Emerging Demographic Change in South India

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Introduction

The estimated global population around 2001 was above 6 billion, out of which India accounts for more than 1 billion, second only to China. The world population is currently growing at 1.4 percent per annum as compared to India's 1.9 percent and China's 1 percent. According to available forecasts, India will overtake China in terms of population within the next 30 years. India's role in the global demographic growth remains therefore both formidable and decisive. However, the 2001 Indian census data also indicate that India's population, after a long spell of unprecedented growth over the last five decades, is now witnessing a gradual deceleration affecting almost all states. South India was a precursor of this demographic reversal because of the spectacular fall of its birth rates. Fertility transition has indeed been the crux of the matter ever since mortality started its slow decline from the 1920s onwards and the impact of mortality variations on the overall demographic growth has now been seriously reduced. The purpose of the present volume is to document the process of fertility change in South India, with focus on each state and its sub-regional components.

Demographic Profile of South India

South India comprises four major states of India; Andhra Pradesh (76 million), Tamil Nadu (62 million), Karnataka (53 million) and Kerala (31 million). It roughly coincides with the Dravidian-language zone, in spite of a sizeable Urdu-, Oriya- or Marathi-speaking population found in the northern fringes of Karnataka and Andhra Pradesh. As per the just concluded 2001 census, South India accounts for 222 million persons, i.e. 22 percent of India's population. While India is currently growing at 1.9 percent per annum, the annual growth rate of South India is just 1.3 per cent. Tamil Nadu's growth is reported to be around 1 percent and Kerala has already reached the below 1 percent level. All four states of South India registered lower growth rates than the national average (See Table A.1). In fact, in Pathanamthitta district in Kerala, the growth rate is just 0.4 percent, one of the lowest in the country. Most of the lowest growth pockets are also located in South India (See Figure A.1)

In terms of population density, the two Deccan states of South India remain below the national average (324 persons per square kilometre); the other two states have a much higher average, most notably because of their rural density which is ultimately linked to their agricultural

productivity (irrigation, multiple cropping, cash crops) and favourable climatic conditions. In South India as a whole, the density is 350 persons per square kilometre, slightly above the national average.

South India has a higher proportion of women in its population than the national average. While the all-India sex ratio is 933 females per 1000 males, the south India ratio is 988 females per thousand males; a gap of 55 points. The highest sex ratio is found in Kerala (1058 females per 1000 males), followed by Tamil Nadu, Andhra Pradesh and Karnataka. This is also true of the sex ratio among children in the age group 0-6 which is closely associated to female discrimination. All states of South India report higher child sex ratios than the national average. India's child sex ratio is 927 females as against 954 females per 1000 females for South India as a whole.

Andhra Pradesh is the only South Indian state which has registered both male and female literacy rates below the national average of 76 percent for males and 54 percent for females. However, as we shall see in a later section of the paper, this is the state which has achieved spectacular decline in fertility during the last decade in spite of its rather low level of social development. Among the major states of India, Kerala is ahead of all others with the highest male and female literacy rates. In South India as a whole, literacy rates are significantly higher than the national average.

Only two states of South India report levels of urbanization above the national average of 27.8 percent: Tamil Nadu and Karnataka. Overall, the urbanization trend is very slow in India; however, South India fares better than the general average. All states in South India (except Kerala) have reported male and female participation rates that are higher than the national average. Though Kerala leads with high literacy rate among males and females in the country, work participation is extremely low among both the sexes, especially among females - just 15 percent (Gulati and Irudaya Rajan 1997).

As per the Sample Registration System, two states of South India have already reached the replacement level and the other two are in the course of achieving it. Our estimates based on the 2001 census also shown a similar trend. South India as a whole has probably achieved the replacement level of fertility (2.1 children per woman) during the late 1990s, though estimates

for particular states may vary. As of 2003, Karnataka and Andhra Pradesh, the late runners in the fertility transition, also achieved replacement levels of fertility.

Fertility Transition in India

This volume will go into details about trends, differentials and determinants of fertility behaviour in the four south Indian states independently and also in South India as a whole as compared to India. However, we will first offer a general picture of fertility change in India and review the published literature on this subject. We will see how the geographical focus of fertility studies has gradually narrowed, from estimates pertaining to the whole Indian sub-continent to more precise analysis, down to the district level and even further as this book will illustrate.

(a) Pre-independent fertility estimates

Prior to the introduction of the Sample Registration System (SRS) in the late 1960s, information on fertility levels and trends was mostly based on indirect estimates using the age distribution derived from census data. The alternative source at the national level such as National Sample Survey (NSS) could simply not provide dependable estimates at the national level due to the inadequacy of the sample size. The first pioneering attempt was made by Kingley Davis in his classical work, `Population of India and Pakistan' published in 1951. Davis estimated the birth rates for India during the periods 1891-1941 and the rates ranged between 45 and 50 (Davis, 1951). Later researchers such as Mari Bhat and Mukherjee who estimated pre-independence crude birth rates for India arrived at figures relatively close to each other (Mukherjee, 1976; Bhat, 1989). However, no estimates were available at the state and the territory levels to assess the levels of fertility in India. But Davis (1951) made some estimates of birth rates for the main five main colonial regions namely, Bengal, Bombay, Madras, Punjab and United Provinces. In the beginning of the 20th century, birth rates were the same for Bombay and Bengal (43.9) and in Madras and United Provinces (44.7); Punjab province registered the highest birth rate. Regional estimates prepared by Mukherjee (1976) as well as Visaria (1969) also show very limited variations across regions in India

(b) State-level analysis

The first comprehensive work on regional differences in fertility was conducted by the

Committee on Population and Demography of the American National Research Council (Bhat, Preston and Dyson, 1984). Based on the inter-censal estimates of fertility, they obtained a remarkably clear picture of the regional diversity: states in Northern India – Rajasthan, Haryana, Uttar Pradesh, Assam and Madhya Pradesh – had birth rates above the all-India average while the southern states - Kerala, Tamil Nadu, Karnataka, Maharashtra and Andhra Pradesh - showed values below the national average. Bihar resembled the northern group in the three series for which reliable estimates were available. Gujarat also followed the northern pattern. Orissa and West Bengal showed no persistent deviation from the national average. Only Punjab violated the north-south dichotomy.

A few studies had appeared which basically used the census data and made estimates of fertility at the state level. Adlakha and Kirk (1974) concluded that the first fertility transition in India occurred during 1966-71. According to them, the level of fertility during the early 1960s probably did not differ substantially from the level of fertility that had existed during the early 1950s as the pretrasitional fertility rise had not been revelaed by the available statistics. They concluded that `crude birth rates in India declined by between 7-10% from a level of about 45 in 1951-61 to about 40.5-42.0 in 1961-71'. Jain and Adlakha (1982) corroborated the view that fertility rate in India prior to 1961 had been high and that it remain virtually constant. According to their estimates of fertility made through proximate determinants for the same periods showed a reduction of 9 to 15 percent, much below the officially reported decline. In short, the analysis indicated that the crude birth rate in India fell from 40.6 births per thousand population in 1972 to 35-37 in 1978 and that the decline was primarily caused by changes in age-specific fertility rates. Fertility during the 1970s is estimated to have decreased in all age groups. The fertility reduction in the younger age groups reflect the effect of rising age at marriage, whereas substantial declines in fertility among women over 25 years of age point to the increased use of fertility control methods.

