined in terms of birth events, it is extended here to include the event of women's own birth which enables us to analyze transition from women's birth to first birth as well as transition from first birth to second birth and so on. These are generally computed by cohorts of women or cohorts of birth. However, there is a problem encountered by truncation because some women who have had a birth recently, say during a period of ten years before the survey, may possibly have the next birth after the survey. Such information is not available in the survey. As a result, progression from births in a period of about ten years before the survey can not be studied. This makes it difficult to study recent changes. The Period Parity Progression Ratio (PPPR) approach overcomes this problem involving the computation of synthetic parity progression ratios for a time period of one year or five years from duration specific parity progression during the period (Feeney and Yu, 1987). The idea is similar to a synthetic cohort Life Table obtained from age-specific death rates (ASDR). For the computation of Parity Progression ratios from women's own birth to first birth (Parity 0 to 1), any first birth beyond the age of 30 and below the age of 15 years are ignored because of their negligible proportion. Therefore, the Period Parity Progression Ratios relates to the probability of having the first birth from the age of 15 to the age of 30 years. Since the chance of having the succeeding birth after 10 years is very negligible, therefore for PPPR beyond 10 years are ignored.

Parity Progression Ratios can be computed either for currently married women or for all women. Computing PPPR for all women is more useful for relating to total fertility rate (Feeney and Yu, 1987). In India fertility outside marriage is negligible, the progression from first to the second parities and subsequent progressions for ever married women would not be different from all women. Therefore PPPR have been obtained from NFHS data files for ever married women. For the progression to first parities that is for progression from women's birth to first birth PPPR (0 to 1), it is necessary to have data on all women, ever married as well as never married. The household files of sample household provide data on all persons. These could be in principle be used to obtain proportions of ever married women by single years of birth. However not all of those

who are ever married in the selected households could be interviewed. The number of interviewed ever married women by year of birth was divided by respective proportion ever married in that year of birth to obtain the number of women born in the specified year.

Multiple Classification Analysis is used to examine the interrelationship between several predictor variables and a dependent variable within the context of an additive model (Retherford and Choe, 1993). Through this technique we are not only able to explain how each predictor variable is related to the dependent variable but also how well all the variables taken together explain variation in the dependent variable. The dependant variable taken here is the number of children ever born which is numeric. The predictor variables used in the analysis are caste (SC, ST, OBC, others); religion (Hindu, others); women's education (illiterate, primary, secondary, higher); residence (urban, rural); wealth quintile (poorest, poorer, middle, richer and richest) as specified by the NFHS III on the basis of a composite index obtained from ownership of assets and housing conditions; work status of women (not working, agriculture, non-agriculture); age at marriage (less than 14, 15-19, 20 and above); exposure to mass media (not exposed, moderately exposed, highly exposed); structure of the household (nuclear, joint and not dejure population).

Results and Analysis:

Fertility Trends:

Prior to the introduction of Sample Registration System, data on fertility was scanty. Therefore indirect estimates of fertility are obtained by different scholars. The estimates of birth rates by using reverse survival method for Orissa shows that during 1951-61 Orissa's birth rate (40.4) was lower than the all India figure (41.7) but the subsequent decade (1961-71) registered an increase of 0.9 points in the former while the later declined by 0.5 points (Premi, 1991). Given that these are indirect estimates and the changes as well as differences are quite small, it would be said that the birth rate in Orissa was stable and about the same as the national rate during 1951-71. Trends in birth rate in Orissa as well as in India since 1971 obtained from Sample Registration System are

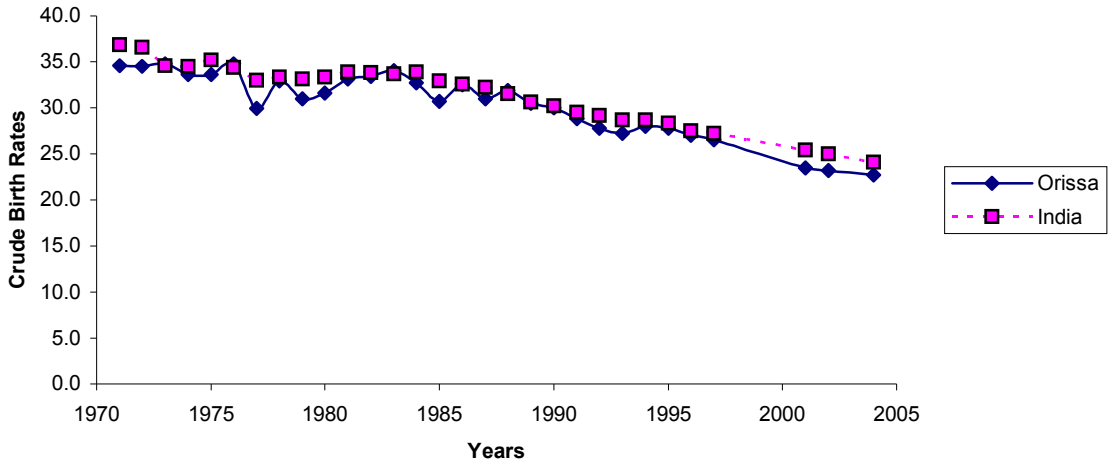
shown in Table 1. The Sample Registration System with dual recording and verification gives fairly satisfactory results and enables an assessment of levels and trends. The results show that the birth rate of Orissa was lower than the all India figure by above 2 points in 1971. But during 1976 to 1986 the birth rate of Orissa was more or less the same with the birth rate of India. Again after 1990, the pace become faster in Orissa than that of India as the gap increases to 2 points by 2001 (Figure 1).

Table 1: Crude Birth Rate in Orissa and India since 1971

Years	Crude Birth Rate	
	Orissa	India
1971	34.6	36.9
1976	34.8	34.4
1981	33.1	33.9
1986	32.5	32.6
1991	28.8	29.5
1996	27.0	27.5
2001	23.5	25.4
2004	22.7	24.1

Source: For 1971-96: India, Registrar General (1999)
For 2001: India, Registrar General (2004)
For 2004: India, Registrar General (2006a).

Figure 1 Birth rates in Orissa and India since 1971



Source: For 1971-97, India, Registrar General (1999),
For 1997-2004, SRS Bulletins.

