# SPATIO-TEMPORAL DIMENSION OF RELATIONSHIP BETWEEN FERTILITY AND ITS DETERMINANTS
## A COMPARATIVE STUDY OF RAJASTHAN AND TAMIL NADU

*Dissertation Submitted to*
*Jawaharlal Nehru University in Partial Fulfillment of the Requirement of the Award of the Degree of*

**MASTER OF PHILOSOPHY**


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## CERTIFICATE

I, Jeetendra D. Soni, certify that the dissertation **entitled "SPATIO-TEMPORAL DIMENSION OF RELATIONSHIP BETWEEN FERTILITY AND ITS DETERMINANTS: A COMPARATIVE STUDY OF RAJASTHAN AND TAMIL NADU"** for the degree of **MASTER OF PHILOSOPHY** is my bonafide work and may be placed before the examiners for evaluation.

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# ACKNOWLEDGEMENT

First of all, I acknowledge the constant support and guidance of my supervisor Prof. ASLAM MAHMOOD. He provided me with precious ideas and suggestions, which helped me in conceptualisation of this issue with indepth understanding. His consistent supervision in shaping this work in the present form is really appreciable. I am thankful to him with a profound sense of gratitude for this benevolent support.

I am grateful to Prof. P. M. Kulkarni for his kind cooperation at every step. He helped me in developing deep understanding of this issue by providing valuable suggestions with a cheering face.

In this course of time, I came across with various institutions. I received cordial support from librarians of National Institute of Public Finance and Policy, Planning Commission, Sewa Bhawan, National Institute of Health and Family Welfare, J.N.U. Central library and C.S.R.D. Documentation Unit.

I am also recognising the active cooperation of Mr. Saswato Ghose and Mr. Varghese on various fronts for making this work presentable. I am thankful to Dinesh, Atul, K.K., Pramod, Hitesh, Sachin, Subhash, Kailash, Ashok, Shiv, Prashant, Suresh, K.G., and Pervinder for cheering me in this busy schedule.

I am thankful from deep core of heart to my friend Moumita for her precious company in all fronts for the completion of this piece of work. She provided me motivation and remarkable advices for this work.

Above all I want to thank my Mother, Father, Brothers, Bhabhis, Nephews and Niece who provided me conducive environment and consistent motivational force for pursuing higher studies and finally shaping me in the present state. I am especially indebted to my brother Surendra, who is actually the guiding force and source of inspiration, helping me to achieve all that is the best in life.

**July, 2003**
**New Delhi.**

**Jeetendra D. Soni**

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# CHAPTER I

# INTRODUCTION

In India the growth of population till the beginning of 20th Century had been quite moderate. It was only in the second quarter of the 20th Century that the population of India started showing signs of acceleration. Since 1961 the population growth rate has been consistently around two percent. Prior to 1920's India was in the phase of high stationary according to Demographic Transition Theory. After this phase, it entered the early expanding stage where along with very high fertility rate mortality was declining progressively. Now we are in the last phase of late expanding stage and entering the last stage of demographic transition. So India is following the demographic transition pattern of other developing countries, from the initial level of "high birth rates and high death rates" to the current intermediate transition stage of "high birth rates and low death rates," which is largely contributing to rapid population growth, before achieving the levels of "low birth rates and death rates". Therefore the second half of the 20th Century is marked by a very high natural increase in the history of Indian population. Our population base widened in the recent past, where even low rate of fertility has caused a significant increase in population size or alternatively one can also say that small magnitude of population growth has contributed to a considerable addition in the absolute number of people.

It is ironical that very soon in 2035 (projected) Indian population will surpass China's population and going to earn the unwanted distinction of being the most populous country of the world. Infact in 1990 the actual births in India were 26.07 million, which were higher than China's addition of 24.58 million new born babies, in spite of China having 310million more population than India and the IMR in India was higher than China, (UNDP, 1994). The fertility differential between India and China is largely contributing for the above scenario. It has been found that TFR of China (2.2) was much lower than that of India (3.9) in 1992, (Srinivasan, 1995). Therefore since independence speedy growth of population become an important issue. However, there is no significant difference in mortality. Controlling of fertility therefore, is the main concern among the government and other agencies to bring down the level of accelerating population growth in India. The higher fertility is not a uniform phenomenon throughout the country. There are areas of low fertility also such as Kerala, Karnataka, Andhra Pradesh, West Bengal, Maharashtra and Tamil Nadu. Understanding of the socio-economic background of the states in relation to their fertility behaviour in the high and low fertility areas will provide a comparative framework in direction. Present study is an effort of this kind.

If one observes the age distribution of the population of developing countries then it is found that they have high proportion of children below 15 years and low proportion of old age people i.e. they are having high young dependency ratios. Such types of population composition are termed as "young population". India is also falling in the similar category. If mean age of the Indian population is considered, we find that India's population has become slightly "younger" in the recent past. In 1991 India's age composition, as percentage to the total population was such where 37.25 percentage people were between 0-14 years, 55.44 percent between 15-59 years and 7.31 percentage in 60 years and above age group. It is clearly depicted that Indian population base is very broad with very high proportion of people in children's age group and the population in reproductive age also constituting large section of Indian population. In the near future the present younger population will be added in this group only. If India fully implements her population control policy then also this momentum of increase in population will continue for some more years, because high TFR in the past have resulted in a large proportion of population being currently in their reproductive years. Annual population growth rates in the last few decades were nearly the same, and the broadening base of population has caused spiral increase in India's population. The absolute increase in number of persons was 68,109,135,163 and181millions during 1951-61, 1961-71, 1971-81, 1981-91, and 1991-2001 respectively.

Technical Group on Population, Planning Commission, has estimated that large proportion of currently married women in India have shown unmet need for family planning services, like, they are not using contraceptives even though they don't want any more children or want to wait for their next child. This factor is contributing nearly 20 percent unwanted fertility in India. It is so because 74 percent of Indian population lives in rural areas, with poor communication and transport, inadequate reproductive and basic health infrastructure and services which very often do not reach them. They also found that in BIMARU states unwanted fertility is close to one birth per woman. It is implicit that this unwanted fertility is again broadening population base, which is imposing threat to population control programmes of India.

"The Global 2000 Study" highlighted the social and environmental consequences of rapid population, which threatens the human existence. It pointed out that if the present trends of population growth rate will continue then world will be more crowded, more polluted, ecologically unstable in the near future. In the similar light of thought "The Limits of Growth," by researches from the Club of Rome, have alarmed that steady population growth, along with economic growth exhaust the non-renewable resources, accelerating environmental pollution, aggravating famines and starvation thereby causing human disaster in about a century.

There are various reasons through which rapid population growth constitutes developmental problems especially in developing and less developed countries such as reduction in availability of per capita resources making it difficult for further investment for improving the population quality, which further affect developmental processes inversely through various ways. So it is very important to know about the significant aspects of the population growth or fertility behaviour. The study of the relationship between socio-economic and demographic aspects and fertility in the different parts of the country can provide more precise information regarding the determinants of the fertility behaviour in different places. Proper understanding of such type of relationships can guide us in the process of the formulation of the strategies for population control or regulating the fertility behaviour.

GOVERNMENT POLICIES TOWARDS POPULATION CONTROL:

In the second half of the $19^{th}$ century, Malthus had warned India against the consequences of over population. Several institutions were established in the 1920's for the propagation of limiting family size like formation of Neo Malthusian league in Madras, Birth Control Movement by R.D.Karve in Bombay in 1921, Indian British Control Society in Delhi in

1922, Wives Clinic in Solapur in 1929, British Control Clinic in Mysore in 1930. The Planning Commission also nominated a Population Sub Committee in 1947.

The implications of rapid population growth in various fields were actually realised right from India's independence. The urgency for controlling the population size was felt and world's first official Family Planning Programme at the national level was launched during the first Five Year Plan (FYP) in 1952 for reducing birth rates to "stabilize the population" at a level consistent with the requirement of the national economy. The achievements of these programmes in terms of crude birth rate (CBR) and crude death rate (CDR) are not at all impressive. Initially Clinical approach was adopted in first two FY Plans. Later on in third FYP (1961-66), this approach was substituted by Community Extension Approach. The Information, Education and Communication (IEC) strategy continued to be an integral component of the population programmes along with use of incentives and disincentives. However until 1965 the programmes were mainly clinic based and urban centered. After 1965 an extension programme had been adopted to embrace rural areas to universalize the population control programmes.

For the first time, Dr. Karan Singh, the then minister of Health and Family Planning, announced National Population Policy in 1976, when India was passing through internal emergency. In this policy the role of education and economic development was realized in the process of fertility reduction but advocated a direct assault on population problem because of its urgency. Age of marriage for both girls and boys was raised to 18 and 21years respectively and the delimitation of constituencies was frozen till the year 2001 on basis of 1971census. Increasing monitory allurements enhanced the incentive approach. In this year Child Marriage Restraint (Amendment) Act, 1976 was also introduced. Under this act, the age of marriage for girls has been raised from 15 to 18 and for boys from 18 to 21 years. In 1978, the Janata Government announced another population policy statement on Family Welfare Program. Both the policy statements lay on the table of the House of Parliament, but were never discussed and adopted. In 1986, the Congress Government issued another population policy statement, but it was also never implemented.

During 1990's government adopted decentralized planning strategy and 73$^{rd}$ and 74$^{th}$ Constitutional Amendment Acts, 1992 were passed by the Parliament. In these Acts health, family welfare and education were made a responsibility of Village Panchayats in the course of decentralized planning and programme implementation.

In 1991 the National Development Council appointed a committee on population in the chairmanship of Shri Karunakaran. In the report this committee suggested that a National Population Policy should be formulated by the government and by the Parliament. The Policy should have a long-term holistic view of development, population growth and environmental protection.

On this line in 1993 an Expert Group headed by Dr. M.S. Swaminathan was asked to prepare a draft of a National Population Policy. It was submitted to the Government of India on 21st may 1994. During Nov. 1997, cabinet approved the draft of National Population Policy but could not be placed in either House of the Parliament. The cabinet discussed it again in 1999 and finally it was approved by the Parliament and on 15th February 2000 government has declared New Population Policy, 2000. This policy statement marks a distinct departure from the past approaches. The main reasons of the failure of family planning programmes in India were the target orientated approach, inferior quality of means of family planning, high proportion of illiterates and unaware population. In the past our family planning programmes did not take into account the various socio-economic variables that influence the fertility behaviour to a large extent. But after the International Council on Population and Development at CAIRO, which was held in 1994, Indian government changed their attitude towards the family planning programmes as well as the implementation of the population policies. In the similar line of thought, in policy document of 2000, an urgent need was felt to view population as an integral part of socio-economic development and quality of life. This policy affirms the commitment of the government towards voluntary and informed choice and assent of citizens while availing of reproductive health services and continuation of the target free approach in administrating family planning services. So India has adopted client oriented reproductive health approach since June, 1996 but we have to wait to see the impact of this change for a few more years.

There has been a regular change in the central aim and strategies of population policy. The population planning in India has failed and inadequate in achieving the target of replacement level of fertility (as TFR equal to 2.1 or NRR equal to one), as required for population stabilization. India's performance on various population-health parameters has been much lower than those of its neighbours such as China and Sri Lanka. In the Human Development Report (2003), published by United Nations Development Programme (UNDP), India stood on 127th rank, lower then China (104th) and Sri Lanka (99th), on Human Development Index score.

A HISTORY OF INDIAN FERTILITY BEHAVIOUR:

According to various estimations, India's population was almost stationary between 300 B.C. to 1600A.D., a period of around 2000 years. In 1871 first national decadal census was conducted in which India's population was 255 million, which decreased to 251 million in 1921because of epidemic and severe famine during 1911-21. In the history of Indian population, 1921 is known as the great divide because from this period only a period of moderately increasing population growth started. Till 1951, the first census of independent India was conducted. The decadal growth rate was hardly 13-14%, with indications of gradual increase. After 1951 rapid growth of population became an important characteristic of Indian demographic behaviour.

Prior to 1960's, when Sample Registration System was not introduced, information on fertility levels was obtained through indirect methods. On the basis of census data various authors have prepared trends of fertility in India, using indirect methods. In the absence of adequate and reliable birth statistics from Civil Registration System, National Sample Surveys were the only source for fertility estimates, but these were again not accurate and reliable. Kinsley Davis had made a pioneering work in his classical work, "Population of India and Pakistan," in 1951, in which he estimated birth rates for the period between 1891 and 1941. He was followed by many individual researchers such as Visaria, Rele and Sinha, Saxena, Adlakha and Kirk, Ragavachari, Premi, Das Gupta and some institutions like Registrar General of India, United Nations which estimated the birth rates for various time periods using indirect techniques.

**Table 1.1:** Levels and Trends in Estimated Birth Rates in India.

(in percentage)

| TIME PERIOD | | DAVIS AND O.R.G. | MARI BHAT | MUKHERJEE | RELE | OTHER ESTIMATES |
|---|---|---|---|---|---|---|
| 1881-91 | | 48.9 | 47.0 | | | |
| 1891-1901 | | 45.8 | 46.6 | 47-49 | | |
| 1901-1911 | | 49.2 | 46.8 | 48-50 | | |
| 1911-1921 | | 48.1 | 46.0 | 48-50 | | |
| 1921-1931 | | 46.4 | 46.4 | 46-48 | | |
| 1931-1941 | | 45.2 | 46.6 | 44-46 | | |
| 1941-1951 | | 39.9 | 45.4 | 42-44 | | |
| 1951-1961 | 1951-56 | 41.7 | 45.7 | 43-45 | 45.9 | 44.9-46.0 |
| | 1956-61 | | | | 45.2 | |
| 1961-71 | 1961-66 | 41.1 | | 40.6 | 44.0 | 40.5-42.0 |
| | 1966-71 | | | | 41.9 | |
| SOURCES | | (1) | (2) | (3) | (4) | (5) |

**SOURCES:** (1) DAVIS (1951); REGISTERAR GENERAL (1964, 1974). (2) MARI BHAT (1989). (3) MUKHERJEE (1976). (4) RELE (1987). (5) VARIOUS SOURCES: RELE AND SINHA (1970, 1973); SAXENA (1965); VISARIA (1969); COALE AND DEMENY (1967); ADLAKHA AND KIRK (1974); RAGACHAVARI (1974); DYSON (1979).

More or less all the estimates had given the similar picture. During the period between 1901-11 crude birth rates were around 50 per 1000, which had declined to nearly 40 per 1000 during 1961-71. However some estimates indicate a slight increase in CBR in 1950s. For the period of 1901 to 1971, no estimates are available at state and UT level. Despite, a vague idea of regional heterogeneity on fertility behaviour has made, based on Davis and Mukherjee's work (1976) on estimates at the macro regional level, which display very limited variations across regions in India.

Before 1960's fertility rates were consistently very high in all the regions of India and fertility differentials among various socio-economic groups of population were also not very significant. From late 1960's onwards Sample Registration System (SRS) offers reliable state level estimates of vital rates on the basis of the large demographic surveys conducted by the office of Registrar General of India. Numerous studies on fertility have concluded, that the turning point in Indian fertility was observed from the late 1960's with the emergence of fertility differentials in various socio-economic groups, along with the secular declining trend in the fertility behaviour. This process got accelerated in coming decades and a number of fertility surveys were launched in different regions of India with the emphasis on the study of the fertility patterns and differentials. This is the landmark, which indicates the beginning of fertility decline in India. The SRS reports of 1972 and 1979 are providing evidence of fertility decline during the 1970's. Although the magnitude of decline in fertility has been characterized by varying rates among the different socio-economic groups. On the basis of some fertility estimates, various researchers have arrived on a consensus that the crude birth rate for India during 1951-61 was about 41 per 1000. Further it is estimated that it has declined from 43 per 1000 in 1960 to 40 per 1000 in 1970 and then declined steadily during the 1970s.

However, since the late 1970's, decline in fertility has slowed down and according to SRS it has remained consistent at 33 per 1000, between 1977 and 1986. After that it was again started showing the mark of slow and regular decline. During 1981-91 crude birth rate was 28.86 per 1000 and for 1991-01 it has further declined to 21.36 per 1000 for a decade.

While the global population have increased threefold in the previous century, from 2 billion to 6 billion. The populations of India, during the same time have increased more than four times, from 238 million to 1 billion. According to the 2001 census, the population of India on 1$^{st}$ march 2001 was 102.7 crore persons, making it second most populous nation of the world, accounting 16 percent of the world population. At the time India is having only 2.4 percent area of the continental land. In the last decade, from 1991-2001, 181 million people were added to the Indian population, which is equal to the total population of Brazil. The decadal growth has declined by 2.52 percent, from 23.86 to 21.34 during 1981-91 to 1991-2001. The average exponential growth has also declined from 2.14 to 1.93 percent during the same period (table 1.2). However, there are large scale regional differences in these changes.

**Table 1.2:** Changing pattern of population growth in India in 20th century.

| YEAR | POPULATION IN MILLIONS | CBR | DECADEL GROWTH RATE | ANNUAL EXPONENTIAL GROWTH RATE | TFR |
|---|---|---|---|---|---|
| 1901 | 238.4 | - | - | - | - |
| 1911 | 252.1 | 49.2 | 5.75 | 0.56 | - |
| 1921 | 251.3 | 48.1 | -0.31 | -0.03 | - |
| 1931 | 279 | 46.4 | 11 | 1.04 | - |
| 1941 | 318.7 | 45.2 | 14.22 | 1.33 | - |
| 1951 | 361.1 | 39.9 | 13.31 | 1.25 | 6 |
| 1961 | 439.2 | 41.7 | 21.51 | 1.95 | 5.7 |
| 1971 | 548.2 | 41.2 | 24.8 | 2.02 | 5.2 |
| 1981 | 683.3 | 37.2 | 24.66 | 2.22 | 4.5 |
| 1991 | 846.3 | 29.5* | 23.56 | 2.14 | 3.6 |
| 2001 | 1027 | 26.1 | 21.34 | 1.93 | 3.2 |

* excludes J&K due to non receipt of returns
**Source:** Registrar General, INDIA (various years)

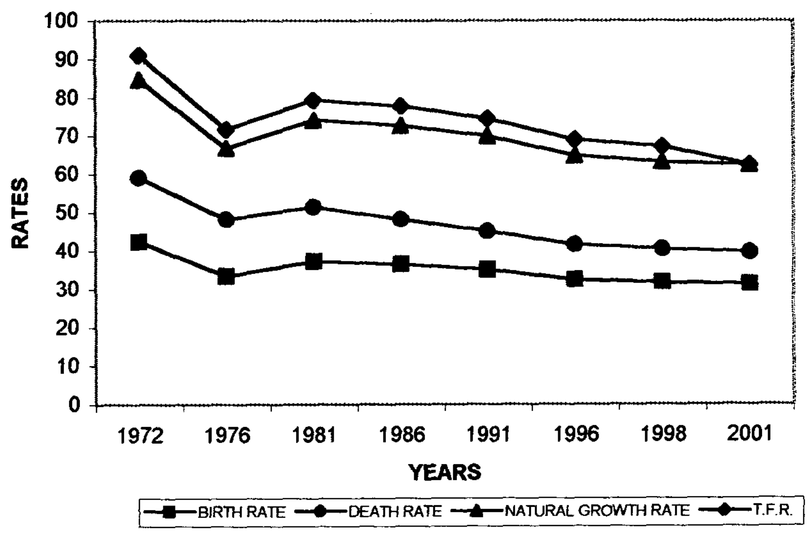
If we give a glance to the Indian demographic achievements during the second half of the last century, after formulating the National Family Welfare Programme, from 1951 to 1998 based on SRS data, then it is found, that India's crude birth rate declined from 40.8 to 26.4 per 1000, total fertility rates reduced from 6 to 3.3 children per women, infant mortality rates from 146 to 72 per 1000, crude death rates from 25 to 9 per 1000 and life expectancy has increased from 37 to 62 years. Here it is clearly reflecting that death rates have declined noticeably but a similar drop in birth rates did not accompany it. Due to this, gap between the birth and death rates has widened and consequently the natural increase of population became very high and population started showing signs of rapid growth during this period. A brief history of demographic characteristics of Indian population during last three decades is given in table 1.3. The trends of various demographic aspects are presented in figure 1.1.