Preston and Bhat (1984) argued that fertility had dropped substantially in India. A large share of this decline probably occurred in the late 1970s; the fertility reduction seems to have been slightly faster in the southern states. A comparison of inter-censal birth rates for 1961-71 made by the American National Research Council with the estimates for 1971-81 shows a mean decline in birth rates of 4.9 per thousand for the five northern states, 6.8 for the five southern states and 4.7 for others with intermediate fertility levels. Rele (1987) assessed the fertility levels and concluded that fertility remains almost stable at around 6 during the 1950s and into

the first half of the 1960s. The turning point in Indian fertility seems to have occurred around 1966. The fall accelerated with an estimated total fertility rate of 5.78 in 1966-71, 5.31 in 1971-76 and 4.65 in 1976-81. Assessing the degree of regional heterogenity among the Indian states, Guilmoto (2000) concluded that fertilily decline began in the periphery along the coasts and in the extreme South, and spread progressively to encircle the region around the Ganges Valley, the heart of traditional India where fertility has scarcely declined. The Hindi-speaking core region is characterised by high fertility, an entrenched partriarchal value system, economic underdevelopment, predominance of Brahminical influence and exclusion of women from eduation.

(c) District level analysis

District level analysis of fertility is a very recent phenomenon. The 1981 census for the first time in India, canvassed the question of children ever born and surviving at the district level which made it possible to estimate fertility and mortality at the district level. This procedure was repeated in the 1991 census on the basis of which reliable district level estimates of fertility and mortality were generated (Registrar General India, 1988; 1989; 1997; Irudaya Rajan and Mohanachandran, 1998) and a few important studies were made.

Malhotra, Vanneman and Kishore (1995) examined the relative importance of the marriage system, discrimination against women and women's economic value in a patriarchal system in affecting the total fertility rates for 358 districts in India. Regional diversity in fertility was expected to vary with levels of economic and social development and gender biases in kinship structure. Women in the south and to some extent in the east were better off and enjoyed a greater level of autonomy. In the final analysis, child mortality and female labour force participation rates had the most significant impact on fertility. Patriarchy had a major influence in total fertility rate by districts which overlapped with other structural factors. In another study based on 296 districts, Murthy, Guio and Dreze (1995) reported findings consistent with those of an earlier study by Kishore (1991) on the link between high fertility and high female mortality.

The first spatial interpretation of fertility was developed by Guilmoto and Rajan (1998). The dispersion profile of fertility in India provides due to several principles that govern the

geographical patterning of demographic behaviour. If we exclude from our consideration the states in the Northeast, the demographic patterns which are not well known, the strong contiguity of demographic change around the Gangetic region which has the highest fertility, is striking. Our analysis almost substitutes the classic North-South Dichotomy popularised in particular by Dyson and Moore (1983) with a more complex spatial structuration defined by an almost concentric (centrifugal) distribution of fertility around a central locus at the junction of the Hindi-language states. The second interpretation is related to the rapid decline in fertility among the coastal areas excluding Orissa. The coastal regions have long been exposed since the colonial rule began, to exchanges (cultural, economic and religious) with the rest of the world. The third finding is that fertility decline was rapid in urban areas, particularly in the major metropolises and most industrial concentrations. We see this phenomenon throughout the country: Kolkatta in West Bangal, Chennai in Tamil Nadu, Bangalore in Karnataka, Nagpur in Maharashtra, Patna in Bihar, Lucknow and Kanpur in Uttar Pradesh, Jaipur in Rajasthan, Coimbatore in Tamil Nadu and Kochi in Kerala.

The analysis also indicated that regional particularisms are still perceptible. The pioneering and atypical role of the Punjab has already been noted in the fertility decline in North India. Similarly, an apparently rapid decrease was recorded in Telengana (Andhra Pradesh), Goa and Saurashtra (Gujarat). Conversely, pockets of high fertility exist in more extensive areas where changes were otherwise rapid. This is notably the case over an area of the western part of the Deccan plateau, along a band extending northward to Maharashtra (Marathawada) as far as Karnataka (Hyderabad Karnatak) and closely corresponding to the implantation's of the Muslim sultanates which flourished until the eighteenth century. Similarly, the peripheral tribal areas of Madhya Pradesh (Chhatisgarh, Gondwana, the Bhil country) report a singularly high fertility rates.

Interestingly, one important piece of new information provided for the first time in the 1991 census was the number of children in the age-group 0-6 at the district level. This information was provided to estimate the effective literacy rate for districts with a view to facilitating comprehensive educational planning. Mari Bhat, using the reverse survival method, has produced birth rates at the district level for the period 1974-80 and 1984-90 and analyzed the cross-sectional variations in fertility. According to him, earlier literature on this subject had overstated the role of patriarchy and female autonomy in explaining the regional variations of fertility (Bhat, 1996). Bhat also states that the above assessment was made in the context of

cross-sectional variations in fertility.

We did also use the proportion of children under 6 to estimate fertility at the district level based on the 2001 census (Guilmoto and Rajan 2002). These data are plotted on Figure A.1. Fertility rates display the usual southern and coastal bias observed in 1981 and 1991. From Gujarat to West Bengal, fertility in the majority of districts belonging to maritime states is now below 3 children per woman. But the decline is also visible in the Punjab, in the mountainous states of Himachal Pradesh and Uttaranchal as well as in the Northeast where estimated fertility is often below three children per woman.

The higher-fertility zone, covering a large number of the BIMARU (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh) states as well Jharkhand and Meghalaya, tends to shrink rapidly. Many pockets of sustained fertility decline are apparent in these states, most notably in South Madhya Pradesh, in Rajasthan and around major urban centres such as Kanpur, Indore, Bhopal and Lucknow. Future decline will probably concern chiefly Haryana, Madhya Pradesh and Rajasthan, while Uttar Pradesh and Bihar seem to be able to withstand the dynamics of change. The map of the district-level growth rate (Figure A.1) is roughly similar as the birth rate remains a strong predictor of the population increase in districts. However, the impact of migration is visible on this map with growth poles creating distinct red patches in the map. Metropolitan regions such as Delhi, Bangalore, Jaipur, Mumbai, Surat and Bangalore have thus recorded spectacular growth during the last decade, for which fertility differentials played only a marginal role.