To understand the changes in fertility in Orissa more clearly, changes in age-specific fertility rates from 1971 to 2004 are examined. Table 2 shows that the fertility decline in Orissa is clearly visible in all the age groups. The remarkable change was found in 45-49 and 40-44 age groups. Fertility decline in rural Orissa was steep at all ages except 20-24 where the change was negligible. The highest decline was registered in 45-49 age group followed by the 15-19 and 15-19 age groups. Fertility decline in rural Orissa was steep at all ages except 20-24 where the change was negligible. The highest decline was registered in 45-49 age group followed by 40-44 and 15-19 age groups while in urban Orissa, the fertility decline is much wider across all the age groups compared to rural Orissa. The highest fertility decline is found in 45-49 age group followed by the 40-44 and 15-19 age groups. But the reduction in fertility in the age group of 20-24 where fertility declined by 32 percent probably due to a reduction in the interval between marriage and first birth caused by delayed marriage.

Table 2: Percentage Decline in ASFR, TFR and CBR in Orissa by Place of Residence in Orissa

Age	Rural			Urban			Total		
Group	1971	2004	% Decline	1971	2004	% Decline	1971	2004	% Decline
15-19	118.8	36.7	69.1	113	21.6	80.9	118.4	34.5	70.9
20-24	223.8	192.9	13.8	208.5	141.2	32.3	222.7	185.1	16.9
25-29	242.9	180.6	25.6	236.3	129.7	45.1	242.4	172.8	28.7
30-34	173.6	90.5	47.9	137.7	52	62.2	171.4	84.7	50.6
35-39	107.9	41.5	61.5	96.2	24.2	74.8	107.2	38.8	63.8
40-44	46.8	17	63.7	42.7	3.8	91.1	46.6	15	67.8
45-49	40.1	8.7	78.3	22.3	2.9	87.0	39.2	7.7	80.4
TFR	4.8	2.8	41.7	4.3	1.9	55.8	4.7	2.7	42.6
CBR	34.7	23.6	32.0	33	17.3	47.6	34.6	22.7	34.4

Source: For 1971, India, Registrar General, 1999.
For 2004, Registrar General, India, 2006b.

The difference between total marital fertility rate (TMFR) and total fertility rate (TFR) can be considered as mainly due to delayed marriage in a population where the numbers

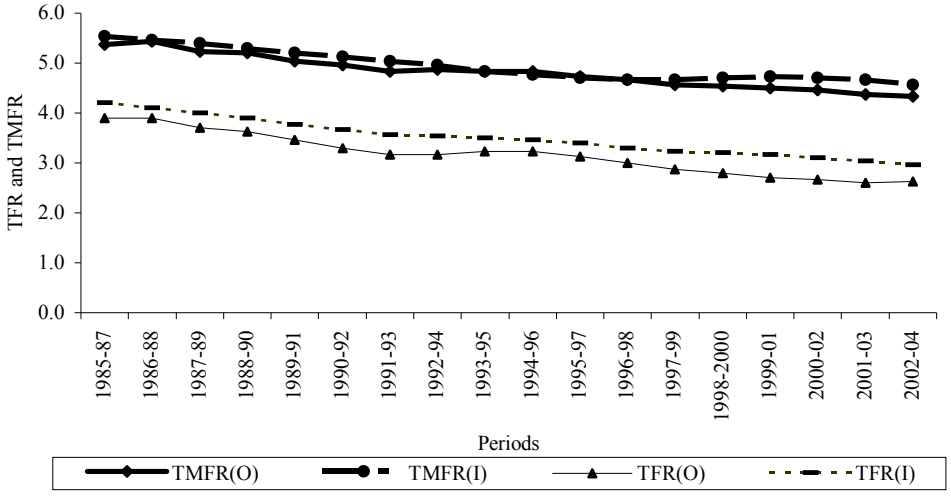
of births outside marriage are negligible (Nag, 1989). This difference has increased from 1.5 in 1985 to 1.7 in 2004 in Orissa while from 1.3 in 1985 to 1.6 in 2004 in case of India, indicating that the effect of the increase in age at marriage on marital fertility is on the rise (Table 3) (Figure 2). But such rise is very slow. Therefore, we can say that the increase in the age at marriage during 1985-2004 was not marked in Orissa. Though the census result shows that the Singulate Mean Age at Marriage (SMAM) for females in Orissa has increased from 17.5 years in 1961 to 20.2 years in 1991 and from 20.7 years to 21.2 years during NFHS I to NFHS II, not much increase is found in the 90's (IIPS and ORC Macro, 2000). However, if the age at marriage for females in Orissa were to increase, the effect of delayed marriage on marital fertility would also increase (Kumar, 1994).

Table 3: Total Fertility (TFR) and Marital Fertility Rate (TMFR) in Orissa as well as India Since 1985

	Orissa			India		
Periods	**TMFR**	**TFR**	**Difference**	**TMFR**	**TFR**	**Difference**
1985-87	5.4	3.9	1.5	5.5	4.2	1.3
1986-88	5.4	3.9	1.5	5.5	4.1	1.4
1987-89	5.2	3.7	1.5	5.4	4.0	1.4
1988-90	5.2	3.6	1.6	5.3	3.9	1.4
1989-91	5.0	3.5	1.6	5.2	3.8	1.4
1990-92	5.0	3.3	1.7	5.1	3.7	1.5
1991-93	4.8	3.2	1.7	5.0	3.6	1.5
1992-94	4.9	3.2	1.7	5.0	3.5	1.4
1993-95	4.8	3.2	1.6	4.8	3.5	1.3
1994-96	4.8	3.2	1.6	4.8	3.5	1.3
1995-97	4.7	3.1	1.6	4.7	3.4	1.3
1996-98	4.7	3.0	1.7	4.7	3.3	1.4
1997-99	4.6	2.9	1.7	4.7	3.2	1.4
1998-2000	4.5	2.8	1.7	4.7	3.2	1.5
1999-01	4.5	2.7	1.8	4.7	3.2	1.5
2000-02	4.5	2.7	1.8	4.7	3.1	1.6
2001-03	4.4	2.6	1.8	4.7	3.0	1.7
2002-04	4.3	2.6	1.7	4.6	3.0	1.6

Source: SRS Bulletins of different years.