**Table 1.3:** Demographic Characteristics of India, 1972-2001.

| YEAR | BIRTH RATE | DEATH RATE | NATURAL GROWTH RATE | I.M.R. | T.F.R. |
|---|---|---|---|---|---|
| 1971 | 36.9 | 14.9 | 22 | 129 | 5.2 |
| 1976 | 34.4 | 15 | 19.4 | 129 | 4.7 |
| 1981 | 33.9 | 12.5 | 21.4 | 110 | 4.5 |
| 1986 | 32.6 | 11.1 | 21.5 | 96 | 4.2 |
| 1991 | 29.5 | 9.8 | 19.7 | 80 | 3.6 |
| 1996 | 27.5 | 9 | 18.5 | 72 | 3.4 |
| 1998 | 26.5 | 9 | 17.5 | 72 | 3.2 |
| 2001 | 25.8 | 8.5 | 17.3 | 68 | - |

**Source:** Various Reports of Sample Registration System.

**Fig. 1.1 : ESTIMATES OF BIRTH RATES, DEATH RATES, NATURAL GROWTH RATES AND TOTAL FERTILITY RATES, INDIA, 1972-2001.**




The first important work, regarding regional differences in fertility levels, was conducted by the Committee on Population and Demography of National Research Council based on intercensal estimates of 1961-66 and 196-71. In this, Bhat, Preston and Dysonl (1984) observed a distinct regional picture. Where north Indian states like Rajasthan, Utter Pradesh, Madhya Pradesh, Assam etc. had birth rates above the national average, states of southern India like Kerala, Tamil Nadu, Karnataka, Andhra Pradesh etc. exhibited birth rates below the national level.

Guilmoto (2000), in his work, "Geographical Profile on Changing Fertility Behaviour in India," came to the conclusion that, fertility decline began in southern periphery along the coasts and then spread progressively towards north to the region around the great gangetic plains, the heart of traditional India, where fertility rates are still high in the presence of exclusion of women in education, and development. He also identified the micro level differences in fertility behaviour, which are again very high

According to the Technical Group on Population Projection (by Planning Commission, 1996) the total fertility rates in India were 3.3 children per woman in 1997. However they observed a significant inter state as well as inter district variations. Out of 32 states and UT's, only 9 were having TFR less than or equal to the replacement level of fertility, 12 were with TFR greater than or equal to 3 children per 1000. Even the three new states, which formed recently, are also falling in the later category. If we examine the IMR and the Contraceptive Prevalence Rate (CPR) in these states and UT's then it is found that the groups which are having TFR below the replacement level, also has low IMR and high CPR than the group of high fertility. The estimated levels and trends of fertility through various sources show a remarkable geographical consistency, with northern states having higher fertility than southern states, where Punjab in the north, is an isolated exception. Rate of fertility decline is also faster in southern states in relation to northern states.

Five states such as Bihar, Madhya Pradesh, Orissa, Rajasthan and Utter Pradesh currently constitute around 44 percent of the total population of India. This is projected to increase by 48 percent in 2016 i.e. these states alone will contribute nearly 55 percent increase during the period 1996 to 2016. These states are having persisting high TFR and lowest CPR in the country. As a result these states are posing the biggest challenge to our efforts of population control.

Bhat and Xavier (1999) have analyzed the differentials in fertility among 76 regions in India, using data generated by the National Family and Health Survey (NFHS). In 1975 all the regions had TFR more than 3, and 29 regions were having above 5 children per 1000. In 1987, there were 13 regions with TFR under 3 and only 8 regions had TFR more than 5 children per 1000. In this period of 12-13 years only 30 percent regions had remained in the same fertility level in which they were in mid 1970s. While, rest of the states have experienced considerable decline in fertility rates, however the regional variations got strengthened.

Currently all the developing societies are experiencing demographic transition at varying pace according to their levels of socio-economic development. In India diverse societies with varying socio-economic and demographic characteristics exist. This leads to significant differences in the phases of fertility decline across different societies and states. On the basis of the above mentioned scenario of regional differences, steps should be taken to identify the area specific needs for effective implementation of family planning programmes to reduce the fertility level and regional differences in it. Government should come forefront to prepare need based, demand driven socio-demographic plans at the micro level, and say on district level, aimed at identifying and providing responsive people centered and integral strategic pogrammes for the future. At the same time socio-demographic goals for the future should be set in accordance to the specific area approach concerning to the local needs and their potential. "Think, Plan and Act locally and support nationally," strategy should be taken for the aspired objectives.

Although recent decades have seen rapid advances in both theoretical and empirical research on fertility behaviour. The links between macro level social and economic changes and individual fertility decline remain unresolved, (Smith, 1989). A variety of multi level models have considered aerial variations to improve understanding to these links, (Enteisle and Mason, 1985; Hirschman and Guest, 1990).

In the initial phase of fertility decline, rate of fertility decline differed from one population group to another and across different regions. Firstly upper social and economic strata of urban population experience the change and then it spreads among the other intermediate groups and then finally reaches the lower social and economic groups and rural population. So it is very much evident that the overall fertility decline can be expected to occur when a country undergoes equitable social and economic development with the aim of reducing regional differences. The basic objective of socio-economic development is to increase awareness among the people, to improve their quality of life, to enhance their overall well being and to provide them with opportunities and choices to become the productive assets in society. The addition of 15.5 million persons annually in population of India is large enough to neutralize the efforts made by the government in all the fronts of social and economic development and environmental conservation. It is essential to achieve stabilization in Indian population in near future, at a level consistent with the requirement of sustainable economic growth, social development and environmental protection.

So it is evident that India is a country of striking demographic diversity. Although the varied pattern of demographic situation in different regions of the country have been a matter of concern since long, but at the same time the census 2001 still points out sharp variations among different regions of India. These differences are largely supported by social, economic and cultural factors, which coexist and reinforce each other. Potts, Selman, Mecdonald and Evans (1979) have argued that human reproduction is determined to a large extent by social factors, beliefs and attitudes towards sex and procreation, the structure of the family and economic and political considerations. So the study of fertility differentials by socio-economic variables is an important area of demographic research and acquires special importance for developing countries like India. It is also said that fertility levels of a region depends on the social, economic, cultural and demographic characteristics of its people. As a consequence, it is very important to address this issue with the help of comparative analysis in extensive manner to go into depth for the better understanding of the issue of regional differences.

District level studies for the analysis of fertility behaviour are recent in India, as estimates for fertility and mortality rates, at district level, have only appeared after 1981 census. Malhotra, Vanneman and Kishore (1998) studied the relative importance of the marriage system, women's economic value in patriarchal system and the means of active discrimination against women in deciding the family size for 358 districts of India. Very few comparative studies have been done at micro level analysis in this field with considerable indepth and their results are also not precise and predictable. With the objective of filling up the gaps in the previous studies, in this study an attempt has been made to provide indepth understanding of the interplay of fertility and socio-economic and demographic variables, using district level data on these aspects. In the present research, a different approach has been taken by holding to different regions constant and trying to explore comparative changes over time in the respective communities of these different area. Fertility differences in various regions and different population subgroups in the same region are of great significance in understanding the mechanism of fertility decline at grass root or micro level.

The main objective of this dissertation is to see the spatial pattern of fertility behaviour and its determinants. Here firstly we are trying to investigate the important socio-economic and demographic variables for Rajasthan and Tamil Nadu. Further an attempt has been made to compare and contrast the pattern of association among various socio-economic and demographic variables and fertility in these two states. It is well known that there is large-scale regional variation in terms of fertility behaviour in India where the north-south divide is distinctly observed in various empirical studies. For the comparative analysis here the above two states of remarkably extreme performance in demographic characteristics are being chosen. On the one hand Tamil Nadu is taken as the representative of healthy demographic characteristics and on the other side Rajasthan is chosen for its unimpressive demographic characteristics.

In this research, techniques of bivariate and multivariate analysis have been undertaken to evaluate the effects of various socio-economic and demographic variables on fertility behaviour. Some other variables have also been studied such as women's autonomy, caste and religion and other cultural factors, but subsequently not taken in multivariate analysis either because of nonavailability of data or because their differentials were captured by some other variables. District-level data are used, from census statistical abstracts and from some other sources. District is a basic unit of administration and is the lowest level at which spatially disaggregated information on fertility is available.

# CHAPTER II

## RESEARCH DESIGN AND ANALYTICAL FRAMEWORK

### OBJECTIVES OF THE STUDY:

Here the aim behind the empirical study is to identify the influence of socio-economic and demographic variables in determining the fertility behaviour of human population and try to explore the causes of differentials in fertility from high fertility to low fertility areas. This basic objective can be translated into the following objectives:

- To identify the socio-economic and demographic determinants of fertility in Rajasthan and Tamil Nadu from 1981 to 2001.
- To investigate the variation of the influence of important socio-economic and demographic variables in Rajasthan and Tamil Nadu.
- To compare and contrast the pattern of association among various socio-economic and demographic variables and fertility in Rajasthan and Tamil Nadu, high and low fertility states respectively for the time period, 1981 to 1991.
- To analyze the causal linkages between fertility and its determinants in terms of their direct and indirect impact on fertility.

### HYPOTHESIS:

The above objectives are translated in the following hypotheses.

Hypothesis 1. : Female education has inverse relationship with fertility behaviour.

Rationale: Educational attainment always broadens the worldview of persons. It also provides better opportunities for them to raise their social status. Education also helps in various ways in increasing their communication and interaction with the surrounding environment. It is expectable that it also affects fertility behaviour via intermediating demographic variables such as increasing use of contraceptives and higher age at marriage.

Hypothesis 2. : Scheduled section of population in a society has higher fertility than the other occupants of the same region.

Rationale: Generally scheduled population has low levels of social and economic status. They do not have access to better education, medical infrastructure, economic opportunities and other avenues in developmental sector. In such conditions, where they have less interaction with outer world, presumably they have higher fertility level.

Hypothesis 3. : Higher level of urbanization is generally associated with lover level of fertility.

Rationale: Urban areas have better infrastructure facilities in all the sectors of development, which provide suitable environment for higher education, give better occupational opportunities, good communicational network, more effective medical facilities and other resources. Along with this social setting in urban areas they also have different sets of norms and values. This collective urban influence brings down the fertility level of a society.

Hypothesis 4. : Quality of life and level of fertility are negatively related phenomenon.

Rationale: As access to electricity, safe drinking water, medical facilities and other sanitary facilities improves i.e. quality of life improves; it also advances the social status of the people. Consequently it affects the fertility level of a society.

Hypothesis 5. : Higher level of female participation in economic activities especially in non-primary sector leads to low level of fertility.

Rationale: Greater participation of females in economic activities increases their role in decision making and makes them economically independent. This is more pronounced among those females who are engaged in non-primary sector. In general it helps in lowering of fertility levels among the above stated section of population.

Hypothesis 6. : Increasing proportion of main workers engaged in non-primary sector has negative impact on fertility behaviour.

Rationale: Higher proportion of main workers in non-primary sector is an indicator of the economic status of a society, which reflects higher levels socio-economic status. Generally it is associated with low fertility level.

Hypothesis 7. : Infant and child mortality situations have direct relationship with fertility behaviour.

Rationale: Higher levels of infant and child mortality rates create uncertainty for the survival of newborn babies. These situations generally prevail in less developed societies. So for better social security, to ensure economic gains and old age security people produce more children.

Hypothesis 8. : Higher female mean age at marriage is negatively related with fertility behaviour.

Rationale: Increase in female mean age at marriage has reduced the reproductive span of females finally resulting in low fertility level.

**INTRODUCTION TO STUDY AREA:**

After reviewing the literature, it has been revealed that socio-economic and demographic variables have enormous impact on fertility behaviour. These are necessary devices for any family planning programme. The importance of these variables is very much evident in the history of Indian family planning programme, where after putting a lot of efforts, the programme is yet to achieve noticeable success to control the rapid growth of population. After the International Conference on Population and Development at CAIRO (1994) the need to incorporate socio-economic and demographic factors into the family planning programme has been realised globally.

In this research, therefore, an attempt has been made to examine the magnitude of the influence of the various socio-economic and demographic determinants of fertility behaviour. It is hypothesized that the fertility behaviour is an outcome of the complex interplay of social, economic, demographic and geographical situations. As a result in this exercise two different societies have been chosen for the empirical analysis, which are different in their level of fertility behaviour as well as in terms of socio-economic, cultural and geographical settings. These two societies are the two Indian states, where the administration units are taken for the convenience of the availability of various data basis, which have been selected on the basis of crude birth rate (CBR) and total fertility rate (TFR). The fertility rate for the Indian states is given in table 2.1. This table indicates that Uttar Pradesh, Bihar, Rajasthan and Madhya Pradesh are showing high fertility rates among the major states of India.

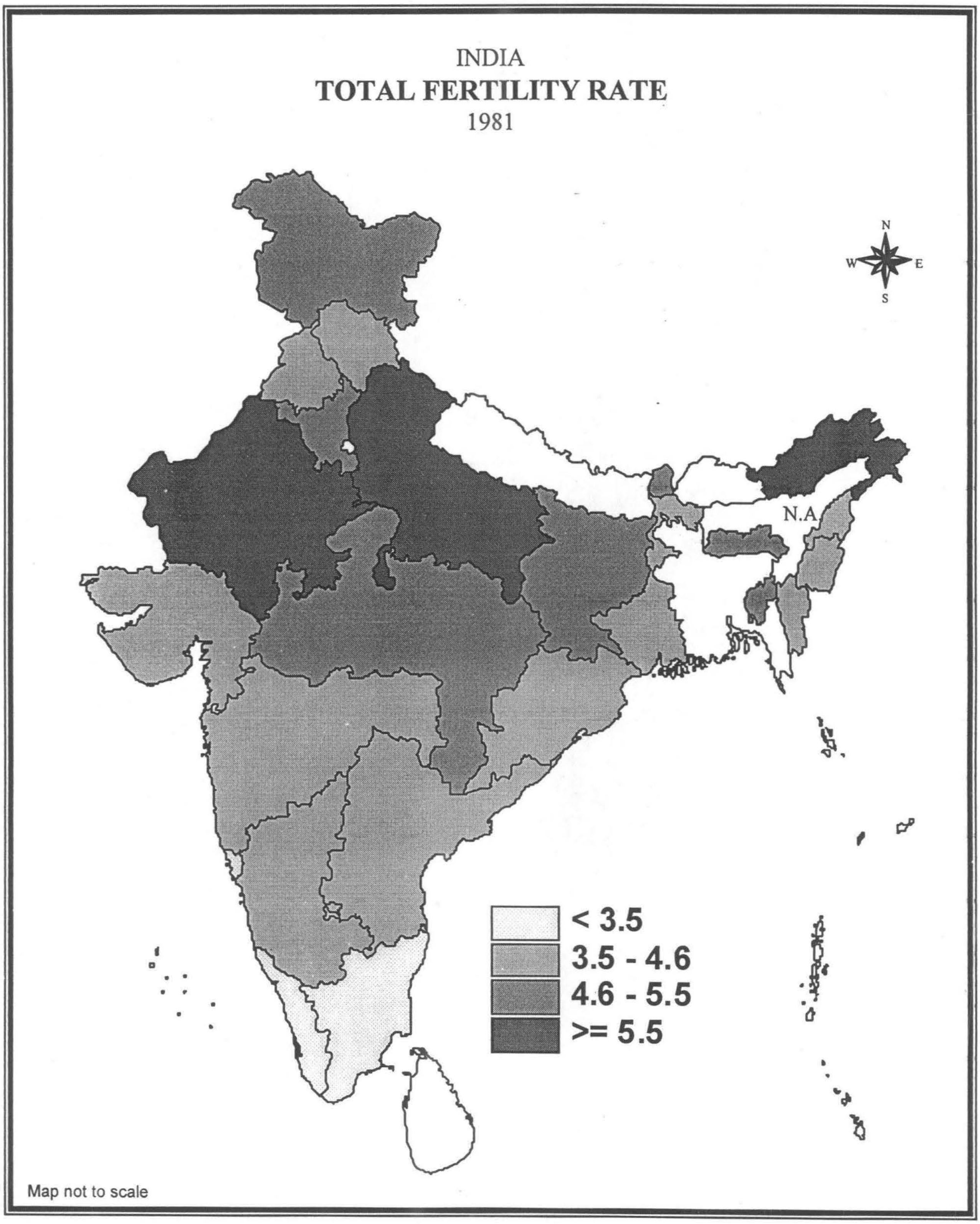
The table 2.1, indicates a clear cut difference between northern and southern states of India in terms of fertility behaviour. A spatial picture of this north-south divide is given in the maps (map no. 1-4), which are showing patterns of fertility behaviour (in TFR and CBR) in India. The classes in these maps are made on the basis of the statistical method of Jenk's Optimisation. It minimizes the sum of variance within each of the classes. Rajasthan is a poor state in terms of the various developmental indicators and has been chosen for the current study. On the other side Kerala shows the lowest level of fertility rates. However, it is an exception because the surprising achievements of this state in the fields of literacy, child and maternal health care and other social sphere are not easily replicable in others. So Tamil Nadu, which also achieved the replacement level of fertility and marked a considerable decline in fertility rates in the last two decades along with consistent improvement on the fronts of social and economic spheres, appears to be a suitable care for a comparative analysis.