In the future, the downward trend of the birth and the death rates will continue. However, the effect of declining mortality on the birth rates tends to plateau as the age pyramid becomes older. As SRS series show, fertility decline now has a stronger impact on the natural increase, which has declined much faster in the 1990s than earlier. In view of the still incomplete onset of fertility decline in thickly populated states like Uttar Pradesh or Bihar, this trend is likely to persist during the next two decades and cause the natural growth to decrease gradually. At the same time, there are a few reasons to believe that population redistribution will slacken in India, especially in view of its still moderate level of urbanization. Migration rates may even increase if economic development remains focused on specific metropolitan regions. All this suggests that district level variations in the future will be more and more linked to migration exchanges likely to be felt first in regions like South India where the natural growth is currently the lowest in

India. The 2001 census results for South India already indicate that the fastest growing regions include not only the high-fertility districts in the Deccan, but also several urban growth poles such as Bangalore, Hyderabad, Chennai and Pondicherry. While fertility in North Karnataka is bound to fall during the present decade, the recent success of the South Indian urban economy will probably generate a continuous migratory pressure towards these major cities and sustain high growth rates in these districts.

Fertility Transition in South India

In an earlier paper, Guilmoto and Rajan (2001) assessed the fertility transition in the Indian districts for the periods 1961 to 1991 using the age data published by the Indian censuses. They used child-woman ratios to reconstitute fertility trends over the past four decades. Two measures were used: child-woman ratio (children 0-4/women 15-49) and child-woman ratio (children 5-9/women 20-54). (for limitations of the child-woman ratio, see Guilmoto and Rajan 2001). In the process, they converted the child-woman ratio into the child-women index and provided with this new indicator district fertility estimates for 8 periods: 1951-56, 1956-61, 1961-66, 1966-71, 1971-76, 1976-81, 1981-86 and 1986-91. The eight maps representing fertility variations across districts are presented in Figure A2. We shall briefly review the fertility transition in South India based on the maps (for details, see Guilmoto and Rajan, 2001).

The maps pertaining to the 1950s in the series offer a new perspective on South Indian fertility as it is the first time that a set of district level estimates were produced using the 1961 census data. The first two maps for the 1951-61 period show the extent of pre-transitional fertility differentials within India. However, several pockets of moderate fertility are visible in South India, particularly in South Kerala and parts of Tamil Nadu. As the maps for later quinquennia show, these areas were remain characterized by lower- than-average fertility. With the exception of moderate fertility areas, fertility increased almost everywhere in India during 1956. This pretransitional rise in fertility is highlighted in Dyson and Murphy (1985). On the other hand, the southern region of India clearly emerged as the region where this reduction was the most visible. A more detailed mapping of the fertility scene during the 1960s showed that Coimbatore and Madras (Tamil Nadu), and Alappuzha (Kerala) as the distinct forerunners of this decline. The drop was also visible in the rest of Tamil Nadu and Kerala, as well as in South Karnataka and Andhra Pradesh. Interestingly, coastal areas were also affected by the fertility transition. The geographical features of this decline were pronounced as all the affected regions

are contiguous.

The 1970s witnessed massive family planning programme throughout the country using camps for sterilisations. The maps for the period showed gradual expansion of fertility decline across almost all regions. The fall was most visible in the lower part of India, below a line that could be drawn from Gujarat in the West and Calcutta in the East. Though pioneering districts of Kerala and Tamil Nadu were still far ahead, the decline was very rapid everywhere in South India. This was the period in which major research on demographic transition in Kerala were documented (Krishnan, 1976; Gulati, 1976; Nair, 1976; United Nations, 1975). The coastal pattern of fertility change continued to manifest in the map in this decade too.

The overall picture emerging from the map looked more complex during the 1990s (see Figure A1). In South India, the fall in fertility rates accelerated everywhere. In many districts of Kerala and Tamil Nadu, values of child-woman index became less than half of values observed in North India. Districts that registered the lowest fertility values in India were still concentrated in the two major pockets, one around Coimbatore in Tamil Nadu and the other along the Kochi-Alappuzha-Kottayam triangle in Kerala. More and more studies have appeared since then to assess the fertility change both in Kerala (Zachariah, 1984; Nair, 1986; Mari Bhat and Irudaya Rajan, 1990; Zachariah et.al, 1994; Zachariah and Irudaya Rajan, 1997; and Tamil Nadu (Kishore, 1994; Savitri, 1994). Apparently, the intrinsic dynamics of fertility decline with self-reinforcing mechanisms have had a global impact in these areas. It is only the central region of the Deccan (Central Maharashtra, North Karnataka and sections of western Andhra Pradesh) a zone that corresponds closely to the former Deccan sultanates, that seems to offer resistance to the pressure of fertility change just as the western districts of Uttar Pradesh where the impact of rapid decline in the Punjab and Himachal Pradesh seems to be minimal.

Districts were also classified into three fertility profiles based on a cluster analysis to describe 40 years of fertility change. Results of this cluster analysis have ended up in dividing the Indian districts into three fertility groups with 67, 146 and 125 districts respectively. While these three fertility profiles share some common structural features, they widely differ in three most visible characteristics: maximal observed fertility level, date of sustained fertility decline, and fertility level in the last period. . The first cluster is also characterized by its early attainment of maximum fertility (1951-61), and hence of fertility decline (1961-66). In many districts in this

cluster, fertility had not recorded any significant rise during the 1950s and seems, at times, to have started declining right from the first decade. Moreover, in these regions, it has not been possible to ascertain the period of the inception of fertility decline since the highest level of recorded fertility might have already occurred before the 1950s. However, the global picture is one of early fall coupled with low or moderate fertility. This first cluster includes a compact area covering most of Tamil Nadu and Kerala, as well as contiguous areas in Andhra Pradesh (Rayalaseema and the almost entire coastal Andhra) and Karnataka (South Konkan and Bangalore) which all come under South India.

Extending the analysis to the latest fertility rates arrived from the just completed 2001 census, we find clear indication that the fertility transition in South India is almost complete with the attainment of the replacement level of fertility (Guilmoto and Rajan, 2002) A few comments may be offered: firstly, the highest fertility decline is observed in Andhra Pradesh (33%), in South India. Secondly, all south Indian regions (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu) have reduced their fertility by more than 25%. Thirdly, what is striking between the two periods (1991-2001), is the fact that the replacement level of fertility is observed beyond the districts of Kerala and Tamil Nadu, moving fast to Chittoor, Nellore and Prakasam districts of Andhra Pradesh and Mysore, Bangalore and Mandya districts of Karnataka. It is quite probable that districts with below replacement fertility will be the majority in South India in about ten years.

Fertility Change in Districts of South India

Before we discuss the organisation of the present volume which covers the wide spectrum of South India's fertility transition and its impact, implications and replicability of the experiences to neighbouring South India and other parts of India, let us briefly document the fertility change in the four individual states of South India: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

ANDHRA PRADESH

Andhra Pradesh is the first state in the country to reach replacement-level fertility in spite of high infant and child mortality, high illiteracy and other unfavourable factors. What are the contributing factors for the quick decline in fertility? As this state is in the middle of the current

debate on India's demographic scenario, let us assess it in some detail.

Andhra Pradesh, one of the largest states in India (and the largest state in South India) with a population size of 76 million, has undergone a rapid fertility transition over the period of the past twenty years and more particularly during the 1990s. The Sample Registration System puts the value of the total fertility rate (TFR) as 2.5 children per woman in 1997 while the second National Family Health Survey estimates the TFR as 2.3 during 1996-98. Our own estimates based on the 2001 census put the value as 2.3 for the same period (See Table A. 2). As of now, Andhra Pradesh has perhaps reached the replacement level of fertility with a TFR of 2.1.