Figure 2 SRS Estimates of Total Fertility Rate and Total Marital Fertility Rate in Orissa and India since 1985-87



Source: Table 3

Regional Variations:

The unavailability of data on fertility at the district level was the main hurdle for planning and intervention to reduce fertility at the grass-root level. Therefore, scholars have obtained the district level indirect estimates of fertility. Here the district level indirect estimates of fertility through the reverse survival method have been presented for the period of 1974-80, 1984-90 and 1994-2000 (Table 4). Though the average level of urban fertility in Orissa has already reached at replacement level and the rural fertility in the state is approaching to the level of replacement, there is large variation in fertility among the districts of Orissa. The latest estimation using 2001 census data shows that, out of 30 districts, 16 districts have registered a CBR and TFR higher than the state average of 23.6 and 2.8 respectively for the period 1994-2000. Thus Orissa is characterized by considerable regional heterogeneity with respect to the level of fertility. The districts of coastal Orissa namely Cuttack, Khurdha, Puri, Jagatsinghpur, Kendrapara, Jajpur, Bhadrak, Baleshwar, Ganjam shows lower fertility levels. The most backward districts of Orissa, nationally known as KBK districts namely Kalahandi, Nuapada, Balangir, Sonepur, Koraput, Malkangiri, Rayagada, Nawarangpur, show very high fertility ranging from 3.4 in Nawarangpur to 2.8 in Balangir and Sonepur in 2001 (Map 3). However the

decline in fertility was experienced in all districts between the late 1970 and the late 1990s.

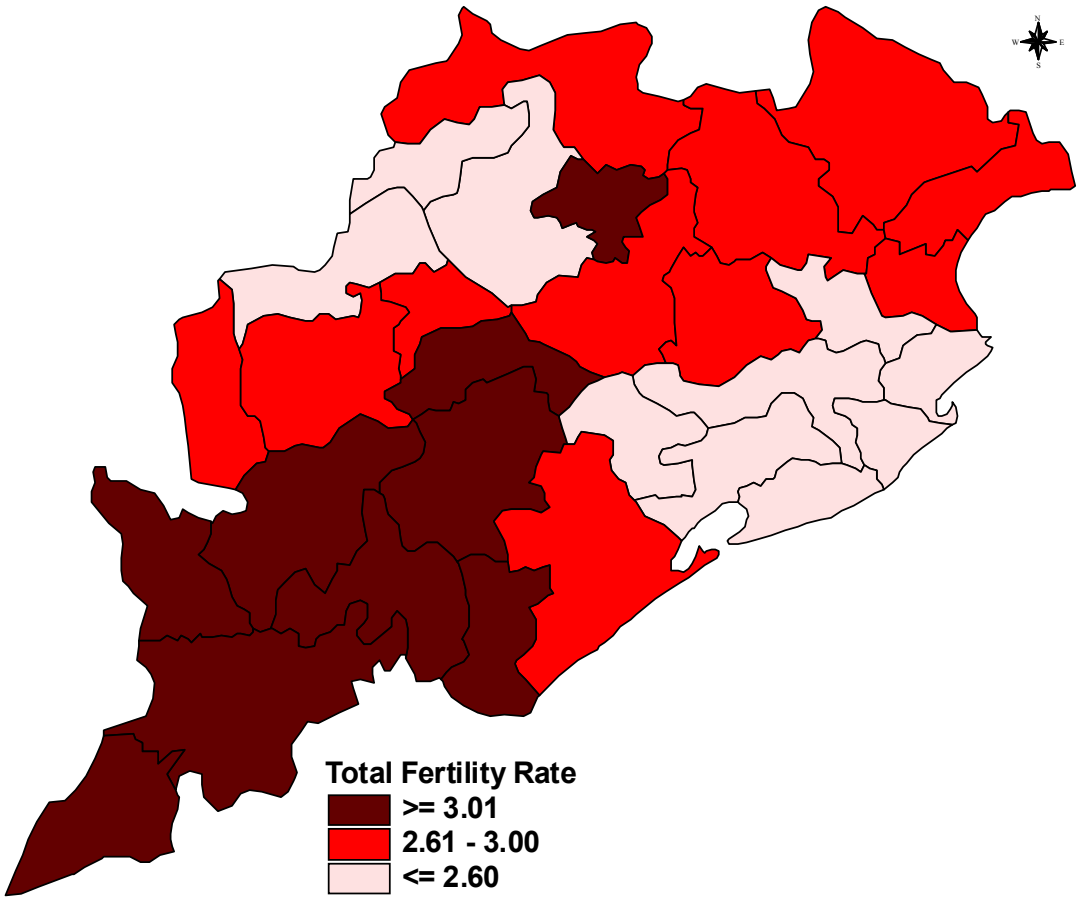
Table 4: TFR and IMR in Different Districts of Orissa in the Recent Decades

Districts	Crude Birth Rate			Total Fertility Rate			Infant Mortality Rate		
	1974-80[1]	1984-90[1]	1994-2000[2]	1974-80[1]	1984-90[1]	1994-2000[2]	1981[3]	1991[3]	2001[4]
Anugul	-	-	23.4	-	-	2.9	-	-	77
Balangir	32.3	28.7	22.9	4.5	3.7	2.8	183	101	78
Baleshwar	36.9	33.2	25.2	5.1	4.3	2.9	190	123	76
Bargarh	-	-	20.6	-	-	2.5	-	-	72
Baudh	-	-	27.4	-	-	3.2	-	-	92
Bhadrak	-	-	24.8	-	-	2.9	-	-	82
Cuttack	33.6	29.2	19.6	4.8	3.8	2.4	197	112	81
Debagarh	-	-	25.5	-	-	3.1	-	-	93
Dhenkanal	35.1	30.7	21.8	5.1	4	2.7	176	105	83
Gajapati	-	-	27.6	-	-	3.3	-	-	103
Ganjam	34.1	31.5	24.0	4.8	4.2	2.9	152	133	82
Jagatsinghpur	-	-	18.8	-	-	2.3	-	-	75
Jajpur	-	-	21.8	-	-	2.6	-	-	78
Jharsuguda	-	-	21.1	-	-	2.6	-	-	64
Kalahandi	33.0	29.4	26.8	4.5	3.7	3.2	169	137	99
Kandhamal	33.3	33.8	30.8	4.5	4.6	3.6	-	-	114
Kendrapara	-	-	21.8	-	-	2.6	-	-	83
Kendujhar	33.4	32.0	25.3	4.6	4.2	3.0	187	99	82
Khordha	-	-	20.3	-	-	2.4	-	-	73
Koraput	33.5	33.4	27.3	4.3	4.2	3.1	133	118	98
Malkangiri	-	-	28.8	-	-	3.3	-	-	100
Mayurbhanj	29.4	32.2	26.0	3.7	4.3	3.0	105	91	62
Nabarangpur	-	-	30.0	-	-	3.4	-	-	100
Nayagarh	-	-	20.9	-	-	2.5	-	-	84
Nuapada	-	-	25.9	-	-	3.0	-	-	88
Puri	32.5	27.8	20.2	4.6	3.5	2.4	170	151	83
Rayagada	-	-	28.5	-	-	3.3	-	-	102
Sambalpur	30.7	27.5	21.2	4.4	3.6	2.6	122	103	79
Sonepur	-	-	22.7	-	-	2.8	-	-	73
Sundargarh	33.6	28.7	22.8	4.5	3.6	2.7	121	101	75
Orissa	33.3	30.4	23.6	4.5	3.9	2.8	163	125	84