**Table 2.1:** Reverse-Survival Estimates of Crude Birth Rate and Total Fertility Rate derived from 1981, 1991 and 2001 Censuses for Indian States.

| STATES | Crude Birth Rate | | | Total Fertility Rate | | |
|---|---|---|---|---|---|---|
| | 1974-80 | 1984-90 | 1994-2001 | 1974-80 | 1984-90 | 1994-2001 |
| Andhra Pradesh | 33.5 | 28.2 | 20.4 | 4.3 | 3.2 | 2.3 |
| Arunachal Pradesh | 39.4 | 39.1 | 29.9 | 5.6 | 5.6 | 3.9 |
| Assam | NA | 35.1 | 27 | NA | 4.1 | 3.2 |
| Bihar | 38.2 | 37 | 33.4 | 5.3 | 5.1 | 4.5 |
| Chhattisgarh | NA | NA | 28.6 | NA | NA | 3.6 |
| Goa | 25.5 | 18.3 | 15.9 | 3.2 | 1.9 | 1.8 |
| Gujarat | 34.2 | 28.8 | 22.6 | 4.3 | 3.2 | 2.6 |
| Harayana | 35.9 | 33 | 25.9 | 5.1 | 4.5 | 3.2 |
| Himachal Pradesh | 32.7 | 27.8 | 20.5 | 4.2 | 3.2 | 2.4 |
| Jammu & Kashmir | 33.4 | NA | 24.5 | 4.8 | NA | 3 |
| Jharkhand | NA | NA | 29.9 | NA | NA | 4.1 |
| Karnataka | 32.2 | 28 | 20.9 | 4.3 | 3.4 | 2.4 |
| Kerala | 25 | 20.3 | 17.1 | 2.9 | 2 | 1.7 |
| Madhya Pradesh | 39.2 | 37.2 | 30.7 | 5.5 | 5 | 3.9 |
| Maharastra | 30.5 | 28.8 | 21.7 | 4.1 | 3.7 | 2.6 |
| Manipur | 31.2 | 27.3 | 21 | 4.3 | 3.4 | 2.6 |
| Meghalaya | 37.4 | 38.3 | 33.6 | 5.1 | 5.3 | 4.5 |
| Mizoram | 36.7 | 31.5 | 27.3 | 5.3 | 4.1 | 3.4 |
| Nagaland | 31.2 | 29.6 | 24.1 | 4.6 | 4.2 | 3.2 |
| Orissa | 33.3 | 30.4 | 23.6 | 4.5 | 3.9 | 2.8 |
| Punjab | 30.4 | 27.2 | 20.1 | 4.2 | 3.5 | 2.4 |
| Rajasthan | 40.5 | 37 | 32.1 | 6 | 5.2 | 4.2 |
| Sikkim | 36.9 | 32.5 | 23.7 | 5.4 | 4.3 | 3 |
| Tamil Nadu | 28.2 | 21.9 | 17.2 | 3.5 | 2.3 | 1.8 |
| Tripura | 31.5 | 31.1 | 21.2 | 4.2 | 4.1 | 2.5 |
| Uttar Pradesh | 42 | 38.1 | 31.4 | 6.3 | 5.3 | 4.4 |
| Uttaranchal | NA | NA | 26.1 | NA | NA | 3.6 |
| West Bengal | 31.1 | 28.9 | 22.5 | 4 | 3.6 | 2.6 |
| INDIA | 34.9 | 31.6 | 25.9 | 4.9 | 4.1 | 3.2 |

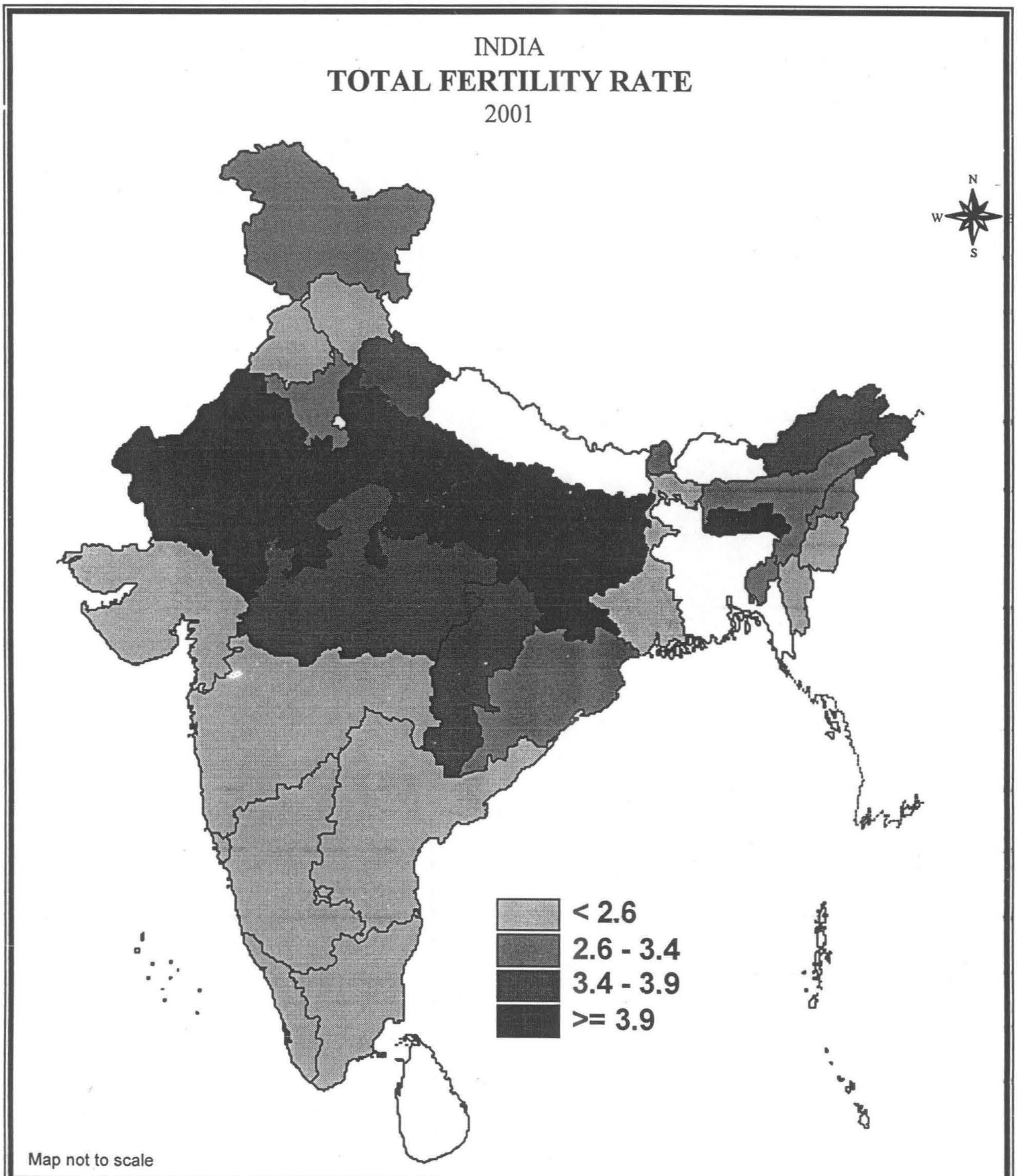
**Source:** 1. Mari Bhat, P.N., (1996), "Contours of Fertility decline in India: A district level study based on 1991 Census".(1981 and 1991 estimates)
2. Guilmoto, C.Z. and Rajan, S.I., (2002), "District Level Estimates of Fertility from India's 2001 Census".(2001 estimates)

## Map No. 1

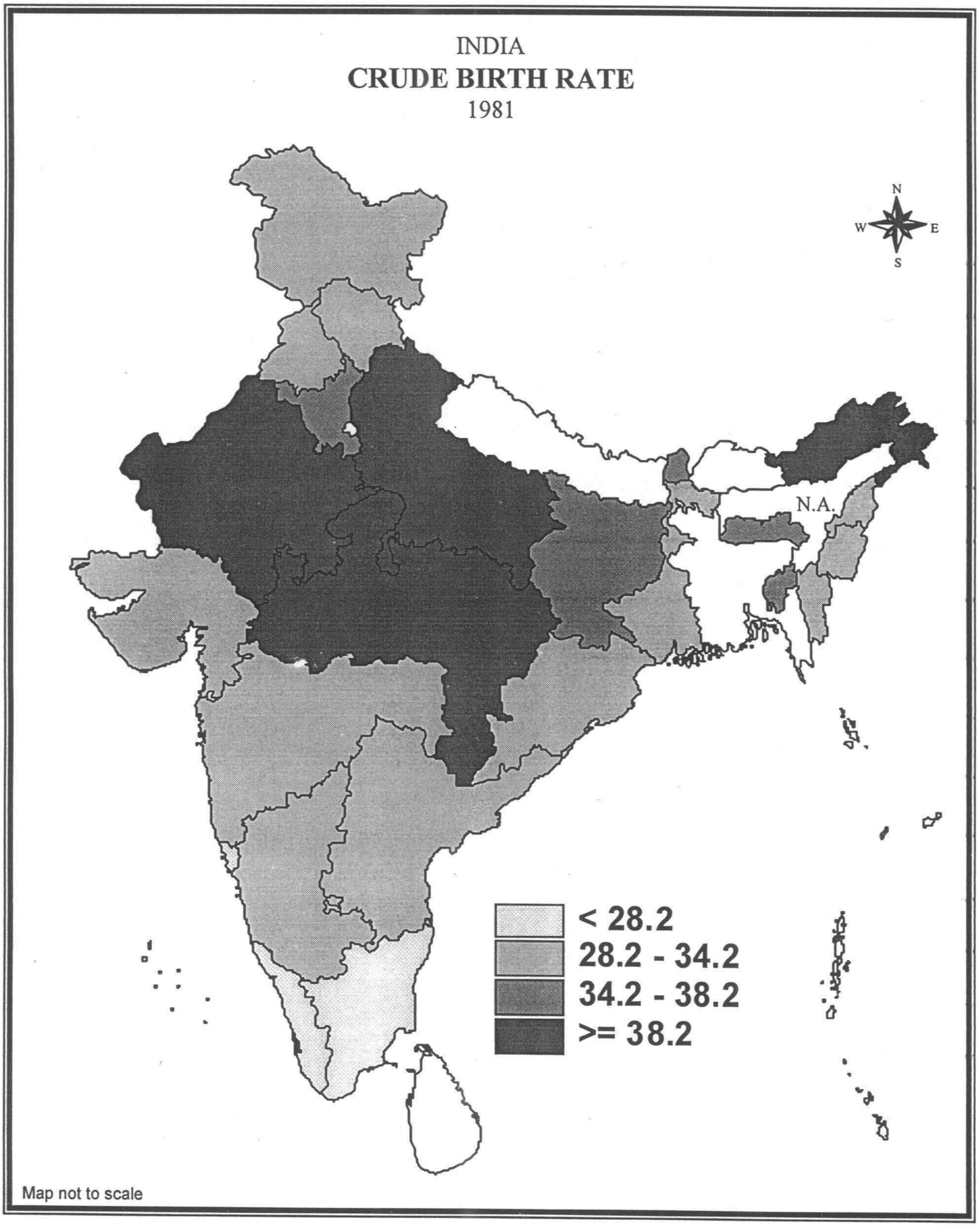


INDIA
TOTAL FERTILITY RATE
1981
N
W
E
S
N.A.
< 3.5
3.5 - 4.6
4.6 - 5.5
>= 5.5
Map not to scale

**Map No. 2**

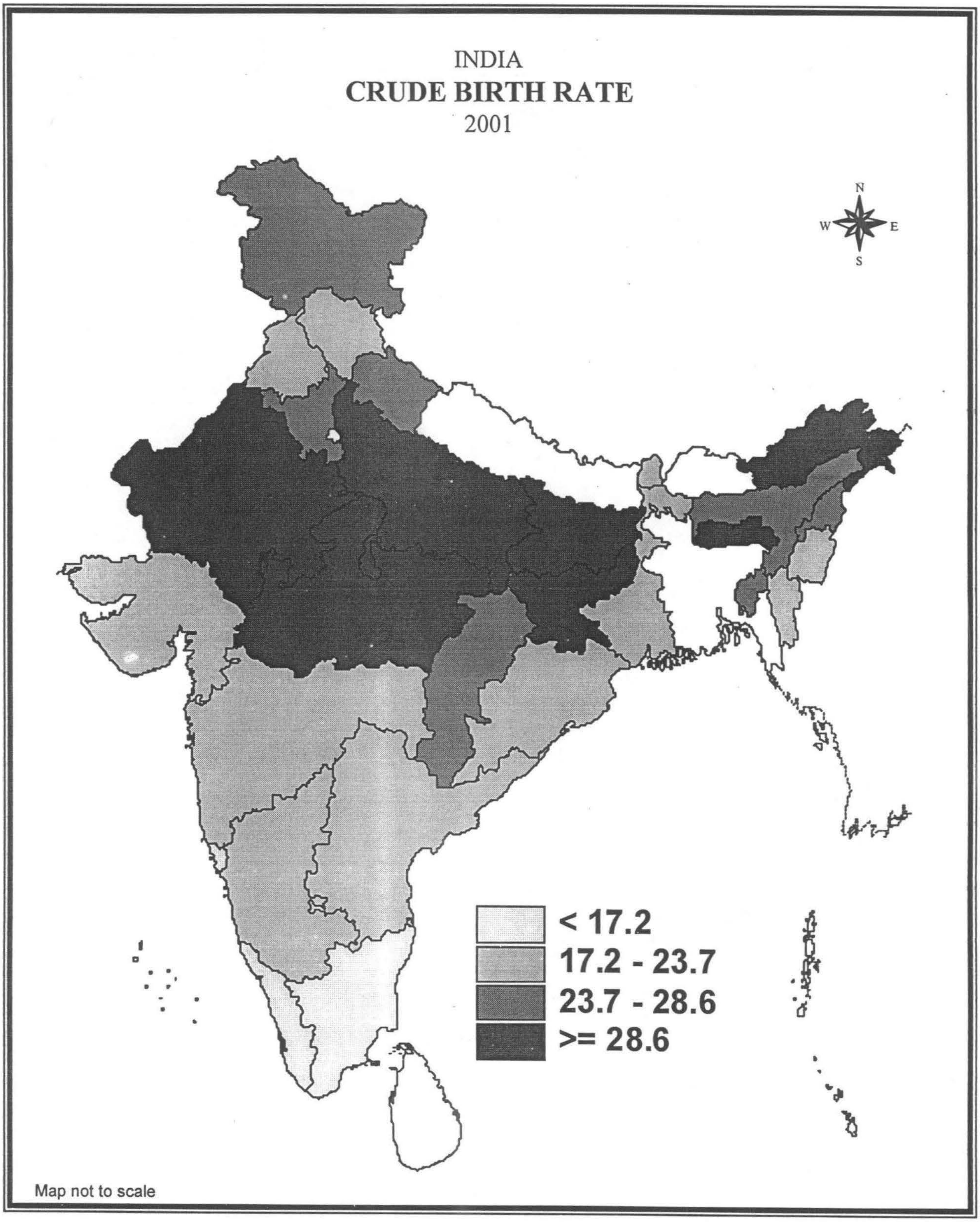

INDIA
TOTAL FERTILITY RATE
2001
N
W
S
< 2.6
2.6 - 3.4
3.4 - 3.9
>= 3.9
Map not to scale

**Map No. 3**



INDIA
CRUDE BIRTH RATE
1981
N
W
E
S
N.A.
< 28.2
28.2 - 34.2
34.2 - 38.2
>= 38.2
Map not to scale

**Map No. 4**


INDIA
CRUDE BIRTH RATE
2001
N
W
E
S
< 17.2
17.2 - 23.7
23.7 - 28.6
>= 28.6
Map not to scale

Both the states are having considerable differences in terms of nearly all the developmental indicators. According to the National Human Development Report (2001), Human Development Index values for Tamil Nadu were 0.343, 0.466 and 0.531 for 1981,1991 and 2001 respectively and ranked 7th, 3rd and 3rd in these respective years among the 15 large states. In case of Rajasthan H.D.I. values were 0.256, 0.347 and 0.424 and ranked 12th, 11th and 9th for the similar reference periods. Average Indian figures for the same points of time were 0.302, 0.381 and 0.472. CMIE Report (Oct, 2000) has also given the similar trends where infrastructure development index value for Tamil Nadu is 145.62 and the comparative figure for Rajasthan is 87.27. If one look into the per capita electricity consumption (1996-97), net state domestic product (1997-98) and consumption expenditure (1999-2000) for Tamil Nadu, the values are 460 kwh, 3141 Rs. (at 1980-81 prices) and 127.54 Rs./month respectively. The similar figures for Rajasthan are 301, 2226 and 110.90. The Census 2001 also revealed the similar situation where for the level of urbanization, literacy and female literacy, corresponding figures for Tamil Nadu are 43.61%, 73.47% and 64.55% respectively and the similar figures for Rajasthan are 23.38, 61.03 and 44.34. Approximately in all the social, economic and demographic indicators, Tamil Nadu is performing better than the national average, where situation is just the reverse in the case of Rajasthan.

In this study, therefore, Rajasthan and Tamil Nadu have been taken for the comparative empirical analysis at district level. This exercise has been carried out on spatial as well as temporal basis.

### *RAJASTHAN:*

Rajasthan is the biggest state of India, with an area of 342239 Sq. Km., situated in the northwestern part of the country. It has a shape of an irregular rhombus with east to west and north to south extension of nearly 850 Km. by 748 Km. The latitudinal and longitudinal spread of Rajasthan is 23°3' N. to 30°12' N. and 69°30'E. to 78°17'E. respectively. The topography of Rajasthan is dominated by the Aravalli system of hill ranges running in a southwest to northeast direction, bisects the state into two major geographical units. This has a steep but discontinuous front to the west and relatively gentle slope towards the east. In the west and northwest part of these ranges lies the desert and semi desert waste, which comprises of sand dunes numerous small elevated hillocks and patches of granite and rhyolite rocks. The eastern part of Aravalli ranges is a vast plain with thin layer of soil and rugged terrain. The southeastern part of these hills is a plateau region. There is wide variation in the physical relief of Rajasthan ranging from 30m. in the vicinity of Rann of Kachchh to above 1000m. at the few points in Aravalli's of Sirohi District. However the few major part of the state lies in between 100 to 350m above the mean sea level.

The 50 Cm. Isohyet, which runs parallel to the Aravalli range divide the state into two distinctive climatic zones. In the western side of this, average annual rainfall is very low and this region has arid type of climate. In the eastern part of it, rainfall ranges from 50 to 100 Cm. Semiarid types of climatic conditions exist here. South and southeastern region of the state, which receives above 80 Cm. average annual rainfall, has humid and semi humid type of climate. The variability of rainfall increases with decreasing magnitude from east to west and from southwest to northeast direction. The average rainfall of the state is 57.51 Cm. The state falls on the periphery of tropical region. The very high annual, seasonal and daily range of temperature is also an important feature of climate of this area.