Though macro-level data such as low infant mortality and high female literacy rates are supposed to be important variables in influencing the fertility level, Andhra Pradesh lags behind the other south Indian states in these aspects. In fact, female literacy in Andhra Pradesh in 2001 remains low, even below the national average. However, the high quality of antenatal care (ANC) for women maintained in Andhra Pradesh could have strong implications for the acceptance of the small-family norm. As per the second National Family Health Survey, only 7 percent of the women did not receive any ante-natal care. Economic factors such as reduction in poverty and unemployment might also have played a role in reducing fertility. For instance, public spending on poverty alleviation programmes in Andhra Pradesh is much higher than in Karnataka and Uttar Pradesh. The state contribution to public spending on poverty in Andhra Pradesh is nearly 41 percent as against only 21 percent in the neighbouring state of Karnataka.

The role of the state in reducing poverty and introduction of different welfare programmes should have created a favourable climate for decline in fertility in Andhra Pradesh. For instance, Andhra Pradesh is the first state in the country to formulate its own population policy (in 1997) and release the document for wide public debate whereas Government of India released its Natioanl Population Policy only in 2000. This is clear indication of the Government's commitment in Andhra Pradesh in achieving the below replacement level.

The district-wise fertility differentials revealed from the last 1991 and 2001 censuses are also worth highlighting. The districts located in the coastal regions (for instance, Srikakulam, West Godavari, Krishna and Guntur) have experienced faster decline in fertility than in other regions. Some of them already achieved replacement level as early as 1996. The lowest total fertility rate is observed in the Coastal region (2.1), followed by Rayalaseema (2.8) and Telengana

regions (2.9). As per the 2001 census based district level estimates, the highest total fertility rate was observed in Mahbubnagar district (3.1) and the lowest value of 1.9 was recorded for the three districts of Guntur, Hyderabad and Krishna. According to available data sources, we may identify three phases of fertility decline in Andhra Pradesh: stagnant fertility during 1971-78, slow decline during 1978-87 and the rapid decline thereafter.

Multiple regression analysis reinforces the earlier findings of low fertility areas in the southern and coastal parts of the state with an additional pocket located in Telengana. Areas of higher fertility fall into broad geographic areas: tribal-inhabited areas and the Deccan. Andhra Pradesh is the state in South India with the highest tribal concentration most notably along the borders with Orissa and with the newly formed state of Chhatisgarh; the analysis confirms the role of tribal composition in explaining fertility variation across villages.

Several interesting observations may be made from the second National Family Health Survey report produced for Andhra Pradesh (see details, Table A3). The median age at first cohabitation with husbands, among women aged 25-49, is just 15 years less than the legally prescribed age at marriage for women (18 years). Compensating for low age at marriage, female sterilisation plays a crucial role in fertility reduction. The percentage of currently married women using sterilisation as their contraceptive is around 53, the highest in South Indian states and the median age at sterilisation is pretty low with 23.5 years. Surprisingly, the unmet need for family planning is quite low for Andhra Pradesh.

KARNATAKA

According to the 2001 census, Karnataka's population is enumerated as 53 million, lower than the population of the neighbouring states of Andhra Pradesh (76 million) and Tamil Nadu (62 million) and higher than that of Kerala (32 million). Karnataka has experienced considerable reduction in fertility, but lower in the scale and slower in the pace than in the neighbouring states of Kerala, Tamil Nadu and Andhra Pradesh. During the three decades (1951-81), Karnataka witnessed a 38 percent decline in fertility. However, the decline has been sharper (22 percent) between 1981-1994 than during the other periods. The just completed second National Family Health Survey (1998-99) reports that urban Karnataka has already attained replacement level and the rural parts are lagging behind.

Detailed investigation clearly indicates that a few districts in Northern Karnataka have high fertility which disturbs the overall achievement of Karnataka State. The districts of Bidar, Bijapur, Gulbarga and Raichur have not only high fertility but are also poor for most socio-economic indicators: agricultural productivity in these semi-arid areas is extremely low for want of proper irrigation and the urban economy remains underdeveloped comparison to the rest of the State. At the same time, these districts belong to an historical region that had been part of the former Hyderabad State and had remained under Muslim rule for centuries. As stated earlier, they are part of a larger high-fertility zone that extends northwards toward the Marathawada region in Central Maharashtra. This situation points to an interesting admixture of historical factors and contemporary economic circumstances in explaining the present-day demographic particularism of this region. In any case, Karnataka is likely to be the last state in South India to reach replacement-level fertility as demographic transition in these northern districts have proved slower than anywhere else in the South.

As per the second NFHS, 33 percent of births in Karnataka are third order and above indicating the unmet need for the family planning programme. Among the four states, the total wanted fertility in Karnataka is quite low 1.56, the lowest among all. Female sterilisation is the most popular method of fertility control as in the case of elsewhere in India (see Table A3).

KERALA

Kerala was the first state in India to reach the replacement level of fertility in the early 1990s. As per 2001 census data, the total fertility rate estimated for Kerala is 1.7. Many studies have analysed the trends and determinants of Kerala's demographic transition and the latest one in this series is an edited volume on the subject by K C Zachariah and S Irudaya Rajan (1997).

According to the figures available from various sources, the crude birth rate in Kerala has come down from 44 per 1,000 in 1951-61 to 21 per 1,000 in 1986-88. The Total Fertility Rate (TFR) (which reflects the total number of live births a woman will eventually end up with if she bares children under current fertility rates) declined from 5.6 in 1951-61 to 2.3 in 1986 and to 1.7 in 1997. An earlier study on fertility using child-woman ratios clearly suggested that fertility decline began first in the Travancore-Cochin region about five years before it occurred in the

Malabar region (Mari Bhat and Irudaya Rajan, 1990).

Birth rates varied considerably from region to region and from district to district. According to unofficial tabulations of the Sample Registration System data, in 1988 the birth rate varied from 14.8 in Alappuzha to 28.4 in Malappuram (Zachariah et.al, 1994). The birth rate for the period 1983-88 had varied from 17.7 in Alappuzha to 33.5 in Malappuram. While the birth rates in some districts in south Kerala such as Alappuzha, Ernakulam, Kottayam, Pathanamthitta have definitely crossed the replacement level, the birth rate in some of the northern districts such as Malappuram, Kasaragod was reported to be near the all-India average. Such large inter-district variations in the birth rate in Kerala were confirmed by an analysis made by Mari Bhat (1996) using the 1991 census data.

According to Mari Bhat estimates, the TFR varied from 1.6 in Ernakulam to 3.4 in Malappuram during 1984-90. In the beginning of 1990, only five districts (Palakkad, Malappuram, Wayanad, Kannur and Kasaragod) in Kerala registered TFR above the replacement level. The remaining districts had already achieved below replacement level of fertility. As per the latest estimates based on the 2001 census, Malappuram is the only district in Kerala where the TFR is above replacement level (Guilmoto and Irudaya Rajan, 2002).