Source: [1] Bhat, (1996)
[2] Guilmoto and Irudaya Rajan (2002)

[3] India, Registrar General (1997)
[4] Computed from Children Ever Born and Children Surviving data using MORTPAK, considering MACB=29.5 years and South Asian Pattern.

Map 1: ORISSA
Total Fertility Rate, Districts, 1994-2000



Source: Guilmoto and Irudaya Rajan (2002)

Table 5: Indicators of Key Socio-Economic Factors in Different Districts of Orissa, 2001

Districts	**Percentage of workers in non-agricultural activities**[1]	**Percentage of urban population**[2]	**Literacy rate**[3] (Percent in age 7+ literate)
Anugul	42.0	13.9	68.8
Balangir	28.8	11.6	55.7
Baleshwar	33.0	10.9	70.6
Bargarh	24.5	7.7	64.0
Baudh	21.9	4.8	57.7
Bhadrak	32.1	10.6	73.9
Cuttack	56.9	27.4	76.7
Debagarh	21.6	7.3	60.4
Dhenkanal	40.2	8.7	69.4
Gajapati	21.9	10.2	41.3
Ganjam	36.9	17.2	60.8
Jagatsinghpur	45.6	9.9	79.1
Jajpur	44.1	4.5	71.4
Jharsuguda	53.3	36.4	70.7
Kalahandi	20.0	7.5	45.9
Kandhamal	30.5	6.8	52.7
Kendrapara	32.5	5.7	76.8
Kendujhar	30.7	13.6	59.2
Khordha	69.7	43.0	79.6
Koraput	27.1	16.8	35.7
Malkangiri	16.3	7.2	30.5
Mayurbhanj	33.6	7.0	51.9
Nabarangpur	17.0	5.8	33.9
Nayagarh	37.7	4.3	70.5
Nuapada	22.3	5.7	42.0
Puri	40.0	13.6	78.0
Rayagada	24.6	14.0	36.1
Sambalpur	46.3	27.4	67.3
Sonepur	22.6	7.4	62.8
Sundargarh	40.6	34.4	64.9
Orissa	**35.3**	**15.0**	**63.1**

Source: [1] Directorate of Census Operations (2001b), [2] Directorate of Census Operations (2001a), [3]Directorate of Census Operations (2004).

Table 6: Results of Regression Analysis of Total Fertility Rate on Socio-Economic Indicators in Orissa: District Level Analysis

Variables	Coefficients	Std. Error	Std. Coefficients	t	Sig.
Constant	2.848	0.442	0.000	6.443	0.000
Infant Mortality Rate	0.010	0.004	0.350	2.724	0.012
% in Non-agri. Activities	-0.007	0.006	-0.242	-1.077	0.292
Percent Urban	0.002	0.005	0.047	0.289	0.775
Literacy	-0.010	0.004	-0.431	-2.407	0.024

Dependent Variable: TFR, No. of Cases: 30, R: 0.881, R Square: 0.777, Adjusted R Square: 0.741, Std. Error of the Estimate: 0.173
Source: Computed from Table 4.4 and 4.5.

It would be quite interesting to look at district wise variations in infant mortality in Orissa (Table 4). The infant mortality ranges from 62 in Mayurbhanj district to 114 in Kandhamal district in 2001. Thus there is a wide variation in infant mortality across districts of Orissa. Though the decline in infant mortality is also taking place across all the districts, still the rate is very high.

To determine how literacy level, urbanization, non-agricultural activities, infant mortality is related to variations in total fertility rates at the district level, a linear regression analysis has been carried out. The explanatory variables that are considered here are infant mortality rate, percent of workers (main and marginal) engaged in non-agricultural activities, proportion of population living in urban areas and the literacy rate. The results of regression analyses of total fertility rate on these variables for all the 30 districts of Orissa are presented in Table 6.

Based on the adjusted R square value, the explanatory variables collectively explain 74 percent of the variation in total fertility rate. The standardized coefficient for the infant mortality rate suggests that in the presence of other variables in the analysis, its relation with TFR is positive which is significant. Further, the literacy rate has the highest standardized coefficient and its direct correlation with TFR is significant. Therefore, the infant mortality and literacy rate are the most important variables in explaining total fertility rate. None of the other variables, percentage of workers engaged in non-

agricultural activities and percentage of population living in urban areas shows a significant effect on fertility. Thus it is clear from the regression analysis that, infant mortality and literacy are the most critical variables related to fertility in Orissa.

Family Building Process in Orissa:

There are various ways of studying and measuring fertility. Fertility differentials are conventionally studied with the help of cumulative fertility (children ever born) or current fertility (using a measure like crude birth rate or total fertility rate). Both these indicators, i.e., Total Fertility Rate and Crude Birth Rate have been used for long by the planners and programme managers. However, such indicators do not provide an understanding of fertility trends in an effective manner. A more promising approach for the study of dynamics of human fertility is Period Parity Progression Ratio (PPPR). This approach enables one to study trends in family building process and to understand how a society is progressing towards destabilization of high fertility (Feeney and Yu, 1987). The study of family building process is important not only for scientific reasons but also for evaluating the existing population policies and programmes, which tend to have goals formulated in terms of parity progression, e.g., stopping at two. (Gandotra *et al.,* 1998). Therefore, the principal measure used here is the Period Parity Progression Ratio (PPPRs).

The Period Parity Progression Ratios (PPPRs) have been computed for Orissa for periods of single calendar years during 1990-2004 for progressions up to the 5^{th} parity. Progressions beyond the 5^{th} birth are not computed since very few women had six or more births and the denominators for progression become quite small. Only 6.7 percent women have had 6 or more births and only 3 percent women have 7 or more births and so on. Therefore, it is not possible to study changes in Period Parity Progression Ratios at higher parities using NFHS data as it covers women below the age of 50 years. Since the survey was conducted during December 2005 to April 2006 in Orissa, the PPPRs have been computed up to and including the year 2004.