During the colonial rule this region was called the 'Rajputana', which comprised 18 Provinces, 2 Thicanas and centrally ruled Ajmer and Merwara states. The word 'Rajputana' was for the first time used by George Thomas in 1800 A.D. The word 'Rajasthan' was for the first time documented by Colonel James Todd in 1829 in his famous work "Annals and Antiquities of Rajasthan". The present administrative form of Rajasthan state came into its existence on 1st November 1956 through the State Reorganization Act, 1956. At that time Rajasthan constituted by 26 districts. During 1980s district Bharatpur was divided into two parts and a new district Dholpur was created. Again in 1990s five new districts emerged on the map of Rajasthan as the result of reorganisation of district boundries. New districts such as Dausa from Jaipur and Sawai Madhopur, Rajsamand from Udaipur, Baran from Kota, Hanumangarh from Ganganagar and Karauli from Sawai Madhopur were created. Thus the total number of districts has gone up to 32 in the Census of 2001.

<u>A DEMOGRAPHIC PROFILE:</u>

As per the provisional figures of Census 2001, Rajasthan state has registered a population of 5,64,73,122 persons, inhabiting in 3,42,239 Sq. Km. area. It is the 8th most populous state of India. Though the percentage share of the area of Rajasthan in the comparison of total area of India is 10.41%, however it comprises only 5.5% of the India's population. The decadal population growth of the state is showing declining trend after 1971. The decadal population growth during 1991-2001 has registered 23.33%, which is still high and above the national average (21.34). The sex ratio, population density, level of urbanization, literacy rate and female literacy rates are 922 females per thousand males, 165 persons/sq.km, 23.38%, 61.03% and 44.34% respectively, in comparison to the national figures for respective heads which are 927 females per thousand males, 324persons/sq.km, 27.78%, 65.38% and 54.16%.

According to SRS data the fertility behaviour and mortality situation in the last three decades have changed considerably. In 1972 birth rate, death rate, natural growth rate, infant mortality rate and total fertility rates were 42.4, 16.8, 25.6, 123 and 6.3 respectively, which declined to 31.2 per thousand, 8.4 per thousand, 22.8 per thousand, 79 per thousand and 4.1 children per woman in 2001. Except death rate, all the figures are higher than the national average, (table 2.2). Trends of various demographic characteristics are given in figure 2.1.

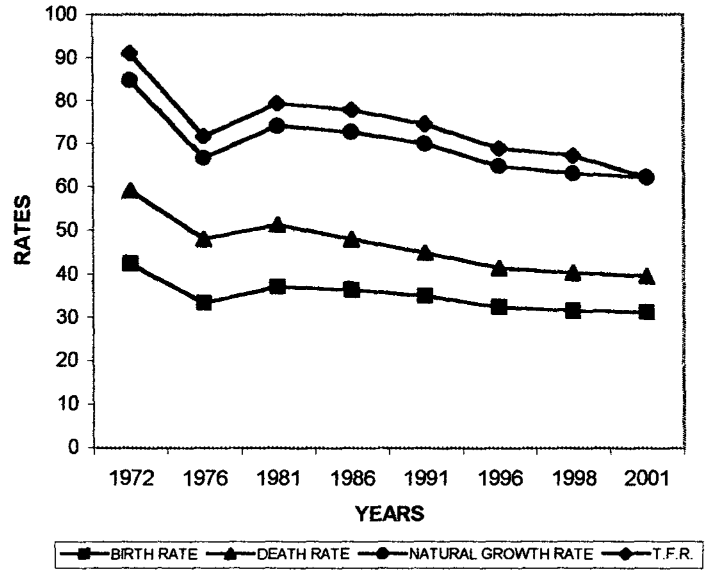
**Table 2.2:** Demographic Characteristics of Rajasthan, 1972-2001.

| YEAR | BIRTH RATE | DEATH RATE | NATURAL GROWTH RATE | I.M.R. | T.F.R. |
|---|---|---|---|---|---|
| 1972 | 42.4 | 16.8 | 25.6 | 123 | 6.3 |
| 1976 | 33.4 | 14.7 | 18.7 | 142 | 4.9 |
| 1981 | 37.1 | 14.3 | 22.8 | 108 | 5.2 |
| 1986 | 36.4 | 11.7 | 24.7 | 107 | 5 |
| 1991 | 35 | 10.1 | 24.9 | 79 | 4.6 |
| 1996 | 32.4 | 9.1 | 23.3 | 85 | 4.2 |
| 1998 | 31.6 | 8.8 | 22.8 | 83 | 4.1 |
| 2001 | 31.2 | 8.4 | 22.8 | 79 | - |

**Source:** Various Reports of Sample Registration System

Apart from this there is large scale variations among the districts of Rajasthan in case of all the above discussed parameters. For instance Jaisalmer has shown 47.45% decadal growth rate of population in 1990s, which is the highest among all the states. On the other hand, population of Rajsamand District has increased only 19.8% during the same time. Out of 32 districts 17 districts are showing increasing trend of population growth and rest are showing the reverse. Again Jaisalmer is having only 0.9% population of the state, in spite of being the largest on the other side Jaipur District is the most populous district (9.3%). On the front of education Kota District has achieved highest literacy rate (74.45%) on the opposite side Banswara District is at the bottom with the lowest literacy rate of 44.22%.

Fig. 2.1: ESTIMATES OF BIRTH RATES, DEATH RATES, NATURAL GROWTH RATES AND T.F.R., RAJASTHAN, 1972-2001




## *TAMIL NADU:*

Tamil Nadu is located in the extreme southern and southeastern part of the Indian peninsula. Its landscape, climate and cultural traditions are quite distinct from those from North India. The state falls between 8°5'N to 13°35'N latitudes and 76°15'E to 80°20'E longitudes. Tamil Nadu extends over an area of 1,30,058 Sq. Km. and comprises 3.96% of the total area of the country, and it is the 11th largest state in India.

Physically Tamil Nadu has been divided into two distinctive natural regions, which are the Western Hilly Tract and the Eastern Plains. The hilly tract comprises the Western Ghats and Eastern Ghats, which are on the periphery of the vast Deccan Plateau. The Western Ghats have lofty mountain ranges and have almost unbroken trend with some gaps like Palghat, Aryankavy and Aramboly passes. A the Eastern ghat enter the state from Andhra Pradesh and have detached hill groups and comprises smaller hills with the height of less than 1000m. The Western Ghats and Eastern Ghats meet at a knot in Nilgiri. Near this is located the highest peak of Tamil Nadu, Doddabetta (2631m.). Eastern coastal plain has three sections. The Palar and the Pennaiyar rivers drain the northern low land. The fertile alluvial plain of Cauvery delta is collectively known as Coromandal Plain. The Vaigai and the Tambarareni rivers drain the dry southern plain.

Tamil Nadu comprises varied relief features. The state is bound by mountain ranges on its western and northwestern parts. A 1000 Km. long seacoast is on its eastern and southern boundaries facing the Bay of Bengal and the Indian Ocean. It has varied relative relief ranging from the mean sea level to 2000mts. The state lies in the zone of tropical climate. The climate of Tamil Nadu is dominated by two monsoons. First, it receives rain from the South-East Monsoon and then it receives bulk of its rainfall during October to December from Retreating Monsoon. The average rainfall in Tamil Nadu is 100.8 cm. The annual, seasonal and daily range of temperature is low in this region due to the proximity to the ocean.

The present state of Tamil Nadu was formed out of the area formerly known as Madras Presidency in colonial rule. Various interstate and inter district territorial transfers took place in between 1901 to 1953. In 1953, a new state viz. Andhra Pradesh was formed by 12 districts of Madras State, with an area of 50331 Sq. Mile. In 1956 changes also took place due to the Reorganization of States on linguistic basis. Again in 1959 some territorial transfers took place. In 1960s, the name of the state of Madras with an area of 130058 Sq.Km. had been changed as Tamil Nadu. In 1981 there were 16 districts. The number of districts in 1991 increased by five more. These new districts were Tiruvannamalai-Sambuvarayar from North Arcot, Pasumpon-Muthuramalinga Thevar and Kamarajar districts from Ramanathapuram, Dindigul-Anna from Madurai and Chidambaranar from Tirunelvelli District. In 2001 the number of districts increased to 30. Nine new districts were created during 1990s. These are Thiruvallur, Namakkai, Karur, Perambalur, Viluppuram, Thiruvarur, Nagapattinam, Theni and Ariyalur.

A DEMOGRAPHIC PROFILE:

According to provisional totals of Census 2001, the population of Tamil Nadu state is 621110839 persons, which comprises 6.05 % of the total population of the country. It is the sixth most populous state of India. At the same time it was occupied only 3.96 % area of the India. Like Rajasthan, in Tamil Nadu too growth rate of population declined steadily after 1981 but the rate of decline was much faster than the former. During 1991-2001 it was 11.19 %, which is nearly half of the national average. The density of the population, sex ratio, level of urbanization, literacy and female literacy rates are 478 persons/Sq.Km., 986 females/1000 males, 43.86 %, 73.47 % and 64.55 % respectively, which are higher than the national average figures.

In an analysis of mortality and fertility rates for the last three decades, one can notice a considerable decline in these rates. In 1971 the birth rate, death rate, natural growth rate, IMR and TFR were 31.4 per thousand, 14.4per thousand, 17 %, 113 per thousand and 3.5children per women respectively which were slightly less than the national average figures. These rates declined remarkably to 19.2, 7.9, 11.3, 51 and 1.8 respectively that are very low in comparison to national averages. These show that the state has achieved noticeable success in terms of fertility decline and improvement in mortality control. The demographic characteristics of Tamil Nadu are given in table 2.3. The trends of these demographic variables are presented in figure 2.2.

**Fig. 2.2: ESTIMATES OF BIRTH RATES, DEATH RATES, NATURAL GROWTH RATES AND T.F.R., TAMIL NADU, 1972-2001.**

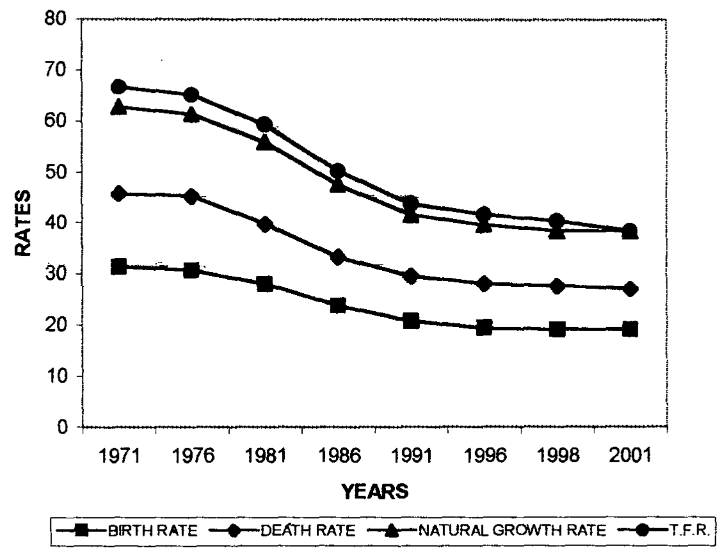



**Table 2.3:** Demographic characteristics of Tamil Nadu, 1972-2001.

| YEAR | BIRTH RATE | DEATH RATE | NATURAL GROWTH RATE | I.M.R. | T.F.R. |
|---|---|---|---|---|---|
| 1971 | 31.4 | 14.4 | 17 | 113 | 3.9 |
| 1976 | 30.7 | 14.6 | 16.1 | 110 | 3.8 |
| 1981 | 28 | 11.8 | 16.2 | 91 | 3.4 |
| 1986 | 23.8 | 9.5 | 14.3 | 80 | 2.7 |
| 1991 | 20.8 | 8.8 | 12 | 57 | 2.2 |
| 1996 | 19.5 | 8.6 | 11.5 | 53 | 2.1 |
| 1998 | 19.2 | 8.5 | 10.7 | 53 | 2 |
| 2001 | 19.2 | 7.9 | 11.3 | 51 | - |

**Source:** Various Reports of Sample Registration System

Here also like other states a large-scale district level variation has found in terms of the above-mentioned variables. In case of decadal growth rate, Coimbatore reported 20.4 % as against Kanyakumari, which reported only 4.34 %. In Tamil Nadu 15 districts are having above 1000 females per 1000 males, where Thoothukkudi District has the highest and Salem has the lowest sex ratio. In population density, Chennai District is the densest district among them with 24231 persons per Sq.Km. where as in Shivaganga District population density is only 275. In case of literacy rate Kanniyakumari has reported 81.4 %, where as Dharmapuri District accounts for the lowest literacy rate of 59.23 %.

**DATA BASE:**

In this exercise district level data have been collected from various sources for fertility level and socio-economic and demographic variables. Here fertility behaviour is taken as a dependent variable while socio-economic and demographic attributes are taken as independent variables.

***Dependent variable:*** The crude birth rate (CBR) considers the whole population responsible for the fertility, which can lead to erroneous conclusions. It is also not useful in comparing the population with varying age. Therefore to avoid the above stated limitations total fertility rate (TFR) is taken as a summary measure of fertility behaviour of a society. TFR is a hypothetical rate, which means "the total number of children a woman would have if she survived to age of 50 years and throughout her reproductive life span she is subjected to a fertility schedule described by the age specific fertility rates". The importance of TFR is that it is a single figure and is independent of age structure.

Unfortunately, the data gathered on the fertility aspect since 1981 census are found to be defective and estimates of the actual fertility levels made directly from the data have been grossly understated. So to undermine this influence, in this study, data for fertility measures have been taken from the estimates given by P.N.Mari Bhat which are based on the indirect methods of estimation of fertility through 'reverse surviving' the population in ages 0-6years.

***Independent variables:*** In this study social, economic and demographic variables are taken as independent variables.

**Social variables:**

1. Percentage of female literate population to the total population.

2. Percentage of female literates secondary and above to the total population of female literates.
3. Percentage of schedule caste population to the total population.
4. Percentage of schedule tribe population to the total population.
5. Percentage of urban population to the total population.
6. Number of hospital beds available to per lakh population.
7. Percentage of households with electricity.
8. Percentage of households with safe drinking water.
9. Percentage of households with toilet facilities.

**Economic variables:**

1. Percentage of female main workers engaged in non-primary sector.
2. Percentage of main workers engaged in non-primary sector.
3. Level of female work participation.
4. Land-man ratio: Total cultivated area to the total number of agricultural workers.
5. Road density: Road length in kilometer per hundred square kilometer.

**Demographic variables:**

1. Infant mortality rate (IMR).
2. Child mortality rate (CMR).
3. Sex ratio.
4. Singulate mean age at marriage (SMAM) of female.

This study has considered the above socio-economic and demographic variables. There are some other variables also which affect the decision regarding family size. The refined economic variables like per capita income and expenditure, the psychological factors like perception of people towards family size, motivation to control fertility and cultural practices etc. are some of these variables. The profound effect of these variables on fertility behaviour is envisaged in various studies. The inclusion of these variables could have improved the precession and predictability of the results. However, unfortunately the unavailability of data regarding such factors has imposed certain limitations, thereby restricting the analysis to a limited framework.

**METHODOLOGY:**

To examine the influence of various social, economic and demographic variables on fertility behaviour, zero order correlation between dependent and independent variables has been worked out. It explains the simple linear relationship between two variables trough the correlation coefficient and correlation matrices have been prepared. In such correlation matrices simple linear relationship between all the variables can be easily read out.

In social sciences any dependent variable is rarely explained by a single independent variable, which is also true in the present study of fertility behaviour. Thus to get a more realistic picture or for the better explanation of any dependent variable, it is necessary to explain it through all possible explanatory variables. For this purpose, stepwise multiple regression technique is very useful in social science research, which gives a convincing relationship among the variables. Due to these advantages the stepwise multiple regression analysis has been utilized in the piece of work. The multiple regression equation for the $i^{th}$ step (where i = 1.........p) has been assumed to be of the following form:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + \ldots\ldots + b_jX_j + \ldots\ldots + b_iX_i + U_i$$

Where,

$Y_i$ = $i^{th}$ dependent variable, ( i = 1...........p )

$X_j$ = $j^{th}$ independent variable, ( j = 1...........n )

$b_j$ = $j^{th}$ regression coefficient, ( j = 1...........n )

$U_i$ = random error

***STEPWISE REGRESSION ANALYSIS:***

In this study, the stepwise regression procedure has been followed to select the explanatory variables responsible in determining fertility behaviour. In case of multiple regression analysis it is useful to know as to how the parameters get changed when new variables are added or subtracted, one by one in the model. This procedure has many advantages. Firstly, it tells us the contribution of an added or deducted variable in explaining the dependent variable (by seeing the changes in the value of coefficient of determination ($R^2$)). Secondly, it helps to see whether the variable is worth including in the model or not (by seeing the changes in the value of adjusted $R^2$). It also helps us in keeping a watch over the changes in the values of the regression coefficient and their standard errors. Finally, it can be said that this procedure selects the minimum number of variables that could explain the maximum variability in the dependent variable. The steps of the stepwise regression procedure are as follow:

1. The stepwise regression procedure starts with the simple correlation matrix. For Regression Analysis, firstly those explanatory variables are considered, which are highly correlated with the dependent variable. It gives the maximum value of $R^2$.
2. Using partial correlation coefficient the variable whose partial correlation coefficient is found highest with dependent variable is entered into the regression as next variable keeping the first variable chosen as constant. This variable gives the second highest value of $R^2$, which is added to the first value.
3. Any variable having high correlation, with the previous variable(s) will also give high value of $R^2$ but it will not be included in the next step due to the fact that its part of explanation has already been explained by similar variable(s). Likewise the variables are added one by one and the entire analysis is carried out for each step. At every step the intercept, the regression coefficient of the chosen variable and their standard error are given along with the summary statistics like $R^2$, $\bar{R}^2$, t and F ratio.

**Assumptions:**

In a regression model it is assumed that:

1. It is a random real variable and has a normal distribution.
2. The mean value of it is zero

   $E(U_i) = 0 \quad ( i = 1 \ldots\ldots\ldots\ldots p )$
3. The variance of $U_i$ is constant

   $E(U_i) = I2$

   This is known as the assumption of homoscedasticity.
4. The disturbance terms of different observations ($U_i$, $U_j$) are independent.

The parameters $b_0$, $b_1$, $b_2$,..............., bn are determined by the method of least square. In principle of least square, the residual sum of squares (RSS) $\Sigma e_i^2$ is minimized with respect to parameters. The decomposition of total variations in Y leads to a measure of the goodness of fit, which is known as coefficient of determination and is denoted as $R^2$.