The second National Family Health Survey conducted in Kerala reveals female sterilisation as the most popular method of fertility control practised in the state (Table A3). The median age of sterilisation is 26 years while the unmet need for family planning is around 11.7 percent, a relatively high figure compared to that of Andhra Pradesh. The median age at first cohabitation among women of 25-49 is around 20 years, higher than any other states in South India. Considered with the statistics on age at marriage, this suggests a brief 6-year reproductive span.

TAMIL NADU

The state had a population of 19.3 million in 1901 which rose to 62.1 million by 2001 (Banthia 2001). The growth over the century is 223 percent, much lower than that of India as a whole, 331 percent. The growth was slow up to 1931, was moderate over 1931-61, high during the decade 1961-71, and moderate thereafter. Guilmoto (1992) has provided estimates of crude birth rate (CBR) for the inter-censal decades up to 1981. As per these estimates, the CBR in Tamil Nadu was above 40 per thousand up to 1941, around 35 during the next three decades, and then declined to about 30 during 1971-81. In India, the rates

were above 45 up to 1941, around 40 during 1941-71 and 37 during 1971-81. The CBR in Tamil Nadu has always been lower than that for India. The second National Family Health survey reports the TFR as 2.1. Our indirect estimates of TFR based on 2001 census places the TFR of Tamil Nadu at 1.8. However, Tamil Nadu has enjoyed neither high social development conditions nor low infant mortality as in the case of Kerala, and its fertility decline has fuelled many hypotheses.

Though Tamil Nadu has by now reached a fairly low level of fertility, there are notable variations across sub-regions. According to the estimates provided by the Office of the Registrar General of India, the following observations may be made. The CBR and TFR were the highest in the Tirunelveli district (36.0 and 4.7 respectively) and the lowest in the Erode district (24.9 and 2.9) in 1981. According to the 1991 census estimates, the CBR and the TFR were the highest in Pudukkottai (31.6 and 3.98 respectively) and the lowest in Coimbatore (22.5 and 2.46 respectively). In 1991, the total marital fertility rate (TMFR) was the lowest in Salem (4.0) and the highest in Kanniyakumari (6.3). The general fertility rate (GFR) was the highest in Pudukkottai and the lowest in Coimbatore. Guilmoto and Rajan (2002) have provided reverse survival estimates of fertility from the 2001 census data : fertility is now very low in the western parts (Erode, Coimbatore, Nilgiris, Namakkal districts and in Chennai) and relatively high in the Dharmapuri district; it is also high in the north-eastern districts of Arcot districts (Thiruvannamalai, Villupuram and Cuddalore), and in the Ramanathapuram district in the south-east.

Though Tamil Nadu has been hailed as the state for the quick fertility transition without either economic or social development as was the case in Kerala, its child sex ratio (girls per 1000 boys below 7) has become the topic of concern, for at last some parts of the state. Female infanticide also played an important role in the fertility process in some districts of Tamil Nadu. For instance, as per 2001 census, among the 593 districts of India, Salem district in Tamil Nadu, only one in South India which occupies the lowest range among the 50 districts in which the sex ratio is below 850. As of 2001, the following districts observed the child sex ratio below the state average, in the ascending order : Salem, Dharmapuri, Theni, Namakkal, Madurai, Dindigul, Erode, Vellore and Cuddalore. The discrepancy between favourable fertility conditions and extreme female discrimination is a real puzzle for those who had earlier argued that Tamil Nadu's fertility decline was a consequence of the better status of women.

Among the States of South India, Tamil Nadu has the lowest female-male ratio among children

among all the four states in 2001, In fact, Kerala was in this position at the time of 1961 census, nearly 40 years ago, Tamil Nadu took the first position in female disadvantage among children in 1971 and continues to lead the position till 2001 (Sudha and Irudaya Rajan, 1999; Irudaya Rajan, Sudha and Mohanachandran, 2000). As mentioned earlier, Salem is the worst district in terms of female discrimination as its sex ratio was just 826 as against the state sex ratio of 939, i.e. a 113 per 1000 deviation from the Tamil Nadu's state average. Another survey conducted in Tamil Nadu shows the sex ratio at birth to be only 858 in the same Salem district, lowest among all the study districts. What are the plausible reasons for the female discrimination in Salem district in Tamil Nadu? The excess female mortality was noticed in the infant mortality rate and in fact, the infant mortality among girls is more than double that of boys. It clearly points to the frequency of both female foeticide and infanticide. According to another study, 15.8 percent of female infant mortality in Tamil Nadu is due to female infanticide. However, in Salem, female infanticide accounted for 64.4 percent of female infant deaths. The rate of abortions in Tamil Nadu is not only higher than in the neighbouring state of Kerala, but also of India as a whole (Meera, 2000). Village level analysis of female discrimination in rural Salem is horrifying. In Idappadi and Mettur regions, the sex ratio was below 660. In numerous villages of this region, there are almost two boys for one girl. Konganapuram block has the lowest child sex ratio (614) in rural Tamil Nadu and it is located in Salem district.

Though the female foeticide is an important issue in Tamil Nadu, the second National Family Health Survey reports the mean ideal number of sons wanted is just 0.8 compared to 1.0 for Andhra Pradesh and Kerala. Interestingly, the percentage of couples who want at least one son is around 66 percent, much lower than in the neighbouring states of Andhra Pradesh and Kerala. Female sterilisation continues to be the major method of fertility control in Tamil Nadu and the current unmet need is 13 percent.

Organisation of the volume

This section of the introduction is followed by three major sections: trends, differentials and spatial variations (6 papers), causes of fertility decline: qualitative analysis (3 papers) and proximate determinants of fertility: quantitative analysis (4 papers).

Trends, Differentials and Spatial Variations in South India

The first paper in this section by Gopinath reviews demographic change, particularly the levels of fertility and mortality in colonial South India. This is one of the very few studies that combine both a historical and a geographical approach. Using scarcely used sources such as age distribution reported from the earlier censuses and vital registration statistics along with the indirect estimates made by different authors for the colonial period, the author concludes that Madras presidency (most of the present South India) was traditionally known as the lower fertility zone among all the zones in India.

The undivided colonial Madras Presidency consisted of different regions, stretching from the dry Deccan districts in the north to the wet tropical Malabar coast in the Southwest and the deltas in the East. The regional variations in fertility and mortality across the Presidency were significant and appear to have depended upon the economic and social history of the areas and their settlement pattern. Surprisingly, dry and wet regions have depicted different demographic regimes; dry regions with high mortality and moderate fertility and wet regions with high fertility and moderate mortality.

Assessing the demographic change in the pre-transitional period, Gopinath has picked up three districts from the different regions of Madras presidency for extensive investigation; Bellary, Thanjavur and Malabar. The fertility of Bellary was higher than that of the other two districts. Nuptiality (age at marriage) proved a major proximate determinant of pre-transitional fertility variations in Madras, a finding quite in conformity with studies on similar subjects in historical Europe. Low mortality, great agricultural security, low sex-ratios, and somewhat low fertility and high age at marriage in colonial South India are features that shaped long-term variations in the regional demographic regimes of India. Their impact is apparently still felt today and may be responsible for the early onset of decline of birth rates in post-colonial South India.