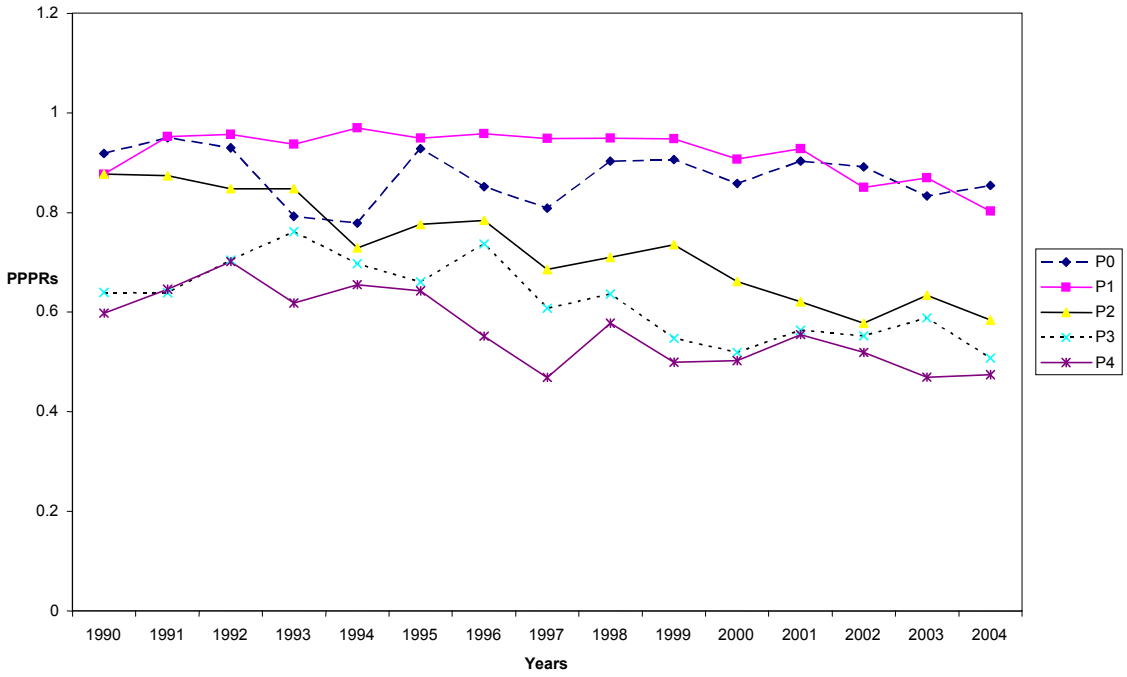
Table 7: Period parity Progression Ratios, Orissa, 1990-2004

Year	P_0	P_1	P_2	P_3	P_4
Annual Series					
1990	0.9184	0.8766	0.8767	0.6392	0.5976
1991	0.9506	0.9526	0.8741	0.6388	0.6456
1992	0.9298	0.9567	0.8479	0.7046	0.7016
1993	0.7923	0.9369	0.8479	0.7613	0.6184
1994	0.7782	0.9694	0.7288	0.6973	0.6552
1995	0.9286	0.9497	0.7763	0.6603	0.6427
1996	0.8516	0.9581	0.7846	0.7370	0.5514
1997	0.8088	0.9485	0.6856	0.6075	0.4685
1998	0.9033	0.9497	0.7101	0.6364	0.5779
1999	0.9060	0.9476	0.7357	0.5474	0.4994
2000	0.8581	0.9067	0.6611	0.5188	0.5027
2001	0.9032	0.9283	0.6211	0.5638	0.5546
2002	0.8916	0.8503	0.5773	0.5524	0.5188
2003	0.8327	0.8699	0.6341	0.5886	0.4693
2004	0.8544	0.8027	0.5840	0.5078	0.4740
Compound PPPRs					
1990-94	0.8689	0.9179	0.8276	0.6802	0.5912
1995-99	0.8858	0.9396	0.7310	0.6387	0.5446
2000-04	0.8626	0.8724	0.6115	0.5477	0.5043

Source: Computed from NFHS III data files.

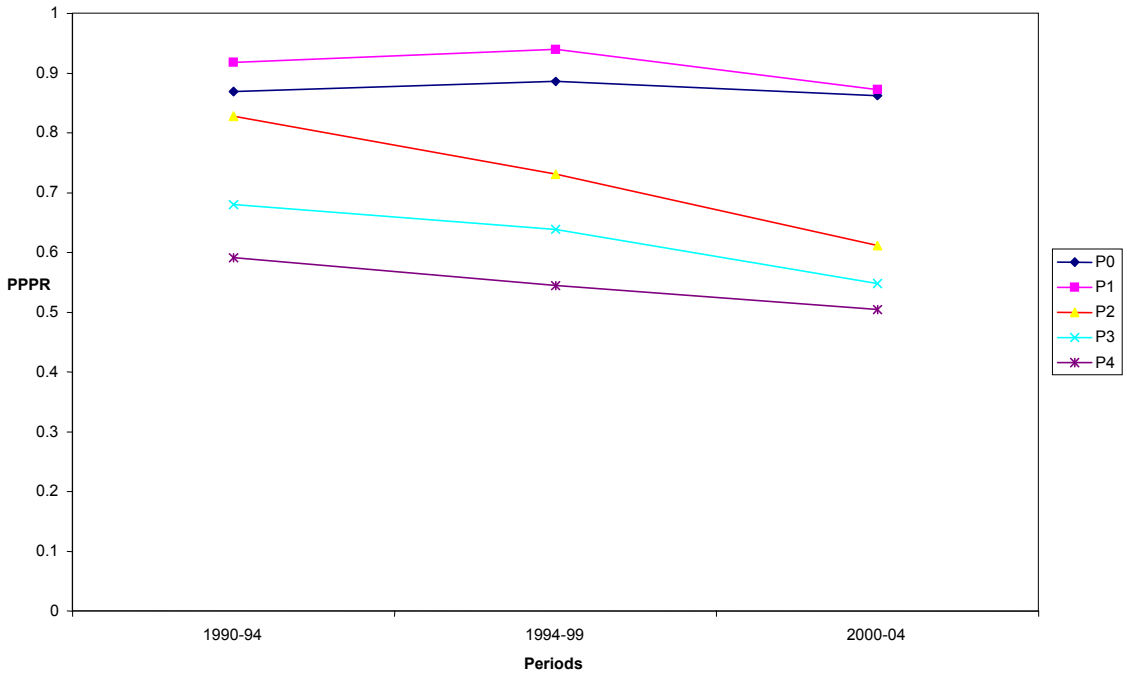
Note: Computed from the ever married women, Succeeding birth after 10 years have been ignored. P_0 refers to the progression from women's birth to her first birth; P_1 refers to the progression from first birth to second birth and so on.