$R^2$ = Explained variation / Total variation ...........( I )

The value of $R^2$ in two problems of multiple regressions and unequal number of variables cannot be compared because of obvious reasons. To make it comparable, the $R^2$ is adjusted for degree of freedom and is denoted by $\bar{R}^2$ as given below:

$\bar{R}^2 = 1-\ n-1 / n-k \ ( 1 - R^2)$ ..............( II )

It may be noted that as additional variables are added into a regression model it will always increase the value of $R^2$, however, the jump in $R^2$ may or may not be large. The additions of new variables will increases the value of k, which in the expression will reduce the value in equation (II). Thus every time a new variable is added there is some gain in the value of $R^2$ as well as there is some lose also. When the jump in $R^2$ is significantly larger it would not be compensated by the decrease caused by increasing value of k. In such cases with the addition of a new variable not only $R^2$ will increase but $\bar{R}^2$ will also increase. However in those cases, where jump in $R^2$ is not large enough, the increase in k value will cause a decrease in $\bar{R}^2$. In stepwise regression analysis it is suggested to terminate the analysis at the stage after which $R^2$ starts decreasing. This last step is taken as an optimal combination of independent variables to explain dependent variable.

***PRINCIPAL COMPONENT ANALYSIS:***

The principal component analysis (PCA), a branch of factor analysis, is a technique designed primarily to synthesize a large number of variables into a smaller number of general components, which retain their maximum descriptive ability. It permits a more economical description of the given set of structural variables and suggests some underlying dimensions (components), accounting for the statistical relationship among them (Mahmood, Aslam). Morrison (1967) has described it as a method to discover those hidden factors, which might have generated the dependence or covariance among the variables.

PCA, which is a method of factor analysis, was first fully developed in the mathematical formulation by Hotelling in 1933. PCA essentially requires an orthogonal transformation of a set of inter-related variables into a new set of independent variables. Here in this work, composite indexes for the social, economic and demographic variables have been generated separately with the help of PCA. Analysis has been worked out on the technique of modified principle component.

In factor analysis, the beginning is made with the correlation matrix of variables, based on a set of observations. This correlation matrix helps in identifying a smaller number of factors or clusters of closely associated variables. The clusters are based on the principle that most closely associated variables are combined with in a single factor and the variables assigned to a given factor should be most nearly independent of those assigned to other factors. Thus the technique of multiple factor analysis facilitates the proper identification of clusters of variables having some statistical properties of cohesiveness and homogeneity within the independence between them.

*PATH ANALYSIS:*

Path Analysis is a popular technique in social science research, which is useful to examine a series of causal relationships, and also gives the magnitude of the causal links. Through this method the importance of the various causal links can be assessed. It is an explanatory model only but not a predictive one. In this technique, firstly a path diagram is conceptualized on the basis of theoretical base. In this path diagram causal relationship among all the considered variables have to be formulated along with the direction of causation. So it should be drawn on the lines of social science theories rather than inductively based on the obtained data bank for the present study.

Afterwards, on the basis of the above path diagram, regression analysis is adopted to see the influence of the explanatory variables on the dependent variable. The regression equations, which are obtained from the regression analysis, are termed as 'structural equations'. In path diagram, variables are arranged from left to right in such a manner, wherein the variables in the extreme left influence all the other variables situated to their right-either directly or indirectly. Variables in between the other variables in the left and the dependent variable in the extreme right are influenced by the former and also affect the dependent variable. The dependent variable in this diagram is placed on its extreme right.

**Causal network:**

There are two different ways of calculating path coefficients. One is by using zero-order correlation coefficients and another is by using standardized regression coefficients, which are obtained by multivariate analysis. The general form of the path coefficient, which can be obtained by using, standardized regression coefficients may be written in the following manner,

$$r_{ij} = \Sigma P_{kj} . P_{ik} \qquad \text{( III )}$$

that is,

$r_{y1} = P_{y1} + P_{41} . P_{y4} + P_{51} . P_{y5}$ .......... + residual (jointly with other)

$r_{y2} = P_{y2} + P_{42} . P_{y4} + P_{52} . P_{y5}$ .......... + residual (jointly with other)

.................................... ( IV )

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.

$r_{yj} = P_{yj} + P_{4j} . P_{y4} + P_{5j} . P_{y5} +$ .......... + residual (jointly with other) where,

$r_{ij}$ = is the zero order correlation coefficient between dependent (Y) and independent variable (X).

$P_{ij}$ = is the standardized regression coefficient between dependent (Y) and independent variable (X). It is called the path coefficient.

i = subscript i indicates the dependent variable and

j = indicates the explanatory variables whose direct effect on the dependent variable is measured by the path coefficient $P_{ij}$.

By solving the simultaneous equations ( IV ) the values of the path coefficients are obtained and the direct and indirect effects of independent variables on dependent variable are measured.

**Assumptions:**

1. The dependent variable Y is the last variable in the causal chain. In other words, the variables causally posterior to the response are not controlled.
2. The causal ordering between the variables to be specified on the basis of theoretical backing and will not be established by the path model. It means the validation of these causal ordering should be verified by different methods than path analysis.
3. Path model assumes the relationships are linear. In practice, it may not exactly hold true and hence the regression of Y on X may always be interpreted as the best linear approximation (Kendall and O'Muircheartaigh, 1977).

The direct effect of the explanatory variables with dependent variable is obtained by the path coefficients ($P_{ij}$) and the indirect effect is obtained by multiplying path coefficients to the respective links and then addition of all of them. The total effect is calculated as follows,

Total effect = Direct effect + Indirect effect.

$$r_{yj} = P_{yj} + \text{Indirect effect}$$

In this study multivariate analysis technique is used and for this stepwise regression and path analysis methods are followed. The explanatory variables are selected through stepwise regression method and these variables have been used to established causal relationship through the path model. The direct and indirect impact of these variables on fertility behaviour is examined in the subsequent discussion.

# CHAPTER III

## ISSUE OF POPULATION GROWTH AND FERTILITY BEHAVIOUR

### CONCEPTIAL FRAMEWORK:

In the historical past various attempts have been made to provide insight and solutions to the problems of population growth and efforts in this fields are still going on. Here this exercise is dealt with the dynamism of fertility behaviour and its relationship with socio-economic and demographic variables. So firstly it is very essential to have a deep understanding that how the issue of population growth and fertility behaviour have been conceptualized over a period of time. Many economists, population scientists and others have contributed in this field to find out that, what are the different attributes which have association with fertility behaviour and how these attributes are responsible in determining or controlling the fertility behaviour of a society. Some of them are discussed in the following discussion.

The classical economists (excluding Malthus) writing on the stationary state gave a hazy picture of the effects of the population growth. According to them the stationary state is reached when the economy has fully adopted new technological possibilities or choices. In this stage economy has attained its maximum per capita income. In the absence of new technological choices, more demand for food with fixed land resources ultimately lead to lowering the per capita income. Thus the population growth is having inverse effect.

Adam Smith having more optimistic view regarded the growing population as the main spring of development under the assumption of ever increasing returns to labour. Adam Smith contended that an ever-expanding population would widen the scope of the market thereby enhancing division of labour and specialization of economic activities and thus generating greater output (Ojo, 1980).

Robert Malthus gave his pessimistic view in his essay on the principle of population (1789) based on the law of diminishing returns to land. He postulated that while population grows at a Geometric progression, food production grew at the Arithmetic progression. According to him therefore there is a competition between population growth and food production where the population surpasses food production. So if population growth is not controlled it would lower the per capita income to a subsistence level. He asserted that if voluntary checks are not followed natural calamities such as pestilence, war, and misery would act as a restraint to population growth.

In the same stream of thought Ricardo argued that the population growth would result in a steady decline of per capita income, which would consequently lead to a stationary state.

Karl Marx disagreed with Malthus and Ricardo and argued that the population problem was an off spring of the capitalist mode of development. He therefore, said with the proper management of population growth, it could serve as an asset for the well being of a nation. In $19^{th}$ century French sociologist, Dumont had argued that people like to move up along the social ladder and this is usually possible in small families. He induced that people should restrict their family size. In the beginning of $20^{th}$ century another sociologist and demographer, Kinsley Davis had argued that every change brings multiple responses, such as change in mortality in terms of decline in mortality rate brings consequent responses on population growth, age at marriage, contraception prevalence rate, migration etc.

These classicists were criticized for lacking in their fore sight in terms of technological development and the discovery of new lands. In Europe, application of Malthus theory failed as per capita income rose with rapid population growth. While the above theories relate population to economic indicators but none of these tried to explain the process of population growth and its impact on development.

The demographic transition model was an attempt to explain the historical process of the population growth of developed countries. This theory postulated that during the process of modernization first decline in mortality is experienced and followed by a fall in fertility. During the intervening period, population explosion takes place largely due to the natural growth. This theory divides developmental processes into four phases – the pre modern, early transition, late transition and modern phase.

In the pre-modern phase both birth and death rates are relatively high and population is in high stationary stage. In the early transition, death rates fall sharply due to the application of modern medicine, improved sanitation and poverty reduction, while birth rates remain unchanged. It is followed by late transition, in which, fertility finally succumbs to the allurements that accompany modernization. Increasing female literacy and participation in economic activities, reduction in infant mortality, traditional belief loosened, betterment of health infrastructure, increase in social security also worked considerably in fertility reduction. With the sharp reduction in fertility rates, mortality was also continuously declining and population growth retards. In the last phase both fertility and mortality have fallen to very low levels and population attains a low stationary state. The theory was also criticized on various grounds like, it does not have predicting values, seems like a grand historical generalization and even the experiences of various developed European countries were not consistent

Demographers and sociologist have been working in this field from quite long, and the efforts of economists in this field in 1960's and 70's have appeared as innocent beginning among the developed communities. But the former were neither systematic and coherent, nor general in their pieces of knowledge.

Micro economic theories of fertility, developed by economists, focus on ultimate decision maker, advances explanations of the effect of socio-economic development on changing fertility in any micro region. These theories have their limitations as well as sound aspects and each of them provide significant insight into the relationship of fertility and its determinants. The cost benefit analysis is the basis for all the economic theories of fertility, where the importance of perceived benefits (utilities) and costs (disutilities) consideration in reproductive decision-making is identified.

The basic assumption in economic theories of fertility is that the reproductive decisions in developing countries are rational. A woman, in the absence of breast feeding, has potential of producing 15 children in their reproductive span, since a woman no where produce so many children. The choice making is obviously involved (Alexander, 1988). According to A.J. Coale (1973) on of the precondition of fertility transition is that the reproductive decisions must be with in the calculus of conscious choice. The change in mentality that leads to family limitation includes a clear notion of what family size ought to be.

In 1957, Leibenstein in his economic theory of fertility has hypothesized that fertility decline take place in the course of growth in per capita income. He assumed that families would balance utilities against disutilities, related to $n^{th}$ child in order to determine whether a family wanted an $n^{th}$ child. So here he gave an importance to rational decision for marginal child. He mentioned three types of utilities, such as, consumption, production and security utility and two types of disutilities, such as, direct costs for feeding a child and indirect costs as loosing opportunities for better earning. He believed that utilities always decrease (except consumption utility) with higher birth order but disutilities do not give a clear picture. Gary Becker, who belongs from Chicago school, also favoured this type of explanations in his paper, published in 1960's. He favoured strong interlinkages between economic development and fertility reduction. To explain fertility he used Hicksion's version of micro consumption theory and developed a demand theory as a pioneering work in this field. He argued that children should be viewed the same as the household views the purchase of durable goods. He studied the American society to explore that why richer families prefer small family size. He found that the children are not inferior goods and as income rises, parents aspire to improve the quality of investment on each existing children. This was a good attempt, which created an intellectual climate in which a good deal of theoretical and empirical research could be done.

Further Namboodari modified the Backer's concept and said that decision regarding to the family size is taken on the basis of past experience initially after having the first children. He further added that tastes also changes during this gap between the present and next order children.

In the similar line of argument other contributors also had given an importance to cost of time and changing opportunity cost of mother due to educational attainment along with income, to strength price effect argument. Becker also gave such explanations in his later work in 1991 and argued that, as the opportunity cost of mother's time increases, say by increase in the labour force participation by married women, raises the cost of additional child care. Further researchers thought that the quality and opportunity cost price effects need not be substitutes, they may be additive. In the coming period they thought in the track of the relative time costs on commodity consumption, compared to 'child services' consumption because with higher income scale goods take more time to consume, which competes with time for 'child services'.

On the other side T. Paul Schultz's (1969) work, on infant mortality, suggested that household desire a target number of surviving children. As income increases the possibility of survival also increases and because of this few births are desired to get the target number of children and also number of son.

Some sociologists, economists and demographers have emphasized the effect of socio-economic status on the taste for children, or the preferences for the material goods or relation between these two. Few of them thought about the threshold values of income, education and economic and social development and believed that prior to the threshold value there is a positive relation between income and above two variables. With these developments in 1970's the great debate on population policy started, which emphasized on the polarization of the views into two opposite directions. On one side of the argument economists and sociologists were with the view that 'development is the best contraceptive' where the family planning programs have little bearing in bringing about changes in fertility behaviour. And they assumed that as society develops, fertility reduction take place because of the changes in demand for children. On the other side proponents of family planning programmes had pointed out to the large unmet need for contraception and the high level of unwanted fertility that could be reduced by strengthening the family planning programmes.

The trends of fertility decline have been extensively documented and analyzed by increasingly sophisticated methods in the last quarter of 20$^{th}$ century, but the great debate continues. Only slight progress has been made towards a consensus that both views are at least partially valid. Many researches have perceived declining fertility as a complex process that involves both, the changing demand for children as well as changing attitudes towards family planning programmes. Among the numerous efforts, which were taken with combination of both the views, Easterline's work was most popular.

Easterline have come out with a series of papers in 1960's and 1970's, to address the basic framework of demand and potential supply of children, and developed the supply-demand theory. He stated that, initially when the level of development is low, demand for children exceeds potential supply because of high child mortality rates (CMR) and the situation of deficit supply takes place. But with the time when the increasing level of development reduces CMR, potential supply increases and after a critical point it overtakes the demand for children and the age of excess supply starts. Further with increasing level of development, means of fertility regulation become socially acceptable and then after a period of time the stage of equilibrium would establish. Easterlin also mentioned that the effect of income also affects tastes, preferences and norms for the disposal of income. He further stated that increased income raises the relative desire for material goods and consequently lower fertility substantially. It is the most widely used theory, because it is conceptually simple and at the same time powerful in explaining fertility behaviour. It synthesizes both economic and sociological approaches to the analysis of fertility. While the economists have stressed on the demand side arguments, sociologists have explored the supply side factors of the fertility differences among different societies. Among the supply side factors, those well recognized are the IMR, the female age at marriage, duration of lactation, birth interval, mother and child health care etc. these variables are identified as important intermediate variables following the proximate determinant analysis, (Bongaarts, 1978).

Caldwell (1970), in his work "Treaties of the Family" explained the fertility behaviour in terms of intergenerational wealth flow at the societal level. He explained that, in the societies where children spend more on their parents after growing up in comparison to what their parents spent on them, generally have high fertility. On the other hand if the flow of wealth is opposite or in the direction from the parents to children as find in modern societies, then in these societies fertility rate has to be lower than the previous societies.

On the basis of the empirical study of English middle class, Bank has found that to maintain 'target standard of living' people cut back their fertility. Duesenberry and Okum argued that varied socio-economic groups establish different social conventions and then conform to a very high degree of the extent to which expenditure can be varied and determine the desired number of children, (from Leibenstein, Harvey, 1974)

Later on in 1970's Leibenstein has found that quality of children, in countries, where state take responsibility of children's education and other facilities, this cost is unlikely to be a significant deterrent in terms direct cost of children for fertility control. At the same time, value of mother's time is highly cultural bound rather than household income, so mothers time is also not significant here. Women's education also has an impact on taste rather than on value of time.

To come out from the above limitations, he gave a more adequate theory on fertility and argued that, income differential with increasing socio-economic status are much more significant than the increase in the costs of children because costs of child rearing need not increase proportionately with increase in income. As Kuznets has concluded that normal interpretation of fertility behaviour and costs influence does not appear sufficient, a social standard influence group theory of cost pressures enables us to workout an explicit explanation. At the same time, social and economic influences must not be considered in isolation because the economic changes always influences the social status of families, and later on tastes change regarding children and goods that compete from one another. So in high status household it may become necessary to spend more on target commodities to maintain their status membership and in this class family member demands more in terms of commitments. This results into tastes differences of people in different classes, which gets influenced by the occupation and education of the group members. Therefore it is possible that households in higher income group would have few children than the low-income group households.

Blake (1968), Lesthage (1983) and Preston (1987) stressed on the role of norms in determining the fertility behaviour. How do norms effect individual's decision to have children? In the societies such as the Catholic Church norms of fertility are motivated by the fear of sanctions. Norms which usually stands in opposition to desires, wishes, preferences and drives, allow groups to solve dilemmas of cooperation that flow the egoistic motivations of their members, (Friedman and Weingast, 1993). Some authors have suggested that cultural and ideological climate can produce similar effect, presumably in essence of sanctions. But there are some problems like these norms are not well defined, potentially relevant alternative causes often are not controlled, mechanism of fertility changes due to ideological changes is not defined.

Because of above lacunas, in the last quarter of 20$^{th}$ century, rational choice modals have become increasingly prominent in fertility research. These are based on constraints and values where former refer to conditions external to individual and later refer to inner state that enable people to evaluate the consequences of desirable behaviours. But the problem is the unobservability of values, which are subjective constructs. So the rational choice theories usually specify values by assumptions rather than by imputation (H. Simon, 1986; Stigler and Becker, 1977).

Cleland (1987) has given an iconoclastic view of the fertility behabiour after attacking on the traditional believes of fertility theories. He criticized demand theories and argued that, even in societies where children are not costly people are adopting fertility regulation methods as found in Europe. He said that, people adopt fertility regulation behaviour to see the others or through the diffusion of innovative ideas. Further he found that upper classes welcome the innovative behaviour first and bring ideational changes and then it spreads in the other social groups. The speed of the diffusion of innovation depends on the efficiency of communication network.

In another explanation theorists said that, their should be a threshold level of development to experience decline in fertility behaviour. Kirk and Srikantan have worked on joint threshold, a combination of various indicators of development to decide the lower limit of the level of development and to experience the decline in fertility. Caldwell argued that the threshold level vary region to region, country to country for instance threshold level in Asian countries is lower in comparison to African countries.

Bongaarts, Warkins and some other researchers have argued that with the changes in time threshold also changes. As the time passes the communication net become strengthened and taste changes and due to this fertility rates decline at the lower level of development in comparison to past.

Walle (1992) has stated that a fertility decline is not very far away, when people start conceptualizing their family size and it cannot take place without such conceptualization. Further population has now become numerate about children; the event is interesting only in retrospect and has little bearing on the future.

Friedman, Hechter and Kanazowa (1994), have proposed a theory of the value of children, to built on existing rational choice modals of fertility by specifying a new assumption of common immanent values to supplement the more familiar instrumental values. They used the assumption of uncertainty reduction to explain why some people in advanced societies have no children while others have at least one child. They argued that in traditional circumstances children were doubly important for uncertainty reduction both in terms of their ability to provide wealth and insurance for their ageing parents and for their contribution to social integration. The first set of contributions diminished in value over time but not the second. The temporal shift in the value of children suggests, as does, the economic theories of fertility decline, that the number of children demanded should reduce but not to zero.