The cartographic analysis of fertility in South India is the theme of the paper by Sebastien Oliveau, using the village level data produced by the 1991 census. The data pertain to 69,700 rural villages comprising four southern states and the union territory of Pondicherry with a population of 134,571,811. The author has carried out spatial aggregation followed by spatial smoothing. The ratio of the number of children below 6 years to the female population above 6 years is a fertility index used to map the fertility transition in South India. The fertility map illustrates very contrasting situations of the level of fertility in South India. Fertility seems negligible along the borders of Andhra Pradesh and Tamil Nadu or between Andhra Pradesh

and Karnataka. This is also the case between Tamil Nadu and Kerala (Ghats) and between Tamil Nadu and Karnataka (Deccan marches). Using the same database, Oliveau has also produced other social indicator maps at the village level such as literacy among men and women and scheduled tribes and makes comparisons with the fertility map.

The next four papers examine in more detail the trends, differentials and spatial variations across the regions and districts using all available sources such as censuses, sample registration system, national family health surveys and other indirect estimates of fertility for each state in South India. The state level study on Andhra Pradesh carried out by Ramachandran and Ramesh; the studies on Karnataka (Sekher, Raju and Sivakumar), Kerala (Irudaya Rajan and Sabu Aliyar) and Tamil Nadu (Rajna, Kulkarni and Thenmozhi).

Causes of fertility decline: Qualitative Analysis.

We have included three papers in this section; the first two papers focus on Tamil Nadu, the first is based on focus group discussions and the second based on field survey and the third on Andhra Pradesh which has extensively used the anthropological methods

The first paper addresses fertility issues based on evidence at the macro level as well as focus group discussions carried out among women in different parts of Tamil Nadu. It relies heavily on qualitative methodology. Discussions were conducted in 32 rural villages of the state chosen from three districts namely Coimbatore, Salem and Chengalpattu, by four research teams. Krishnamoorthy, Kulkarni and Audinarayana were assigned 8 villages with different levels of social, economic and infrastructural development. In all, they conducted 32 focus group discussions and 64 in-depth interviews. What are the observations the authors make based on the group discussions and case studies on the process of fertility decline in Tamil Nadu ? The findings refer to three distinct social groups ; the urban upper class, the middle class and the lowest socio-economic groups. The urban upper classes tried to maintain their social and economic support systems that was threatened by the Dravidian movement and the government's reservation policy on education and employment. One solution was to reduce one's number of children. The large middle class families were able to taste the fruits of social change and economic opportunity through education. Due to rapid urbanisation (now higher in

Tamil Nadu than in other large Indian states), development of transportation and the growth of government educational institutions, rural middle class families were able to send their children to schools. However, the cost of education has increased sharply (transport, tuition and other costs) and child labour opportunities have decreased. The middle class found itself confronted with the classical quality-quantity dilemma: the preservation of quality, they presumed, was possible only through reduced family size. Among the lowest ladder in the society through new awakening, upward mobility has become a distinct objective. To move upwards in the social ladder, it becomes necessary for them to emulate other higher sections of the population and to limit their family size. Like Bangladesh's experience, Tamil Nadu's recent demographic evolution has proved that rapid fertility decline can occur in a context characterized by low economic and moderate social development.

The link between low fertility and female discrimination is elaborated by Vella. Through field-level assessment, the author provides an account of infanticide practised by Kongu Vellalar Gounders, Vettuva Gounders and Dalit caste groups. The private doctors practising in the villages of Salem informed that pregnant women do come for sex selection test and get abortions done in the villages as they cost less. As Vella observes, increasing dowry pressure is a reason often given for sex discrimination; there exists however, no evidence to prove that dowry inflation has affected this particular region than the rest of South India. Sex discrimination may therefore be sustained primarily by local-specific institutions enforced by the dominant agrarian castes. While most other communities in Tamil Nadu -with the exception of *Kallars* in the Usilampatti region- have resisted the strong bias against girls generated by the dowry system, Salem appears as a cultural enclave somewhat cut off from the rest of the state.

An anthropological enquiry on the family size and fertility decision is the focus of the paper by Raju. The data were collected through survey and anthropological methods in a village in a coastal district of Andhra Pradesh. Basic demographic information was collected during February-April 1984, followed by the survey during May-August and in-depth interviews and group discussions during September 1984-January 1985. Households were revisited again in 1989 to trace the changes that occurred at the family level. As per the analysis, the size of the household and the number of sons are the determinants of joint living arrangements between parents and married children. Macro-level data produced by the two national family health surveys also indicate that the mean household size in India is on the decline; from 5.7 persons in 1992-93 to 5.4 persons in 1998-99.

Proximate Determinants of Fertility: Quantitative Analysis

Four technical papers are included in this session. The opening paper is by Srinivasan and Kumar explaining the role of medical and paramedical personnel in demographic transition. The authors have done a multiple regression analysis using the district level variables obtained from the 1981 and the 1991 censuses. Detailed investigation reveals that the state played an important role with regard to lowering child mortality, increasing the age at marriage and contraceptive use and reducing total fertility under different social, economic and geographic conditions.

Manisha Chakrabarty and Christophe Z Guilmoto have used the South Indian Fertility Project database and analyzed the determinants of fertility behaviour in South India at the village level. This paper is an attempt to statistically assess the fertility differentials and their determinants at the lowest possible level. Child-woman ratio at the village level was used as an indirect indicator of fertility rate. They have used twenty explanatory variables which belong to major categories such as education, health and communications and employed various regression models. Among other things, an interesting analysis in this paper is the modelling of the literacy and fertility relationship at lower unit levels. The analysis demonstrates that for a given literacy level, Tamil Nadu and Kerala villages have significantly lower fertility than the two other South Indian states. Though literacy level is a powerful determinant of fertility, the statistical relationship varies between region to region. Another finding is that a favourable agricultural setting characterized by a lesser proportion of labourers among peasants and higher irrigated land resulted in lower fertility levels. This is the most important impact of economic development in rural areas. The analysis would definitely require more social and economic variables than those available at village level, but it already shows that below-district fertility data are amenable to fruitful statistical analysis. A somewhat similar analysis has also been presented in the regional studies made earlier such as the paper by Ramachandran et.al who carried out a sub-regional statistical analysis.

Using the second National Family Health Survey, James and Subramanian attempt to identify fertility behaviour using a multi-level analysis. This is the only paper in this volume using extensively the data from NFHS-2. Multi-level modelling allows the analysis of all the different layers of information (such as for women, households or village communities) collected by this

survey. The results confirm that significant variations remain among villages even after taking into account essential socio-economic and compositional factors. In short, fertility decline can be triggered off by local and endogenous factors.

The comprehensive paper on the subject is prepared by Christophe Z Guilmoto. The first part of the paper overviews the theoretical framework on the subject, followed by various analyses based on the past three censuses and finally a preliminary district level analysis based on the 2001 census along with Reproductive and Child Health survey carried throughout the country.