Figure 3: Period parity Progression Ratios, Orissa, 1990-2004, Annual Series



Source: Table 4

Figure 4: Compound Period Parity Progression Ratios, Orissa, 1990-2004



Source: Table 4

Trends in Period Parity Progression Ratios:

The Period Parity Progression Ratios for Orissa during 1990-2004 are presented in Table 7. For the sake of better understanding the PPPR is shown in Figure 3 and 4. The notation P_0 refers to the progression from women's birth to her first birth, P_1 refers to the progression from first birth to second birth and so on. The results show that the progression to the first birth has an irregular trend and the PPPR generally below 0.9. As in Orissa births outside marriage are quite negligible and progression from women's birth to her marriage has not been explored because of the non-reliability of data, therefore it may be due to the lower proportion of ever marrying women (Gandotra *et al.* 1998 found that, the proportion ever marrying is comparatively low in Rajasthan, Orissa, West Bengal, Assam, Goa and Kerala) or may be due to primary sterility. The PPPR from the first to the second parity has remained more or less steady with values from 0.8 to 0.97 and generally higher than 0.9 indicating near universal progression to the second birth.

For the PPPR from the second to the third parity (P_2), a clear declining trend is visible from about 0.9 in the 90's to below 0.6 in the 2004. In other words, the proportion of women moving to the third parity ranges between 877 per 1000 women in 1990 to 584 per 1000 women in 2004 showing a clear cut decline. Similarly, the PPPR to the fourth birth also shows a decline from over 0.7 in the early 90's to about 0.5 in the 2004. The PPPR values have fallen substantially for fourth and fifth parities as well. A close look at the third and higher order birth progressions reveal that, the tendency to go for the third and higher order births has declined, though the decline is not steep while most continue to go for the second child.

It is seen that there are some fluctuations over the period as a result of which the trend is not steady. This can be attributed by two plausible reasons:

1. For single years, the number of women at specified duration may not be large.
2. Misdating of births might have caused fluctuations due to reporting errors, which often occurs due to digit preferences.

To avoid such shortcomings, a five year period was considered to be appropriate for computing the Period Parity Progression Ratios. The five year periods considered here are 1990-94, 1995-99 and 2000-04.

The results show that the progression to the first parity remains constant over the period. The PPPR to the second parity shows a declining trend over the period of observation. Further the PPPR to the third parity shows a decline through 1990-2004. Clearly it shows that, a significant decline is found after second parity. For progression from the third to the fourth parity, the ratio has declined since 1990-1994 onwards but much faster during 2000-04. In Orissa, the PPPR from third to fourth parity was below 0.7 even during 1990-94 and thus appears to have been low even before the 90's but over the next 15 years, the PPPR declined from 0.68 to 0.55. Similar situation is also found among women who progress from fourth to fifth parity.

Fertility Differentials:

An important aspect of fertility research is the study of fertility differentials among population groups classified in terms of various socio-economic and cultural characteristics such as caste, religion, education, place of residence, standard of living and so on. Information about such differentials is necessary to identify the factors and assess the prospects for change. It is also useful for identifying the major determinants of the fertility level of the population.

Total Fertility Rate:

A good measure to assess the magnitude of fertility decline is the total fertility rate. The total fertility rate in Orissa has been fallen from 4.7 births per woman in 1971 to 2.6 by 2003. That means a decline of 2.1 births per woman during the 32 years period. The NFHS III estimate of TFR of 2.34 births per woman in Orissa with rural areas having higher fertility (2.48) than urban areas (1.89), on average, 0.59 children more per rural woman than urban woman. Particularly all the socio-economic groups have experienced this decline in fertility in the state. A comparison of NFHS I, II and III show that, there have been decline in fertility in all the groups (Table 8). The pace of decline in fertility in

urban areas was higher (25 percent) than rural areas (17.3 percent) since NFHS I to NFHS III. Fertility differentials are commonly observed not only with regard to place of residence (rural or urban) but also for different socio-economic groups. Educational level, religion and caste group are the common variables with respect to which significant differences in fertility rate are noticed in Orissa. Across the different educational groups, the TFR is lower among the literate with some educational background than among illiterate women. Considerable decline in fertility is observed in Muslims and Christians. Their fertility has declined by about one child, though from the latest report their information is not available. Similarly, quite a remarkable fertility decline is also observed among scheduled castes. This is crucial in a state where two-fifth of the population belongs to SC and ST. Any significant decline in fertility for the state depends on the fertility decline among these socio-economically backward sections of the society.

Table 8: Total Fertility Rate for women aged 15-49 by Background Characteristics for the three years Preceding the Survey, Orissa, NFHS I, II and III

Background Characteristics	NFHS I[1]	NFHS II[2]	NFHS III[3]
Place of Residence			
Urban	2.53	2.19	1.89
Rural	3.00	2.50	2.48
Education			
Illiterate	3.17	2.82	3.13
Literate, <Middle school complete	3.08	2.42	2.24
Middle school complete	2.59	1.96	2.01
High school complete and above	1.63	1.62	1.89
Religion			
Hindu	2.90	2.45	2.35
Muslim	4.25	3.01	-
Christian	3.36	2.43	-
Caste			
SC	3.68	2.85	2.30
ST	2.90	2.66	3.14
OBC	}2.82	2.47	2.25
Others		2.07	2.01
Standard of Living Index (SLI)			
Low	-	2.69	3.00 (Poorest)
Medium	-	2.40	2.45 (Poorer)
High	-	1.77	1.94 (Middle)
			1.93 (Richer)

			1.58 (Richest)
Total	2.92	2.46	2.37

Source: [1]IIPS (1995), [2]IIPS and ORC Macro (2000), [3] IIPS and Macro International (2008)

Determinants of Children Ever Born: Results of Multiple Classification Analysis (MCA)

Table 9 shows the results of the multiple classification analysis (MCA) which gives the information on the mean number of children ever born to women under study in the two forms – Unadjusted and Adjusted. Here the analysis has been restricted to currently married women who have been married only once. Currently married women have been taken because their marital status effectively controls for variation in birth histories and in the use of contraception which are of interest to policy makers and programme managers. Marital duration has been included as a covariate.