However, the critical question how much of fertility change in a particular society can be attributed to each of these broad explanatory factors, such as socio-economic development and diffusion of family planning programmes, remains unanswered. Along with the process through which social and economic variables affect fertility and it's proximate determinants have received relatively little attention. Bongaarts in 1993 have attempted to address this problem by proposing a variant of Easterlin's model. The variant allows the convenient quantification of the three key mediating variables: the supply of and demand for births, and the degree of implementation of reproductive preferences. He also proposed a new technique to trace the fertility trend in terms of the separate effects attributable to the individual mediating variables. In the application of this model, he found that increase in preference implementation are on an average slightly more important determinants of fertility decline than changes in wanted fertility.

In the study of effects of development and family planning programmes on the mediating variables, he found that socio-economic development has the expected negative effect on wanted fertility as well as a positive on implementation of preferences. Family planning programmes exert their strongest effect by increasing the level of implementation, and also have influence on wanted fertility.

Caroline Foster (2000) has propounded "A Biosocial Approach" to limits the low fertility. She acknowledged that our biological predisposition towards nurturing behaviour plays an important role in the motivation for child bearing dose not mean that all women are genetically determinant to become mother i.e. biology is not destiny. In the second half of $20^{th}$ century the link between biology and destiny also broke with use of efficient contraceptives and induced abortion. What remains is the knowledge that to a greater extent, we all have a need to nurture and in turn be nurtured that is the manifest characteristic of only evolved human psychology. It is evident that despite of the high costs and greater difficulties of bearing and bringing up children and in the absence of social force most women will choose to have at least one child. There is no inevitable link between genetic disposition and behaviour therefore it is possible that predisposition towards nurturing could be supposed, resulting in further fall in fertility rates that is why women will continue to fulfill this fundamental human need by having children.

In the above mentioned discussion, it is very much clear that socio-economic development has played a prominent role in changing fertility behaviour. In the work of Bongaarts it is explicit that socio-economic development has multidimentional effect on the process of determination of fertility behaviour.

**DETERMINISTIC MODELS:**

In the area of the study of fertility behaviour scholars from the various fields of the knowledge came forward with different type of models, which are deterministic in nature. In these models an attempt has been made to streamline the interrelationship between fertility behaviour and its determinants. Such type of modeling includes, in what way various socio-economic and demographic variables are associated with fertility behaviour and among themselves. These models also deal with the direction in which these variables are operating to have an impact on fertility behaviour. In the following discussion it has been discussed that how these relationships have changed in terms of direction and nature of variables over a period of time.

Though the birth of a child is basically a biological phenomenon, but child bearing takes place in a particular social set-up, it is affected by social, cultural and economic factors. So the conception of baby is affected by the social set up of that particular society, such as its customs, structure, norms and value system related to the various aspects of the childbirth. So it can be said that, the social environment, in which people live, which comprises various political and economic settings, regulates fertility behaviour of its inhabitants. Along with the societal effects on child bearing, decisions of individual couples about whether to have a child or not also have significant influence. Therefore to have a deep insight into the issue of differential fertility one has to have a clear idea about the relationship between the independent variables for instance social, economic and demographic variables and fertility behaviour.

Kingsley Davis and Judith Blake (1956) have explained the way in which all non-psychological factors affect fertility in any society, in their work "Social Structure and Fertility". They gave eleven intermediate variables, for three stages of child bearing, through which non-psychological factors affect fertility behaviour. All the eleven intermediate variables have either a positive or negative effect on fertility. These are as follows:

INTERMEDIATE VARIABLES

I. Intercourse Variables:

(A) Those governing the formation and dissolution of unions in the reproductive period.

(1) Age of entry into sexual unions.

(2) Permanent celibacy.

(3) Part of the reproductive period spent after or between unions

a) When unions are broken by divorce, separation or desertion;

b) When unions are broken by death of husband

(B) Factors governing exposure to intercourse within unions.

(4) Voluntary abstinence.

(5) Involuntary abstinence.

(6) Coital frequency.

II <u>Conception Variables:</u>

(7) Fecundity or infecundity, as affected by involuntary causes.

(8) Use or non-use of contraception

a). By mechanical or chemical means;

b). By other means.

(9) Fecundity or infecundity as affected by voluntary causes (sterilisation, sub-incision, medical treatment, etc.)

III <u>Gestation Variables:</u>

(10) Foetal mortality from involuntary causes.

(11) Foetal mortality from voluntary causes.

All of these variables are present in every society and any change in fertility may be affected through change in one or more of these intermediate variables.

Freedman (1962) has made modifications in the above model by including a set of variables like education, occupation, income, family structure etc.

Yankey (1969) presented a model, which explains the taxonomy of fertility determinants. He gave three individual classes of his model.

Class 'A' includes the norms regarding family size and intermediate variables, Class 'B' incorporate intermediate variables and Class 'C' includes the dependent variables.

He has argued that most of the population scientists, especially, fertility researches focused on the relationship between the Class 'A' and Class 'C' variables. He said that there is a need to look into the interrelationship between Class 'A' and Class 'B' variables and between Class 'B' and Class 'C' variables.

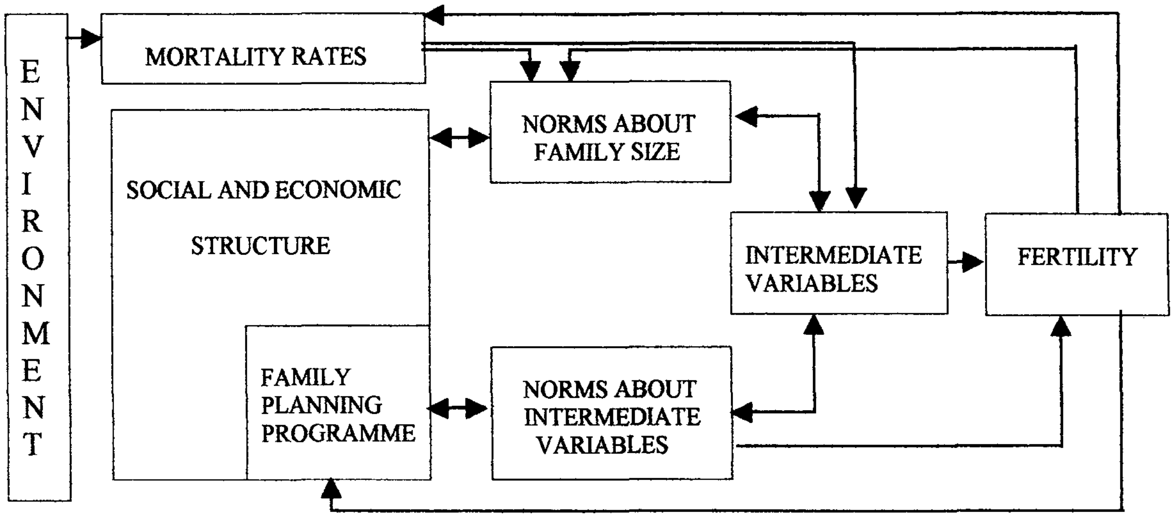


FIG. NO. 3.1
YANKEY'S MODEL (1969)

In the similar path an important contribution came from Bongaarts in 1978, who tried to make quantitative assessment of the effects of intermediate variables on fertility. He effectively simplified the relationship fertility and its determinants, which can be presented in following diagrammatic form.

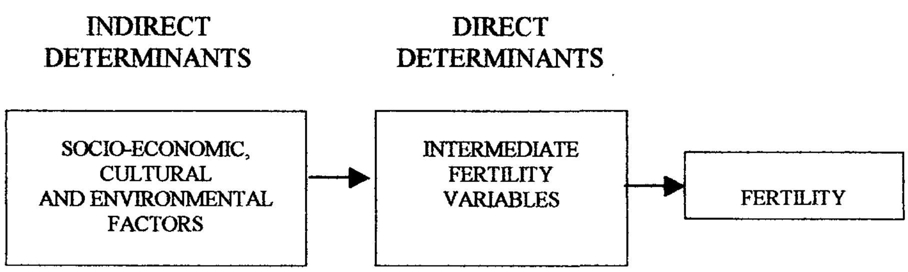


FIG. NO. 3.2
BONGAARTS'S MODEL (1978)

Bongaarts in his empirical research found that a major portion in the change in fertility levels could be explained by only four intermediate variables out of eleven intermediate variables. These variables are called proximate determinants of fertility. The details are as follows:

(1) Nuptility variable (age at marriage and proportion of non-marriages).

(2) Period of lactation following childbirth.

(3) Incidence foetal wastage.

(4) Prevalence of contraceptive practice.

Richard P. Bagozzi and M. Frances Von Loo (1978) developed a general fertility theory and hypothesized that demand for children is primarily determined by social psychological process with in the family, subject to certain socio-economic constraints. They proposed two social psychological processes as determinants of fertility. First, the attitude or tastes of family members influence the demand for children. Second, the nature of the husband-wife interaction (in terms of sharing of power, conflict, decision making process and marital satisfaction) decides family size. They mentioned that the socio-economic factors influence fertility through their impact on social psychological processes within family, which then direct influence the fertility behaviour.

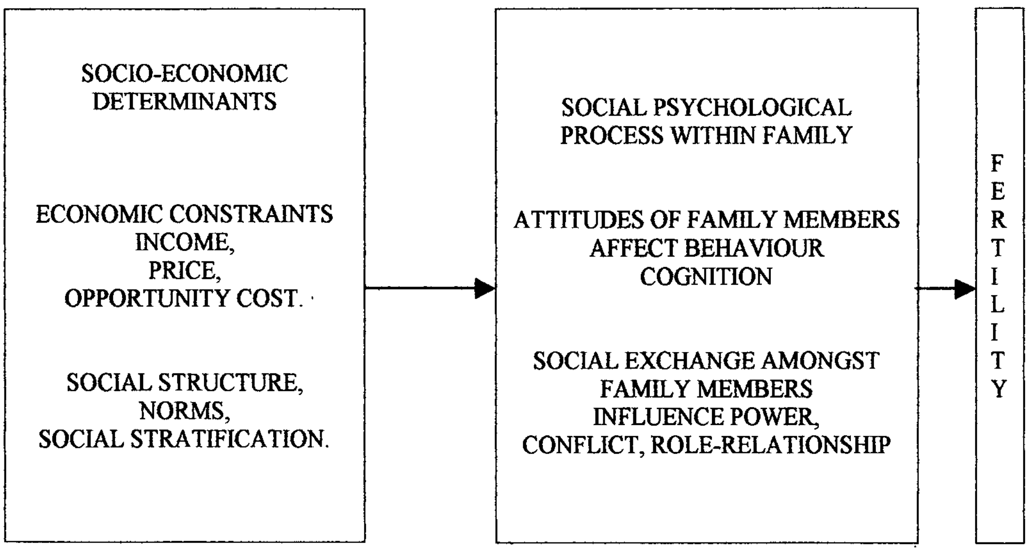


FIG. NO. 3.3
RECHARD, BAGOZZI AND LOO (1978)

T. R. Balakrishnan, G. E. Embanks and G. F. Grindstaff (1980) have studied the influence of socio-economic and demographic variables on fertility. They also tried to prepare a model to explain the relationship between fertility and its socio-economic and demographic determinants. They took religion, ethnicity, mother tongue and residence as inherent characteristics, education, income and work status as achieved characteristics. The current age of women and age at first birth are incorporated as demographic factors in their model to explain fertility behaviour.

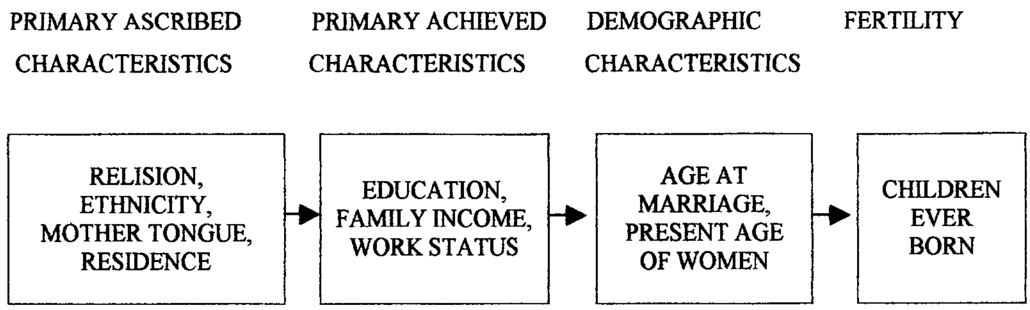


FIG. NO. 3.4
BALAKRISHNAN, AMBANKS AND GRINDSTAFF (1980)

Kennith C. W. and Helon L. Ginin (1988) have proposed a model for the analysis of fertility behaviour in which the process of family formation in modern world has explained. According to them fertility behaviour is not always a result of decisions at conscious level and it certainly act at a given time frame. These decisions are not always rational ones, but some of these are made rationally where people weight alternatives and make decisions to fulfill their needs or objectives at the best. They said that a decision to have a child or not, is not a decision of a single occasion. The ultimate decision regarding family size is the result of a series of minor decisions.

Before the analysis of their framework one should know the inherent meaning of terms like "cultural press" and "situationally specific factor". Cultural press comprises all the institutional and cultural support for child bearing. It is a set of values in favour of having children. Where the later includes the factors, which mold couple to have more children and the factors, which stop them for having more children. The term "Situationally Specific Factors" refers to the conscious and explicit reasons for having a child or not, in favour of couples decision, at any particular time.

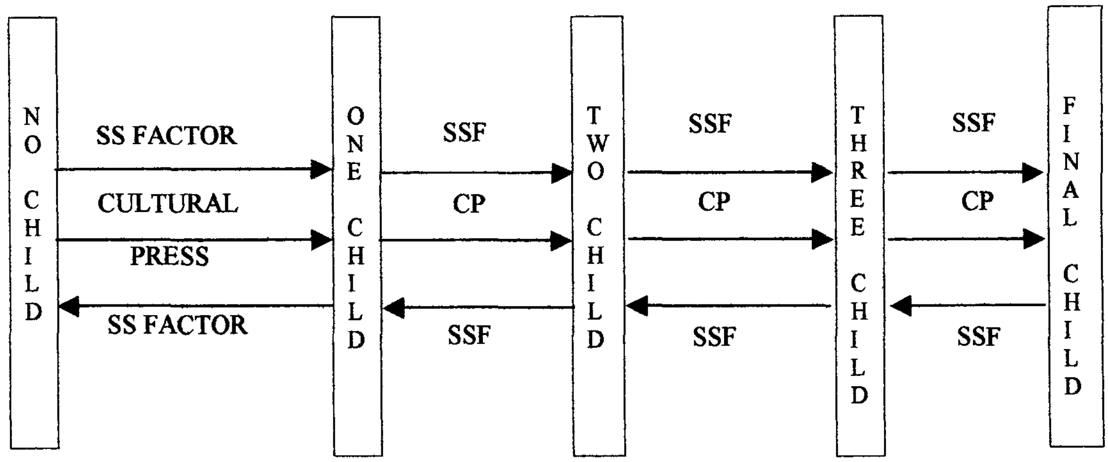


FIG. NO 3.5
KENNITH, KAMMEGER AND GININ (1988)

Premi (2002) has found that the capacity to reproduce is governed by several parameters. These parameters are gene selection, age at menarche and age at marriage, length of lactation period, natural sterility, contraceptive use etc. The socio-economic status of any community has control over these parameters, which determine the fertility behaviour of that particular society.

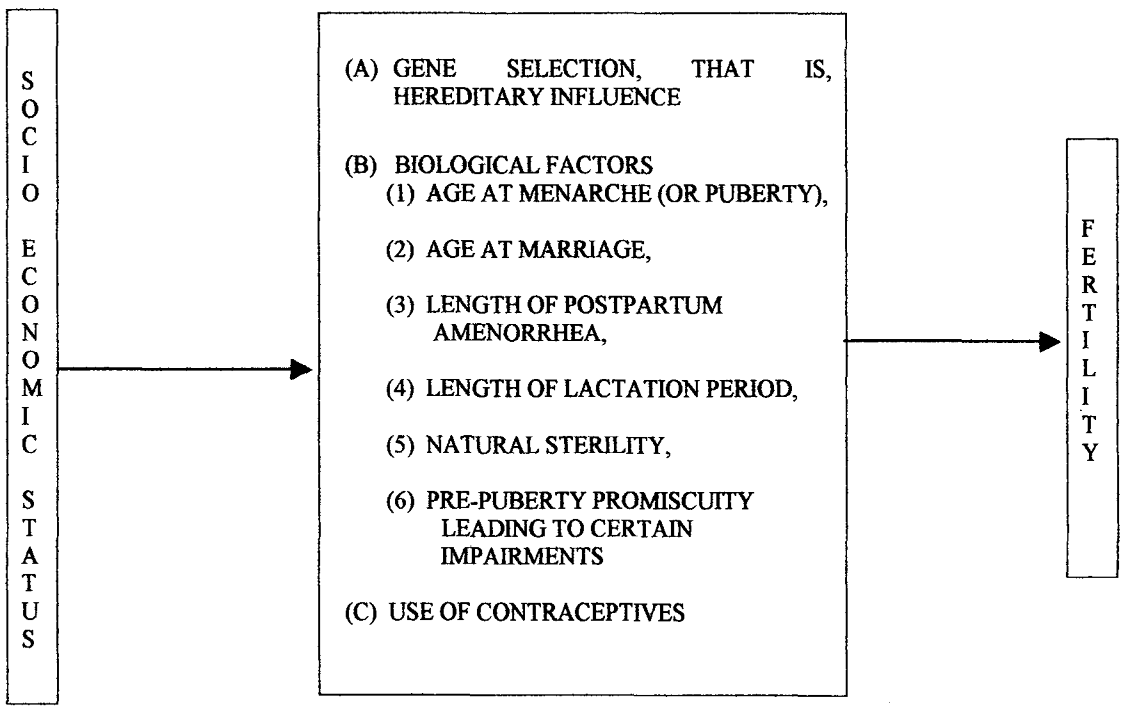


FIG. NO. 3.6
PREMI (2002)

**REVIEW OF THE IMPIRICAL STUDIES:**

Though the consideration of the issue of fertility behaviour started long back, it was very much accelerated during the second half of $20^{th}$ century. From this period onwards a plethora of literature regarding very aspect of fertility behaviour have been published globally. On the basis of empirical evidences, researchers have identified number of fertility determinants.

Various studies and surveys regarding fertility differentials had been carried out before 1960s in the different parts of the country. The various studies undertaken by the Gokhale Institute of Politics and Economics, Pune in the different parts of Maharashtra, indicated that none of the socio economic factor had any significant effect on fertility. Similar was found in case of demographic survey in Sholapur city in 1955. Driver's study on differential fertility in Nagpur district in late1950s also concluded similar results. In a large-scale survey in erstwhile Mysore state in 1951-52, observed very small impact on fertility differences by religion, education and economic status. In 1956, a fertility survey conducted in rural Banaras tehsil found an impact of caste on fertility differentials but such differentials were largely explained in terms of differences in mortality and in the portions of terminated marriages.