The preliminary results of the first model based on 2001 census indicate that access to education emerges as a global variable in explaining fertility differentials. A closer examination of the maternal and child health variables and fertility revealed a strong correlation co-efficient of –0.898 per cent. These findings were examined with two-stage regression analysis and the results are entirely different ; maternal and child health index has no independent impact on fertility. It confirms that women who use reproductive health services are the ones who have already decided to regulate their fertility.

Various models employed on the recent data accounts for 72 to 90 percent variation. For instance, in an earlier study, Drèze and Murthi did not identify any economic variable which explained 10 percent variation. The analysis reveals that the Christian and the Muslim minorities have experienced higher fertility than the average and that this may be related to their contraceptive choices. Women's status, measured in terms of their literacy and work status, has direct link with fertility behaviour. This analysis also indicates that female neglect (son preference) has strong association with high fertility. However, in the Punjab, we see fertility decline and female foeticide going hand in hand as has been observed also by Vella in Tamil Nadu. On the other hand, the geography of female discrimination goes beyond the Punjab, Haryana and parts of Rajasthan and Uttar Pradesh.

Another model illustrates that the education of women and infant and child mortality do play crucial roles in fertility reduction (see Bhat, 1996 ; Drèze and Murti, 2001). The geographic variables, on the other hand, play a considerable role in the fertility differences among districts. The analysis indicates a systematic gap between South India and BIMARU states, a gap of nearly 1.4 children. When carried out only for South India, this analysis of fertility variations

shows similar geographical gaps that are not explained by social or economic factors.

Research Directions

In south India, the first group of districts which were pioneers of fertility control comes from the Thrissur-Kottayam-Trivandrum triangle of Kerala and also from the districts of Coimbatore, Nilgiris and Chennai City of Tamil Nadu. More research is now required, beyond the statistical exercises reported in this volume, to unravel the path followed by demographic change within the South Indian society. The preliminary identification of the social and geographical forerunners will no doubt permit to better focus our attention towards the vectors of demographic change.

This volume has clearly established the magnitude and geography of fertility decline in South India. It may be now time for historians and sociologists to unravel the intricacies of the social mechanisms involved in this revolution. The fact that fertility decline has spread along visible geographic lines forces us to give credit to the role played by diffusion mechanism. This probably does not obliterate the impact of other crucial factors such as the specific anthropological setting of South India and the progress of literacy rates in accelerating the fertility transition. But the diffusion effect observed in several analysis suggests that social changes possess self-sustaining characters; these traits tend in turn to favour regions in which pioneer groups were present in the past to amplify their social experiments in fertility reduction.

References

Adlakha, A and Dudley Kirk. 1971. Vital Rates in India 1961-71 Estimated from 1971 Census Data. Population Studies, 28, 3, Pp. 381-400.

Banthia, J. K., 2001. *Provisional Population Totals*, Paper -1 of 2001, census of India 2001, Controller of Publications, Delhi.

Bhat, P N Mari, Samuel H Preston and Tim Dyson. 1984. Vital Rates in India, 1961-19881. Report No. 24, National Academy Press, Washington.

Bhat, P N Mari. 1989. "Mortality and Fertility Transition in India, 1881-1961: A Reassessment" in Dyson Tim. (eds). India's Historical Demography: Studies in Famine, Disease and Society. Curzon Press, London, 73-118.

Bhat, P. N. Mari and S. Irudaya Rajan. 1990. "Demographic Transition in Kerala Revisited." *Economic and Political Weekly*. 25(35&36): 1957-1980.

Bhat, P. N. Mari, 1996. "Contours of Fertility Decline in India: A District Level Study Based on the 1991 census" in K Srinivasan (ed.). *Population Policy and Reproductive Health*. Hindustan Publishing Corporation, New Delhi, 96-179.

Davis Kingsley. 1951. Population of India and Pakistan. Princeton University Press, Princetion.

Drèze, J. and Murthi, M., 2001. "Fertility, Education, and Development: Evidence from India", *Population and Development Review*, 27, 1, 33-64.

Dyson, T. and Moore M. 1983. "On Kinship Structure, Female Autonomy and Demographic Behavior in India." *Population and Development Review*, 9, 1, 35-60.

Dyson, Tim and M Murphy. 1985. The Onset of Fertility Transition. *Population and Development Review*, 11, 3, 399-440.

Guilmoto, C. Z. 1992. "Towards a New Demographic Equilibrium: The Inception of Demographic Transition in South India," *The Indian Economic and Social History Review* 29, no. 3: 247-289.

Guilmoto, C Z. 2000. The Geography of Fertility in India (1981-1991). In C Z Guilmoto and A Vaguet (eds). Essays on Population and Space in India. Ponidcherry: Institute of Poondicherry, Pp. 37-53.

Guilmoto, C. Z., and S. Irudaya Rajan 1998. *Regional Heterogeneity and Fertility Behaviour in India*. Centre for Development Studies, Working Paper No 290. Thiruvananthapuram.

Guilmoto C.Z and S Irudaya Rajan. 2001 Spatial Patterns of Fertility Transition in Indian Districts. *Population and Development Review*, Volume 27, No.4, Pp.713-738.

Guilmoto, C. Z and Irudaya Rajan. 2002. "District Level Estimates of Fertility from India's 2001 census", *Economic and Political Weekly*, XXXVII, 7, 665-672.

Gulati Leela. 1976. Age of Marriage of Women and Population Growth: The Kerala Experience. *Economic and Political Weekly*, XI, 31-33, 1225-29

Gulati Leela and S Irudaya Rajan. 1997. Women and Work in Kerala: A Comparison of the 1981 and 1991 Censuses. *Indian Journal of Gender Studies*, Volume. 4, No. 2, Pp. 231-252.

International Institute for Population Sciences (IIPS), 2000. *National Family Health Survey Health Survey (NFHS-2), India, 1998-99,* IIPS, Mumbai.

International Institute for Population Sciences (IIPS), 2001. *National Family Health Survey Health Survey (NFHS-2), India, 1998-99: Tamil Nadu.* IIPS, Mumbai.

International Institute for Population Sciences (IIPS), 2000. *National Family Health Survey Health Survey (NFHS-2), India, 1998-99: Andhra Pradesh.* IIPS, Mumbai.

International Institute for Population Sciences (IIPS), 2001. *National Family Health Survey Health Survey (NFHS-2), India, 1998-99: Kerala.* IIPS, Mumbai.

International Institute for Population Sciences (IIPS), 2001. *National Family Health Survey Health Survey (NFHS-2), India, 1998-99: Karnataka.* IIPS, Mumbai.

Irudaya Rajan, S. and P. Mohanachandran, 1998. "Infant and Child Mortality Estimates, Part I." *Economic and Political Weekly*, 33, No 19, 1120-40.

Jain, A K and A L Adlakha. 1982. Preliminary Estimates of Fertility Decline in India during the 1970s. Population and Development Review, 8,3, Pp. 589-606.

Kishore, S., 1991. "May God Give Sons to All: Gender and Child Mortality in India." *American Sociological Review*, 58, 2 ,247-265.