The results reveal that, religion has a substantial effect on the number of CEB. The unadjusted values show that, Hindu women have less number of children (2.62) than those who belong to other religious group (3.16). But this indicates that even after making an adjustment for all the variables and covariates used in the model, the explanatory power of religion in determining the CEB is more or less constant and very high. Thus the results indicate that Hindu women are more satisfied with fewer numbers of children than other religious groups. The unadjusted means reveal that the educational level of women has a significant negative influence on their fertility that is higher the educational level lower the number of children. The average number of CEB to those women who have been categorized as illiterate, primary, secondary and higher are found to be 3.15, 2.89, 1.99 and 1.25 respectively. Even after controlling other predictor variables and covariate, the predictive power of women's educational level has the negative influence on children ever born. Unadjusted means by place of residence shows in an expected direction. However, after being adjusted the predicted mean of urban women shows a higher value (2.70) than the rural women (2.61).

Wealth Index which is the proxy of economic status of the household has a substantial negative effect on the number of children ever born. The unadjusted values show that those women who have been categorized as Poorest, Poorer, Middle, Richer and Richest are found to have 2.96, 2.81, 2.57, 2.43 and 2.04 mean number of CEB respectively. This also shows that after controlling the effect of other predictors, wealth index has also a negative effect on mean number of CEB. As the economic condition increases women tend to have lesser number of children but of better quality. With respect to work status of women, the unadjusted means reveals that, higher average number of children is found among those women who are engaged in agriculture and household related activities than those who are not working and engaged in non-agricultural sectors. But after controlling the other predictors, the work status of women does not show significant effect. The age at marriage of women has a negative influence on children ever born in both the cases, i.e., unadjusted and adjusted. But the differences in adjusted means are small, because most of the effect of age at marriage would be via marital duration, but once the latter is a co-variate, the residual effect is small.

The unadjusted category of means shows that the women's exposure to mass media has a negative effect on their fertility, that is, those who are exposed to mass media show lower mean CEB than those who are not exposed to mass media. But such effect becomes negligible after controlling the other predictors. Structure of the household shows an important determinant of children ever born. The unadjusted category of means shows that women residing in nuclear family have more children compared to those residing in joint family. But such gap (between nuclear and joint) becomes negligible when all other variables are controlled.

Table 9: Multiple Classification Analysis of Children Ever Born on Background Variables, NFHS III, Orissa

Background Variables	N	Unadjusted Deviations	Eta	Deviations Adjusted	Beta	Unadjusted Predicted Mean	Adjusted Predicted Mean
Caste			0.098		0.027***		
SC	591	0.194		-0.007		2.83	2.63
ST	663	0.227		0.091		2.87	2.73
OBC	878	-0.064		-0.044		2.58	2.60
Others	1128	-0.185		-0.016		2.46	2.62
Religion			0.055		0.057***		
Hindu	3148	-0.019		-0.019		2.62	2.62
Others	112	0.52		0.538		3.16	3.18
Women's education			0.333		0.062***		
No education	1404	0.511		0.09		3.15	2.73
Primary	674	0.248		0.063		2.89	2.70
Secondary	1024	-0.649		-0.127		1.99	2.51
Higher	158	-1.387		-0.242		1.25	2.40
Place of Residence			0.062		0.023		
Urban	941	-0.172		0.063		2.47	2.70
Rural	2319	0.07		-0.026		2.71	2.61
Wealth Index			0.180		0.109***		
Poorest	1084	0.316		0.17		2.96	2.81
Poorer	622	0.165		0.089		2.81	2.73
Middle	576	-0.073		-0.021		2.57	2.62
Richer	470	-0.206		-0.044		2.43	2.60
Richest	508	-0.603		-0.408		2.04	2.23
Work Status of women			0.148		0.008		
Not Working	2164	-0.178		0.006		2.46	2.65
Agriculture	686	0.462		0.004		3.10	2.64
Non-agriculture	410	0.167		-0.039		2.81	2.60
Age at first marriage			0.281		0.029		
<=14	469	0.733		0.054		3.37	2.69
15-19	2014	0.145		0.022		2.79	2.66
20+	777	-0.817		-0.089		1.82	2.55
Exposure to mass media			0.160		0.028		
Not Exposed	762	0.383		0.089		3.02	2.73
Moderately Exposed	897	0.172		-0.023		2.81	2.62
Highly Exposed	1601	-0.279		-0.03		2.36	2.61
Household Structure			0.244		0.039***		
Nuclear	1653	0.368		0.064		3.01	2.70
Joint	1421	-0.265		-0.053		2.38	2.59
Not Dejure Resident	186	-1.248		-0.168		1.39	2.47
Multiple R=0.660		R^2=0.436		N=3260		Grand Mean=2.64	

Note: Marital duration is used as a covariate. This analysis has been carried out only for currently married women. **Level of Significance:** ***P<0.01; **P<=0.05
Source: Computed from NFHS III individual data file.

Conclusions:

The analysis of fertility transition in Orissa brings out several interesting dimensions of the transition for the present and the future. The achievement of the state is commendable as far as fertility reduction is concerned. This reduction does not confirm to the classical theories which thought fertility reduction necessitates considerable improvement either in economic or social development. During the 1980's and 1990's the state has experienced a considerable reduction in fertility. SRS estimates indicate that the Crude Birth Rate (CBR) is 22.7 in 2004. The NFHS III estimated a Total Fertility Rate (TFR) of 2.37 per woman during 2003-05, only about 13 percent above the replacement level of 2.1 children per women. The urban TFR (1.89) is below the replacement level and the rural TFR (2.48) is 18 percent above the replacement level (IIPS and Macro International, 2007).

The above analysis, clearly shows that, the progression to the first two parities is still high and very little decline is visible through the period under study 1990-2004. It is only at the third birth that the decline in PPPR is seen. We can infer that there are broadly two groups of people in Orissa, i.e., one group who stop at second birth and the other group who continue till fifth or higher births. The more surprising observation is that still about fifty percent of women with four births in Orissa move on to the fifth birth.