Robinson (1961) examined the trends in rural-urban differences in fertility in India for the period 1921-1951, based on Census data and found that the difference in infant mortality between cities and rural areas was major reason for this scenario.

Thus the studies and surveys carried out before 1960s in the various parts of India found consistently an absence of significant socio-economic influence on the differences in fertility behaviour. All the groups of women contributed fairly high levels of fertility with absence of genuine fertility differentials. Where, the differences did exist, they were largely attributed to demographic variable like age at marriage, duration of marriage.

After 1960s, in the era of industrial growth and economic development with the movement from the stage of uncontrolled fertility to the stage of controlled fertility, differences in fertility were emerging and these were accelerated by the modernization in the contraceptive method. Goyal (1974), in the Delhi fertility survey during 1969 with a sample of 7857 households found a significant difference in fertility levels in respect to almost all the important socio economic variables.

Zacharia (1984), and Bhat and Rajan (1990) have studied the anomaly of fertility decline in Kerala where despite the low economic development, and agricultural growth statistics, fertility decline was experienced in last two-three decades. They found that high female literacy, agrarian reforms, increasing health and educational infrastructure, family welfare programmes, influence of mass media and political will are responsible for rapid decline in fertility behaviour in Kerala.

In Tamil Nadu, Jayalalitha's 15 point programme that is largely based on the welfare of children, women's empowerment through education and health care with special reference to reproductive health care etc. is considered the main source of fertility decline in the recent past. This is an integrated and quality oriented and women and children centered programme, aimed at population stabilization without relying heavily on contraceptive targets alone. It has to be seen as a model population policy for Indian nation (S. Ramasunduram, 1994).

Gertler and Mdyneaux (1994) have studied the combined effect of economic development and family planning programmes to reduce Indonesian fertility. Their empirical study for 1982-87 has suggested that 75% of the fertility decline resulted from increased contraceptive use, but was induced primarily through economic development and improved education and social opportunities for females along with the highly responsive contraceptive supply delivery system.

If we look at the political aspect of population problem then we find in the democratic polity of India, number is the only way to preserve the religious and caste or ethnic identity and thus it act against the population control policy. Paradoxically politics in the sense of development politics, is the only way to solve it, in the long run only accelerated socio economic development could bring development politics in India, which could reduce the adverse effect of electoral politics on family control programmes in India (Panandiker and Umashakar, 1994).

Dreze, Guio and Murthy, 1996 have studied the determinants of demographic outcomes of India for 1981. They found that the female literacy and their labour force participation have negative and statistically significant relationship with TFR, child mortality and anti female bias attitude. Beside this level of urbanization, medical infrastructure also has significant negative effect, where poverty has positive association with fertility and child mortality. They also found that fertility is significantly lower in southern region and in districts with high proportion of scheduled tribe.

Audirayana (1997), in his analysis of the linkage between the study of woman and fertility in urban Tamil Nadu is found that the various dimensions of status of women have played a crucial role in effecting the fertility behaviour. Educational status, work status, income, autonomy in certain personal, material and domestic affairs etc. are the various dimensions of status of woman and improvement in these status dimension along with the eradication of social customs, believes and traditions, which undermine the value of woman in society, can bring considerable change in the fertility behavior. Kaushik (1999) gave light to the importance of husband's approval of using contraception, lack of women's autonomy, women's unequal social status and limited access to economic resources, issue of women empowerment, age at marriage, exposure to mass media.

Meashan, Rao, Jamison; Wang and Singh (1999) have studied the role of income changes and other aspects over the period of time in determining IMR and TFR for different countries and of individual Indian states. The regression analysis suggests that increase in income has a significant influence on IMR and TFR reduction. For Indian states they found weak correlation of per capita income with IMR and TFR, due to non-income, state specific factors which are weakly correlated with income. The factors such as levels of female literacy, female age at marriage and access to medical facilities which have much higher association with decreasing IMR and TFR along with income in India.

In an interstate analysis based on NFHS data for 1992-93, Mausumi Manna (1998) has found a high degree of negative association between fertility and level of female education and mother and child health. She also observed an inverse relationship between state ranks in terms fertility behaviour with the use of contraceptives as well as achievement of family planning targets. Premi (2002) also got similar results in the analysis of NFHS data for 1992-93 and1998-99. It has been observed that the levels and patterns of fertility vary considerably in terms of educational attainment, occupation, income, family type etc., (Bhende and Kanitkar, 2000).

Andhra Pradesh the first State that formulates a State population policy, and also witnessed a rapid fertility decline during 1990s, despite slow progress in socio economic development. The TFR has declined from 4 (1980) to 2.5 (1996), a 38 % decline in 15 years (Shekher, Raju, and Sivakumar, 2001). They also found in their regional analysis that low literacy, low female age at marriage, poor health infrastructure and low status of women are the major factors in northern states for lagging behind this region in comparison to southern states.

Dreze and Murthi (2001) in their district level analysis of fertility behaviour have found that, the connection between fertility and female education is robust and the effect of child mortality and son preference on fertility is also very strong in fertility reduction. Apart from these overall development and modernization of such as male literacy, urbanization and even poverty has have influence on change in fertility behaviour. Further they said that, fertility decline is not just a product of economic growth; it depends on improvements in the specific conditions that are conducive to change fertility goals and that helps parents to realize these goals.

In the following part of this section various studies are discussed in the separate categories of different influencing factors.

***EDUCATION:***

Education, specially school education, is the most effective vehicle of awareness about various population and developmental issues and helps in the formation of positive attitudes and influence their value orientation in respect to these issues. This helps them to take informed and rational decisions for adopting small family norms to ensure a better quality of life.

The working committee on primary and secondary education in relation to population stabilization has reported that education is the key determinant of population change. On the basis of the empirical study based on the N.F.H.S. data, they found that there is a significant correlation between the educational status of potential parents, more particularly of the potential mothers and their fertility behaviour. The higher the level of education, the lower is the fertility. They advocated that the educational programmes should actively motivate and inform the youth and adults about family planning and responsive parenthood, with inculcation of consciousness about the problems of high population growth in primary and secondary education.

In Greater Bombay Fertility Survey (1965), marked socio-economic differences in fertility were observed and the negative relationship between the educational level of wife and decline in family size was more pronounced. The similar results were observed in two National Surveys in Pakistan, (Sathar, et.al. 1988). Driver (1963) and Verma (1996), in their study of central India and Patna district respectively, also got the similar findings.

The SRS surveys for 1972 and 1979 with sample size of 6.23 million and 1.05 million ever-married women from all parts of the country respectively, have found an inverse relationship between fertility rates and level of education. Furthermore, the decline in fertility was more significant, when the educational attainment of women was above matriculation. The similar results were obtained from the second All India Family Planning Survey. Arkansan and Bhate (1989) also got the similar picture in Maharashtra.

A base line survey was conducted in Rajasthan in 1980 by IIPS, Bombay. It was observed that illiterate married women had borne 4.1 children as compared to 2.9 children borne by literate women and fertility differentials by literacy status were more significant, (Talwar, et.al. 1982). The parallel results were found in the base line surveys in Bihar (1980), Orissa (1982) and Maharashtra (1983). Census data on fertility since 1971 also presented the negative association between the educational attainment and family size.

Caldwell (1980) has found that the greatest impact of education is indirect, through the restructuring of family relationships and family economies and the effects of these on direction of net wealth flows between the generations. He believes that schooling attacks the traditional family economic structure by weakening the authority of the old over the young and of the male over the female. Further, he (1982) considered that when parents begin to invest more in the education of their children, then children contribute to the family through child labour and care for the aged parents. This reversal in the intergenerational wealth flow from children to parents and from parents to children encourages couples to opt small family norms. In 1996, he said that fall in fertility rates in second half of $20^{th}$ century in Sri Lanka and recently in Bangladesh is attributed largely to the increasing level of education, especially female education. Where the low level of female education in Pakistan is mainly responsible for their high fertility rates.

Cleland and Winson (1987) have argued that education seems to change women's perception, ideas and aspirations and then influences fertility behaviour and acceptance of contraceptives, rather than such objective realities, as their work opportunities or cost of children.

Srikantan, Mulay and Radkar (1992), in their study of acceptance of family planning in Maharashtra, based on National Fertility and Mortality Survey, Maharashtra (1980) data, found that the existing number of children, particularly son, have much greater impact on family planning and then reduction in fertility in comparison to education.

Tafan (1992) has recommended that mass scale educational spread is necessary to change the societal norms, like son preference, myths regarding the contraceptives etc. This would reduce the fertility as it has been experienced in some of the less developed countries such as Thailand and Taiwan.

Singh and Choudhary (1994) have found positive correlation between illiteracy, particularly female illiteracy and high fertility during 1992-93. The female literacy rates in the states of Madhya Pradesh, Utter Pradesh and Rajasthan varies from 20.4 to 28.8% and TFR in these states varies from 3.63 to 4.1. On the other hand the states like Kerala, Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh have high literacy rates ranging from 33.71 to 86.93% also have lowest TFR ranging from 2 to 2.86.

Sivakumar (2000) in the study of Alapuzha district of Kerala found that, better educational attainment of females along with social development on various fronts is a crucial factor, which might have contributed to a rise in age at marriage and then fertility reduction.

Parekh and Gupta (2001) have found, in their comparative study of Andhra Pradesh and Utter Pradesh that, female literacy reduces birth rates and have its impact on age at marriage. Further they argued that female literacy is a critical precondition but other measures such as economic development, increasing female work participation and provisions of health and family planning services are also needed for the over all development to experience fertility reduction.

*PLACE OF RESIDENCE:*

The rural urban differential in fertility is one of the most widely studied area in fertility research. Generally, in societies undergoing socio-economic, cultural and demographic changes, fertility will be lower in urban areas then in rural areas due to various factors. The lower fertility in urban is attributed to their factors, like, larger proportion of couples who are well educated, open to innovative ideas and new life style, engaged in white colour jobs and who are thus marry late and have smaller family. Where as in rural areas women have low education, limited formal sector employment and limited access to health and family planning facilities, are expected to have low rates of contraceptive use results in high fertility. In India level of fertility is high in rural areas in comparison to urban areas, as it is conmen for rest of the world.

The difference between rural urban reproductive behaviour in Western European countries widened during the early phase of fertility decline, but it was narrowed during the period of recovery after world war second. In the Eastern European countries and in USSR the differences appeared to have widened during 1950s. The developing countries, on the other hand, do not show consistent differentials by rural urban residence, (UN, 1973). In some other studies urban fertility was found lower than rural fertility in Taiwan (Freedman, et. al. 1972) and Thailand (Goldstein, 1973). Njoru (1991) in his study of trends and determinants of contraceptive use in Kenya, during last quarter of 20$^{th}$ century found that urbanized groups were more likely to contraception and fertility rates among these groups were also low in comparison to rural groups. While higher fertility rates in urban areas in comparison to rural areas, was observed in Indonesia (University of Indonesia, 1974) and Egypt (Omran, 1973), (source: Hakim Abdul, 1999).

Recently the place of residence has received increasing attention as a major factor affecting reproductive behaviour in many less developed and developing counties, (Cleland, Casterline, Singh and Ashurst, 1984; Freedman et. al. 1981).

A remarkable difference between rural urban fertility was observed in SRS survey, 1972. In this survey urban fertility has been found lower than the rural fertility throughout the nation. The TFR was 4.3 for urban India in comparison to 5.8 children per women in rural India. Third All India Family Planning Survey also revealed the similar picture and found that rural areas exhibited higher fertility than in urban areas, in a baseline survey in Rajasthan in 1980 by IIPS, Bombay, (Talwar et. al. 1982), a large-scale survey in Maharashtra in 1980 (Srikantan and Bhate, 1989). But the results of base line survey in Bihar did not reveal any significant difference in rural urban fertility, where the overall fertility level was very high in both the places. Census data on fertility, after 1971, also revealed considerable rural urban differentials in fertility behaviour.

Singh and Choudhary (1994) in their state level analysis, found that the TFR in rural areas in every state in India is higher than the urban areas, where majority of Indian population (around 74.3%) live in rural areas. During 1992-93, TFR for rural population was 3.69 against 2.7 children per women for urban areas. Even in Kerala, TFR in rural areas (2.69) was higher than the urban areas (1.77).

This difference is largely attributed to low level of literacy and poor performance of rural areas in all the population health parameters, such as IMR, CBR, acceptance of contraceptive methods, immunization rate etc.

***PROPORTION OF S.C. AND S.T. POPULATION:***

The scheduled caste (SC) and scheduled tribe (ST) population usually belongs to lower economic strata of the society. They have very poor social and economic status in all the fronts of developmental indicators.

A large-scale survey of 100 villages and 104 urban blocks in the state of Maharashtra in 1960 as a part of National Fertility Survey and Mortality Survey (NFMS) was conducted. It was found that, in terms of current fertility measures after Muslims, SC and ST exhibited the highest CBR (31.4) in comparison to intermediate (28.6), and advance caste Hindus (26.1), (Srikantan and Bhate, 1989).

Mehta (1993), in his study of the tribal region of Rajasthan, has found that the opportunity cost of child birth and rearing is not very high because of the compatibility of women's work and child care and the sharing of this responsibility with other members of the household, mainly other siblings. Along with this because of the prevalence of the child labour tradition, children are looked as net producers and as the children grow, their net contribution to the household increases.

Various large scale sample surveys on fertility including those by Census Organization and NFHS have shown that tribal fertility varies not only across the states but also higher in some regions and lower in others as compared to the fertility of mainstream population, (Maharatha, 1998).

*EXPOSURE TO MASS MEDIA:*

Diffusion of information through mass media plays an important role in changing the attitude towards small family norms. Retherford and Mishra (1997) have found that media exposure increases significantly the acceptance of contraception. On the basis of NFHS data (1992-93), they observed that contraceptive use increases by 76% when women have general media exposure. They said that the recent exposure of family planning messages on radio and television are very important in case of India where 63% of currently married women of reproductive age are illiterate.

*ECONOMIC STATUS:*

Economic determinants play a central role in most of the models of fertility behaviour from Malthus to Becker and Caldwell but the specific composition of economic factors vary largely from work to work and place to place. Some economic determinants are commonly used these are income level, economic status of society through workers engaged in other than primary sector, household expenditure and consumption pattern which reflects permanent income etc.

Kertzer and Hogen (1989); Pollak and Watkins (1993); Robinson (1997) and Schultz (1997), have studied the effects of socio-economic status on fertility. Most of them readily accept that fertility behaviour is mediated by economic status.

With the rise in income, a greater concern for the quality of children dominates over the numbers. It requires greater investments than returns and as a consequence, rise in income might lead to reduction in fertility. This negative relationship is supported by Easterlin (1975); Bulatao and Lee (1983); Registrar General (1989). However Roy, Jayachandran and Banerjee (1999) have found in their study of four major states of India that, the standard of living or economic status is not always sufficient to understand the complex mechanisms of fertility decline. Only Punjab has shown negative relationship between economic status and fertility. According to them a set of other socio-economic factors, directly or indirectly, influence couple's decision on reproductive behaviour. Caldwell (1977) also said that there could be no such things as a purely economic theory of fertility.

The standard of living of a household is a good indicator of the economic condition. Women belong to the class of high standard of living, generally record low fertility and high use of contraceptive methods. Kanitkar and Murthy (1983), in a study of contraceptive use in Rajasthan and Bihar, have found a direct relationship between standard of living and contraceptive use. In the similar direction Bhende and Kanitkar (1993), also found that, low acceptance of contraceptives and high fertility in developing countries is largely because of the low level of standard of living of their people. The second All India Family Planning Survey also depicted the similar results, represented an inverse relationship between family income and family size.

A husband's occupation is an indicator of social status in the society and it has been widely used as an index of socio-economic status in the study of socio-economic differentials. Classically, changes in the occupational distribution of the population of industrially advanced countries have accompanied with a general decline in fertility. A relatively high fertility has been found to be associated with people engaged in primary sector, while lower fertility has been found to be associated with the professional classes, white colour workers and urban industrial workers, (U.N., 1973) (Source: Hakim Abdul, 1999).

In India where nearly 3/4$^{th}$ population is living in rural areas, agricultural development is very important indicator to examine the characteristics of rural population and here in present discussion, their fertility behaviour. Murthy (1991), examined the relationship between agricultural modernization, costs and benefits of rearing a marginal child and fertility behaviour of couples of rural Andhra Pradesh. He found that couples from backward villages had different perception than the couples from developed villages, regarding costs and benefits of rearing children. In the agriculturally advanced areas, couples scored high on the indices of economic and non-economic costs and scored low on similar benefits. As a consequence they desired to have small family size in comparison to couples from agricultural less developed areas.

According to Singh and Singh (1996), family income exerts much influence on fertility behaviour. As adoption rate for contraceptive measures is much higher in middle and high-income families as compared to low-income families.

*FEMALE WORK STATUS:*

The proportion of women engaged in paid work can be considered as an indicator of the status of women and her economic independence. Working women have greater opportunities to communicate with the outside world, which help in widening their worldview and bring changes in their attitudes towards the family size and use of contraceptives, (Basu, 1992).

At the same time, the meaning of 'status' is heavily context dependent i.e. what indicates high status in one social setting may indicate low status in another. Selected aspects of status may influence fertility and mortality differently in different cultural contexts, (Masons, 1984).

In SRS survey of 1979, it was found that female workers have exhibited lower fertility than non-workers. Further, women engaged in service sector has shown lower fertility than those engaged in other occupations

In India like other developing countries, women usually serve as household maids and other non-formal activities but their primary roles are still seen as those of wives and mothers and they have very little say in decision making. Although a negative association between female work participation and fertility has been found in various studies in India, it is not consistent. However, women who work in other than primary activities and earn in cash are presumed to have active participation in decision making regarding family matters and subsequently control family size. Becker (1981) has said that the higher wages might be expected to increase the opportunity cost of women's time and hence raise the 'price' of children.

Cain (1979) investigated the gender differences in Bangladesh labour market and noticed important differences in women's work by economic class. Generally all the poorer women are engaged in wage work, while the richer stayed at home. However, all the women had heavy workload and received fewer regards than men. In rural Bangladesh, female labour force participation did not entail greater emancipation or higher status. So here one cannot establish relation between fertility and female work participation, where the females from lower class having high fertility despite have higher proportion of female work participation.

In a district level analysis (358 districts) of fertility behaviour in India, Malhotra, Vanneman and Kishore (1995) have found that female labour force participation had the most significant effect on fertility and observed a distinct divide between northern and southern regions of India.

*CHILD LABOUR:*

Children are expected to contribute substantially to their parent's well being especially in the societies where the household income is low. Tribute paid by the children to the parents is expected to meet their needs.