Kishore, S. 1994. "Fertility Decline in Tamil Nadu, India" in Bertil Egero and M. Hammarskjold (eds.). *Understanding Reproductive Change: Kenya, Tamil Nadu, Punjab, Costa Rica*. Lund University Press. Lund

Krishnan, T. N., 1976. "Demographic Transition in Kerala: Facts and Factors." *Economic and Political Weekly*. 11(31-33).

Malhotra, A., Vanneman, R. and Kishore, S., 1995. "Fertility, Dimensions of Patriarchy and Development in India" *Population and Development Review*, 21, 2, 281-305.

Meera, N. 2000. Female Infanticide in Tamil Nadu: A Micro Level Investigation. M.Phil Disseration Submitted to the Jawaharlal Nehru Unviersity, New Delhi; Center for

Development Studies, Thiruvananthapuram.

Mukherjee, S.B. The Age Distribution of the Indian Population: A Reconstruction for the States and Territories. University of Hawaii Press, Honolulu.

Murthi, M., Guio, A. C. and Drèze, J. 1995. "Mortality, Fertility and Gender Bias in India." *Population and Development Review*, 21, N0 4, 745-82.

Nair, P K B. 1986. Factors in Fertility Decline in Kerala in K Mahadevan (ed). *Fertility and Mortality: Theory, Methodology and Empirical Issues*. Sage Publications, New Delhi.

Nair, P. R. G., 1974. "Decline in Birth Rate in Kerala: A Hypothesis About the Inter-relationship Between Demographic Variables, Health Services and Education." *Economic and Political Weekly* . 9(6):323-336.

Preston, S.H and P N Mari Bhat. 1984. New Evidence on Fertility and Mortality Trends in India. Population and Development Review, 10, 3, Pp. 481-503.

Registrar General of India. 1988. Child Mortality Estimates for India. Occasional Papers No 5 of 1988. New Delhi: Controller of Publications.

Registrar General of India, 1989. *Fertility in India: An Analysis of 1981 Census Data*. Occasional Papers No 13 of 1988. Controller of Publications, New Delhi.

Registrar General of India, 1997. *District Level Estimates of Fertility and Child Mortality for 1991 and their Interrelations with Other Variables*. Occasional Paper No 1 of 1997. Controller of Publications, New Delhi.

Rele, J R. 1987. Fertility Levels and Trends in India, 1951-81. Population and Development Review, 13, 3, Pp. 513-530.

Savitri, R., 1994. "Fertility Decline in Tamil Nadu: Some Issues." *Economic and Political Weekly*, 29, 1850-52.

United Nations. 1975. Poverty, Unemployment and Development Policy: A Case Study of Selected Issues with Reference to Kerala. United Nations, New York.

United Nations Children Fund. 2001. Multiple Indicator Survey (MICS-2000). India Summary Report.

Visaria Pravin. 1969. Fertility and Mortality in India, 1951-60. Milbank Memorial Fund Quarterly, Volume 47, No.1.

Zachariah, K. C., 1984. *The Anomaly of the Fertility Decline in India's Kerala State: A Field Investigation*. Staff Working Paper No.700, The World Bank, Washington DC.

Zachariah, K. C., S. Irudaya Rajan, P. S. Sarma, K. Navaneetham, P. S. Gopinathan Nair and

U. S. Mishra, 1994. *Demographic Transition in Kerala in the 1980s* Centre for Development Studies Monograph Series, Trivandrum.

Zachariah, K C and S Irudaya Rajan (eds.). 1997. *Kerala's Demographic Transition: Determinants and Consequences*. Sage Publications, New Delhi.

Table A1: Social, Economic and Demographic Indicators of South India, 2001

State	Population	% to total Population	Annual growth rate	Population Density (Per square Kilometre)	Sex Ratio (Females per 1000 males
Andhra Pradesh	75727541	7.37	1.30	275	978
Tamil Nadu	62110839	6.05	1.06	478	986
Karnataka	52733958	5.14	1.59	275	964
Kerala	31838619	3.10	0.90	819	1058
South India	*222410957*	*21.66*	*1.32*	*350*	*988*
India	*1027015247*	*100.00*	*1.93*	*324*	*933*

State	Child Sex Ratio (Females per 1000 males)	Literacy Rate		Percent Urban	Work Participation rate	
		Male (%)	Female (%)		Male (%)	Female (%)
Andhra Pradesh	964	70.85	51.17	27.35	56.44	34.92
Tamil Nadu	939	82.33	64.55	43.86	58.05	31.32
Karnataka	949	76.29	57.45	33.98	56.86	31.87
Kerala	963	94.20	87.80	25.97	50.36	15.27
South India	*954*	*78.63*	*61.90*	*33.32*	*56.15*	*30.30*
India	*927*	*75.85*	*54.16*	*27.79*	*51.93*	*25.67*

Source: Census of 2001 (provisional results)

Table A2 : Estimates of Fertility for South India, Various Sources, 1995-2001

State	CBR	TFR	CBR	TFR	CBR	TFR	TFR
Period	1994-2001		1995-99		1996-98		2000
source	Census 2001		NFHS-2		SRS		UNICEF
Andhra Pradesh	20.4	2.31	21.4	2.25	22.6	2.5	2.3
Tamil Nadu	17.2	1.85	21.4	2.19	19.2	2.0	2.3
Karnataka	20.9	2.4	20.4	2.13	22.6	2.5	2.6
Kerala	17.1	1.7	18.8	2.0	18.1	1.8	2.3
South India	*19.2*	*2.12*	*20.8*	*2.17*	*21.0*	*2.3*	*2.4*
India	*25.9*	*3.16*	*24.8*	*2.85*	*27.1*	*3.3*	*3.2*

Notes: CBR in per 1000 and TFR in children per woman.

Source: Guilmoto and Rajan (2002); IIPS (2000), SRS bulletins, UNICEF (2001)

Table A3: Fertility and Family Planning Indicators for South India, NFHS 1998-99.

	AP	TN	KA	KE
Median age at first cohabitation with husbands among women 25-49	15.3	18.8	17.0	20.3
Mean number of living children among current married women, 15-49	2.38	2.14	2.49	2.17
Percentage of third and above order births	31.4	23.1	33.7	21.0
Median age at first birth	18.0	20.6	19.2	21.9
Median age at last birth	27.3	27.9	27.8	28.1
Mean ideal number of sons	1.0	0.8	0.9	1.0
Percentage who want at least one son	76.0	66.3	70.0	72.6
Percentage who want at least one daughter	71.3	63.9	67.5	70.7
Total wanted fertility rate	1.88	1.71	1.56	1.81
Total fertility rate	2.25	2.19	2.13	1.96
Percentage of current married women using any contraceptive method	59.6	52.1	58.3	63.7
Percentage of currently married women who were sterilised	52.7	45.2	51.5	48.5
Median age at sterilisation among women	23.5	25.3	24.2	26.5
Unmet need for family planning	7.7	13.0	11.5	11.7

Source: National Family Health Survey 2, Various state reports.