The analysis of different socio-economic and demographic variables suggests that late marriage, educational developments are some of the probable causes of fertility decline in the state. Accelerating acceptance of contraception among Orissan couples (51 percent) is also another cause of fertility decline. Despite the high IMR and CMR the state has experienced reduction in fertility. So further reduction in IMR and CMR, would bring down fertility to further lower level. Therefore, the nutritional status of mothers and children also needs to be improved and girl's education should be given more priority.

The evidence unambiguously shows that Orissa has progressed well into fertility transition. Substantial fertility decline has occurred and a large proportion of couples

have begun to regulate fertility. The idea of regulation has been well accepted and modern contraceptives adopted. An interesting feature is that such a change in behaviour has occurred in seemingly unfavourable conditions. In particular, child survival continues to be poor with poverty fairly widespread and overall development of the state not of a high order. Unlike what happened in Kerala and Tamil Nadu, Orissa experienced no remarkable change in social and economic development. Does this convey that socio-economic development is not a necessary condition for fertility transition? Or, have the socio-economic thresholds of fertility decline become quite low?

While it is true that an impressive fertility decline has occurred in Orissa at an admittedly low level of socio-economic development, there are clearly variations by socio-economic factors at the individual level. Individual factors especially education show very clear fertility depressing effect. Though not much variations have been found with respect to wealth index when all other variables are controlled. Thus, even in the overall less developed state like Orissa fertility is influenced by key socio-economic factors. Yet the question remains on occurrence of transition in such a setting. There are various possibilities. As noted earlier, thresholds could have fallen due to changing tastes and quality-quantity considerations for the entire state. Such changes could occur because of speedier diffusion of ideas. It is also possible that the government family planning programme has been successful in modifying norms and popularizing fertility regulation and contraceptive use. In a negative way poverty might have induced fertility decline as some demographers have argued in similar contexts. It is difficult to provide answers to these questions from the secondary data that are available. Understanding changes and tastes, attitudes and behaviour is a difficult task. It requires in-depth investigation into the processes that shape individual behaviour on highly personal and complex matter such as childbearing. Further research on Orissa's demography needs to address these issues.

References:

Bhat, P.N.M. 1996. 'Contours of fertility decline in India: A district level study based on 1991 census' in K. Srinivasan (ed), ***Population Policy and Reproductive Health***, New Delhi: Hindustan Publishing Corporation, 96-179.

Directorate of Census Operations. Orissa, 2001a. ***'Census of India 2001, Series 22, Orissa, Provisional Population Totals, Paper 2 of 2001, Rural-Urban Distribution of Population',*** Bhubaneswar: Directorate of Census Operations.

Directorate of Census Operations. Orissa, 2001b. ***'Census of India 2001, Series 22, Orissa, Provisional Population Totals, Paper 3 of 2001, Distribution of Workers and Non-workers',*** Bhubaneswar: Directorate of Census Operations.

Directorate of Census Operations. Orissa, 2004. ***'Census of India 2001, Series 22, Vol. II, Orissa, Table A8 & A9, Primary Census Abstract'***, Bhubaneswar: Directorate of Census Operations.

Feeney, G. and Jingyuan Yu. 1987. 'Period Parity Progression measures of fertility in China', ***Population Studies***, 41: 77-102.

Gandotra, M.M., R.D. Retherford, A. Pandey, N.Y. Lathur and V.K. Mishra. 1998. 'Fertility in India', ***NFHS Subject Reports No. 9***, Mumbai: IIPS and Honolulu: East-West Centre program of Population.

Government of India. 2007. ***'Poverty Estimates for 2004-05'***, New Delhi: Press Information Bureau.

Guilmoto, Christophe, Z. and S. Irudaya Rajan. 2002. 'District level estimates of fertility from India's 2001 Census', ***Economic and Political Weekly***, 37(7): 665-672.

International Institute for Population Science (IIPS) and Macro International. 2007. ***'National Family Health Survey (NHFS-3), 2005-06, India: Volume 1'***, Mumbai: IIPS.

International Institute for Population Science (IIPS) and Macro International. 2008. ***'National Family Health Survey (NHFS-3), 2005-06, Orissa'***, Mumbai: IIPS.

International Institute for Population Science (IIPS) and ORC Macro. 2000. ***'National Family Health Survey (NHFS-2), 1998-99, Orissa'***, Mumbai: IIPS.

International Institute for Population Science (IIPS). 1995. *'National Family Health Survey (NHFS-1), 1992-93, Orissa'*, Mumbai: IIPS.

Kumar, A. 1994. 'Orissa's population growth and fertility change', ***The Journal of Family Welfare***, 40(1): 49-57.

Nag, Moni. 1989. 'Alternative roots of fertility and mortality decline – A study of Kerala and Punjab', in Singh, S.N. et al. (eds), ***Population Transition in India***, Vol. 1, New Delhi: B.R. Publishing corporation: 143-157.

Premi, M.K. 1991. *'India's Population Handing towards a Billion: Analysis of 1991 Census Provisional Results'*, New Delhi: B.R. Publishing Corporation.

Registrar General and Census Commissioner, India. 2001. Census of India, 2001, India, Series 1, ***Provisional Population Totals***, Paper 1 of 2001.

Registrar General, India. 1997. ***'Census of India 2001, District level estimates of fertility and child mortality for 1991 and their inter-relations with other variables'***, Occasional paper No. 1 of 1997, New Delhi: Registrar General of India.

Registrar General, India. 1999. *'Compendium of India's fertility and mortality indicators 1971-91 based on the SRS'*, New Delhi: Registrar General of India.

Registrar General, India. 2001. Census of India 2001, ***Population profiles (India, States and Union Territories),*** Total Population and Scheduled Castes and Scheduled Tribes Population, New Delhi: Registrar General of India.

Registrar General, India. 2004. *'Report No. 1 of 2004, Sample Registration System Statistical Report 2001'*, New Delhi: Registrar General of India.

Registrar General, India. 2006a. *'Sample Registration System Bulletin 2004'*, Vital Statistics Division, New Delhi: Registrar General of India.

Registrar General, India. 2006b. ***'Sample Registration System Statistical Report 2004'***, Vital Statistics Division, New Delhi: Registrar General of India.

Retherford, R.D. and M.K. Choe. 1993. *'Statistical Models for Causal Analysis'*, New York: A Wiley-Interscience Publication, John Wiley and Sons, Inc.