Tafan (1992), have said that population growth and economic development have two-way relationship where change in one variable have direct impact on the other. He pointed out that the child labour is a main cause for high fertility among the poor because children are seen as productive sources and old age security. He suggested that, child labour should be discoursed in developing world.

In all the developing societies children are seen as productive assets and from the perspective of parents, a high parity of children is an economically rational position. Children of both sexes begin to become net producer at early ages and compensate for the cumulative consumption even before they achieve adulthood, (Mehta, 1993).

*POVERTY:*

Poverty, which is the biggest social evil of present developing societies, has a negative influence on fertility behaviour. The poor section of population usually does not have access to good social and economic infrastructure, thus they have low acceptance for contraceptive measures and perform high fertility. For instance in poor section, one has found high IMR because of inadequate medical facilities that motivates a desire for large number of children for economic reasons, as they are seen as economic assets.

The SRS survey (1972), revealed an inverse relationship between the per capita monthly family expenditure and fertility. With an increase in per capita monthly family expenditure, there was a reduction in marital fertility.

Estwood and Lipton (1999) have studied the effect of demographic variables on poverty on developing and transitional economies. They observed that high fertility damages growth of overall economy, which has its impact on poverty. They explored that, high human fertility which posses extra child cost and fall in real wages, alters the total household consumption per person of working age. It is again more severe in poorer households, because of their increased dependency burden.

*HEALTH INFRASTRUCTURE:*

Health infrastructure plays an important role in the fertility decline largely through the reduction in unwanted fertility, increasing space between the births etc. Caldwell (1996) has mentioned that fertility reduction in Sri Lanka during the mid 20$^{th}$ century is mainly attributed to an easily accessible health system with other determinants.

Numerous studies have established clear relationship between health infrastructure and the fertility behaviour. Pathak et. al. (1998), found that in India if all the women with an unmet need were to use contraception, the contraception prevalence rate would rise from the current 41% to 60%. Consequently, it would result in a drop in TFR from the current 3.4 to 2.3 children per women, which is near to replacement level. The higher fertility would decrease by 20% of the current fertility level due to this. Therefore, it is necessary to improve the health infrastructure because reproductive health and basic health infrastructure and services often do not reach to nearly 3/4$^{th}$ population of India living in rural areas.

On the basis of Ministry of Health and Family Welfare statistics, committee on National Population Policy, 2000 has identified that the health care centers are over burdened and struggling to provide services with limited staff and insufficient equipments. These inadequacies in the existing health infrastructure have contributed largely for high proportion of unmet needs for contraceptive services and then for high fertility.

Visalia (2000) has pointed out that the rapid fertility decline in Tamil Nadu, from a TFR of around 3.8 in the mid 1970s to 2 children per women in 2000, is largely attributed to the reasonably good quality of health care, including family planning services, effective implementation of reproductive health programme, restructuring of the recruitment of medical officers, logistic management of drugs, attractive incentive based strategy, involvement of many donor communities, in its objective for health for all.

*AGE AT MARRIAGE:*

The effect of patterns of age at marriage on fertility has been a prominent theme in demography since Malthus who advocated delayed marriage (moral restriction) as a strategy for control of population growth. Numbers of studies have established direct relationship between women's age at marriage and the level of fertility. Societies where the late marriage is a norm have more autonomy and they adopt control over their child bearing. The European countries also assisted by the factor of control of population growth in the late marriage, (Coale, 1992). According to the various sources CBR were around 50 per thousand in the beginning of previous century, declined to around 40 per thousand during 1961-71. This decline is partly attributed to increase in the female age at first marriage during this period.

The mean age at marriage, which marks the entry into a sexual union and beginning of exposure to child bearing, is an important indicator of the status of women. The consequences of low mean age at marriage can be seen in two different ways. One is that it increases the reproductive period of women for child bearing, which has direct influence on fertility behaviour. On the other side it has adverse impact on the educational attainment, work experience and employment opportunity of the young mothers. It ultimately decreases the socio-economic status of women and their families, which indirectly affect the fertility behaviour at societal level.

The postponement of marriage beyond 19 years of age would probably produce an appreciable decline in fertility because women who marry at these ages will loose an appreciable amount of their fertile period and are not likely to compensate for the loss, (Aggarawal, 1967).

In India prior to 1961 fertility rates were consistently high. The estimates of total fertility rate for 1972 and 1978 based on SRS are 5.5 and 4.3 respectively, which shows around 22% decrease, where fertility estimates through proximate determinants show 9 to 15 point reduction for the same period. In other words CBR fall from 40.6 births per thousand in 1972 to 35-37 in 1978. The fertility reduction has been observed in all age groups but decline in young age group reflects the effect of rising age at marriage and in other group because of use of birth control measures, (Jain and Adlakha, 1982).

Carol Vlassoff (1991) in his study of village of Satara district in Maharashtra found that age at marriage; along with education attainment and marriage distance have inverse relationship with fertility i.e. those who married later experienced greater willingness to adopt birth control measures

In rural Bangladesh age at marriage is found to have a significant direct negative effect on fertility. It was observed that expanded facilities for female education and female labour force participation might contribute to rise the age at marriage, (Shafiqulislam and Abdullahkhan, 1991).

In a study of 230 currently married couples, conducted in a village of Varanasi district of U.P. in 1994 reveal that the age at marriage determines the fertility behaviour of population. Among the studied sample 33.48% mothers married below age of 15 years had produced 3.8 children, 52.17% mothers married between age of 15-19years, had produced 3.02 children and 14.35% mothers married later had given birth to on an average 2.45 children per women, (Singh and Singh, 1996).

Verma in 1996 in his village level analysis found that, the fertility among married women varies according to differences in their ages at marriage and with increasing age at marriage significant decline in fertility is experienced.

Leela Visaria (1999) has found that mean age at marriage of women for Kerala is 23.9 years, which is the highest in India, whereas for Rajasthan it is 17.6 year, which is the lowest in India in the recent past. The corresponding rate of fertility is just opposite, which is showing the clear cut impact of mean age at marriage on fertility behaviour.

Klepinger et. al. (1999) have studied relationship between teenage child bearing, human capital investment and wages in early childhood in United States. They found that adolescent child bearing has major adverse socio-economic consequences and it effects educational attainment; work experience of young mothers and reduces both quality and quantity of human investment. The long-term effects of these consequences can be seen in their wages, earning and employment.

A negative relationship between the female age at marriage and their fertility levels is observed along with the positive relationship between the female age at marriage and their educational attainment and working status in the survey of 911 women of reproductive age in Alapuzha, a district of Kerala. The finding shows that there is a rising trend in age at marriage along with declining trend fertility, (Shivkumar, 2000). In a study of fertility behaviour in Pakistan, Hakim (1999) has found that among the important demographic variables age at marriage is the most important determinant of reproductive behaviour.

If the age at marriage is low, a woman will have a longer exposure period and is expected to end up with high fertility, while late marriage has been found to have a fertility reducing effect, (Coale, 1975) (source: Hakim Abdul, 1999).

***INFANT AND CHILD MORTALITY:***

In such settings, where IMR and CMR are high, parents want large number of children to ensure that some of them will survive upto adulthood to provide them old age security. Along with the positive changes in socio-economic status, when IMR and CMR decline, fertility also seems to drop slowly. In Sub-Saharan countries IMR and CMR are the highest in the world where in some of the countries, nearly 20% children die prior to their fifth birthday. These countries are also showing the highest fertility rates in the world.

In all the societies, there is a family size goal or targeted number of surviving children that parents want. So the incidence of deaths among offsprings necessitates a compensating adjustment in birth rates to achieve any specific family size goal, (Schultz, 1969).

Adlakha and Kirk (1974), using the age distribution from 1961 and 1971 Censuses, has concluded that fertility decline in India occurred during the second half of 1960s, when the child women ratio for children aged 0-4 year have lowered by 2% during 1961-71. This small decline in ratio shows a greater decline (7-10%) in fertility rates, which is attributed to the continuous decline in mortality, spatially in child mortality, during 1960s.

Tulsi (1990) has observed in a survey, conducted in Mogra village in Jodhpur district of Rajasthan, that a fall in child mortality is making younger couples more favorably disposed towards a small family size and acceptance of contraceptive methods. Malhotra, Vanneman and Kishore (1995) also found the similar results in their district level analysis. They also observed a strong influence of the sex ratio of child mortality on fertility. The similar findings were found in the works of Kishore (1991) and Murthy, Guio and Dreze (1995), in which the effect of child mortality, particularly for girls, on fertility was observed.

All the above-mentioned studies are clearly bringing out the message that social, economic and demographic factors have very strong association with fertility behaviour.

Further we can see the influence of various determinants of fertility individually on fertility as observed in various studies.

# CHAPTER IV

## DYNAMISM IN FERTILITY BEHAVIOUR AND ITS DETERMINANTS

This chapter deals with the statistical analysis of the influence of socio-economic and demographic variables on fertility behaviour in two different states viz. Rajasthan and Tamil Nadu. Here an attempt has been made to explain the fertility behaviour through explanatory variables with their magnitude and direction of explanation. Among the statistical tools regression method is a popular technique to identify the overall influence of various explanatory variables and their individual influence on fertility. Ordinary regression analysis is greatly handicapped by the problems of multicollinearity among the independent variables. It fails to give unbiased estimates of the standard of error (Rao and Miller).

To handle a situation where multicolinearity is prevalent stepwise regression technique is suggested as a better alternative (Prakasam, 1986). In this study also to undermine the effects of multicollinearity among the independent variables for the identification of the total influence of the explanatory variables, stepwise regression technique is adopted. In this technique to avoid the influence of multicollinearity among the different sets of data and to get a more realistic pattern, all the socio-economic and demographic variables are treated as different sets. In this analysis explanatory variables are divided into three broad independent categories like social, economic and demographic to get added advantage suppressing any multicollinearity among the variables in these sub-sets.

**List of variables**:

***Dependent Variable*:**

Total Fertility Rate. $Y$

***Independent Variables*:**

Social Variables:

Percentage of Female Literate population to the total population. $X_1$

Percentage of Female Literates secondary and above to the total population of female literates. $X_2$

Percentage of Schedule Caste population to the total population. $X_3$

Percentage of Schedule Tribe population to the total population. $X_4$

Percentage of Urban Population to the total population. $X_5$

Number of hospital beds available to per lakh population. $X_6$

Index of physical standard of living. $X_7$

<u>Economic Variables</u>:

Percentage of Female Main Workers engaged in non-primary sector. $X_8$

Percentage of Main Workers engaged in non-primary sector. $X_9$

Level of Female Work Participation. $X_{10}$

Land-man Ratio: Total cultivated area to the total agricultural workers. $X_{11}$

Road Density: Road length in kilometer per hundred square kilometer. $X_{12}$

<u>Demographic Variables</u>:

Infant Mortality Rate (IMR). $X_{13}$

Child Mortality Rate (CMR). $X_{14}$

Sex Ratio. $X_{15}$

Singulate Mean Age at Marriage (SMAM) of female. $X_{16}$

**STEPWISE REGRESSION ANALYSIS:**

The results of correlation and stepwise regression analyses for Rajasthan and Tamil Nadu are given in tables from 4.1a to 4.20b. In these tables firstly we have given correlation matrix of these variables. Subsequent tables are giving results of stepwise regression analysis. In the initial stage, the overall influence of the explanatory variables on fertility behaviour is taken into consideration. In the correlation analysis for Rajasthan in 1981, variables like Female Literacy upto secondary and above, level of urbanization, and physical standard of living are seen to have significant inverse relationship with fertility. On the other hand CMR is positively associated with fertility behaviour. Among the other variables, the proportion of Main Workers in the non-primary sector is also seen to have considerable negative effect on fertility. However, in 1991, there was an observable change in the situation and along with the aspects of physical standards of living, Female Work Participation and Sex Ratio are

**Table 4.1a**: Zero-Order Correlation co-efficient matrix between TFR and Independent variables for Rajasthan in 1981.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Y1** | 1 | | | | | | | | | | | | | | | | |
| **X1** | -0.54** | 1 | | | | | | | | | | | | | | | |
| **X2** | -0.39* | 0.746** | 1 | | | | | | | | | | | | | | |
| **X3** | -0.05 | 0.244 | 0.118 | 1 | | | | | | | | | | | | | |
| **X4** | 0.076 | -0.224 | -0.085 | -0.731** | 1 | | | | | | | | | | | | |
| **X5** | -0.508** | 0.875** | 0.696** | 0.325 | -0.457* | 1 | | | | | | | | | | | |
| **X6** | -0.436* | 0.785** | 0.561** | -0.061 | -0.168 | 0.807** | 1 | | | | | | | | | | |
| **X7** | -0.506** | 0.812** | 0.767** | 0.089 | -0.087 | 0.719** | 0.662** | 1 | | | | | | | | | |
| **X8** | 0.052 | 0.451* | 0.385 | 0.2 | -0.083 | 0.363 | 0.395* | 0.338 | 1 | | | | | | | | |
| **X9** | -0.338 | 0.842** | 0.657** | 0.22 | -0.328 | 0.868** | 0.768** | 0.726** | 0.578** | 1 | | | | | | | |
| **X10** | -0.166 | -0.285 | -0.161 | -0.597** | 0.581** | -0.435* | -0.227 | -0.193 | -0.6** | -0.51** | 1 | | | | | | |
| **X11** | -0.098 | -0.15 | -0.113 | 0.308 | -0.484* | 0.274 | 0.232 | -0.043 | 0.258 | 0.117 | -0.502** | 1 | | | | | |
| **X12** | -0.171 | 0.423* | 0.278 | -0.205 | 0.337 | 0.202 | 0.339 | 0.397* | 0.056 | 0.337 | 0.125 | -0.503** | 1 | | | | |
| **X13** | 0.18 | -0.245 | 0.151 | -0.224 | 0.453* | -0.377 | -0.371 | 0.024 | 0.129 | -0.217 | 0.244 | -0.412* | 0.002 | 1 | | | |
| **X14** | 0.39* | -0.157 | 0.104 | 0.083 | 0.202 | -0.33 | -0.425* | -0.157 | -0.184 | -0.252 | 0.361 | -0.77** | 0.158 | 0.506** | 1 | | |
| **X15** | -0.27 | -0.172 | -0.233 | -0.609** | 0.533** | -0.243 | -0.011 | -0.125 | -0.594** | -0.266 | -0.695** | -0.339 | 0.272 | -0.107 | -0.045 | 1 | |
| **X16** | 0.07 | 0.166 | 0.075 | -0.167 | 0.161 | 0.098 | 0.225 | 0.233 | 0.409* | 0.257 | -0.311 | 0.239 | 0.263 | -0.066 | -0.415* | -0.01 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.1b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Independent Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X1 | -0.54 | -3.14 | 0.004 | 0.291 | 0.262 | 6.633 | 9.862 | 0.004(a) |
| Step II | | | | | | | | |
| X1 | -0.604 | -3.769 | 0.0001 | 0.427 | 0.377 | 10.004 | 8.564 | 0.002(b) |
| X15 | -0.374 | -2.332 | 0.029 | | | | | |
| Step III | | | | | | | | |
| X1 | -0.555 | -3.602 | 0.002 | 0.507 | 0.44 | 9.152 | 7.537 | 0.001© |
| X15 | -0.352 | -2.312 | 0.031 | | | | | |
| X14 | 0.287 | 1.889 | 0.072 | | | | | |
| Step IV | | | | | | | | |
| X1 | -0.611 | -4.243 | 0.0001 | 0.602 | 0.526 | 6.392 | 7.933 | 0.000(d) |
| X15 | 0.008 | 0.037 | 0.971 | | | | | |
| X14 | 0.482 | 2.927 | 0.008 | | | | | |
| X10 | -0.591 | -2.237 | 0.036 | | | | | |
| Step V | | | | | | | | |
| X1 | -0.57 | -4.277 | 0.001 | 0.681 | 0.601 | 7.719 | 8.524 | 0.000(e) |
| X15 | -0.08 | -4 | 0.693 | | | | | |
| X14 | 0.59 | 3.715 | 0.001 | | | | | |
| X10 | -0.72 | -3.112 | 0.005 | | | | | |
| X3 | -0.393 | -2.222 | 0.038 | | | | | |
| Step VI | | | | | | | | |
| X1 | -0.606 | -4.838 | 0.0001 | 0.737 | 0.654 | 9.468 | 8.892 | 0.000(f) |
| X15 | -0.214 | -1.086 | 0.291 | | | | | |
| X14 | 0.745 | 4.478 | 0.0001 | | | | | |
| X10 | -0.703 | -3.263 | 0.004 | | | | | |
| X3 | -0.54 | -3.003 | 0.007 | | | | | |
| X13 | -0.317 | -2.027 | 0.057 | | | | | |
| Step VII | | | | | | | | |
| X1 | -0.481 | -3.468 | 0.003 | 0.775 | 0.688 | 6.68 | 8.88 | 0.000(g) |
| X15 | -0.025 | -0.114 | 0.91 | | | | | |
| X14 | 1.212 | 3.9 | 0.001 | | | | | |
| X10 | -0.826 | -3.817 | 0.001 | | | | | |
| X3 | -0.719 | -3.609 | 0.002 | | | | | |
| X13 | -0.307 | -2.064 | 0.054 | | | | | |
| X11 | 0.5 | 1.747 | 0.098 | | | | | |

Contd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step VIII | | | | | | | | |
| X1 | -0.091 | -0.395 | 0.698 | 0.819 | 0.734 | 5.747 | 9.619 | 0.000(h) |
| X15 | 0.012 | 0.06 | 0.953 | | | | | |
| X14 | 1.463 | 4.678 | 0.0001 | | | | | |
| X10 | -0.887 | -4.388 | 0.0001 | | | | | |
| X3 | -0.844 | -4.349 | 0.0001 | | | | | |
| X13 | -0.197 | -1.328 | 0.202 | | | | | |
| X11 | 0.719 | 2.517 | 0.022 | | | | | |
| X2 | -0.404 | -2.024 | 0.059 | | | | | |
| Step IX | | | | | | | | |
| X1 | -0.149 | -0.656 | 0.521 | 0.842 | 0.752 | 4.685 | 9.439 | 0.000(I) |
| X15 | -0.041 | -0.209 | 0.837 | | | | | |
| X14 | 1.459 | 4.836 | 0.0001 | | | | | |
| X10 | -0.762 | -3.591 | 0.002 | | | | | |
| X3 | -0.754 | -3.838 | 0.001 | | | | | |
| X13 | -0.234 | -1.617 | 0.125 | | | | | |
| X11 | 0.675 | 2.437 | 0.027 | | | | | |
| X2 | -0.377 | -1.949 | 0.069 | | | | | |
| X16 | 0.187 | 1.509 | 0.152 | | | | | |
| Step X | | | | | | | | |
| X1 | -0.227 | -0.917 | 0.374 | 0.848 | 0.747 | 4.525 | 8.394 | 0.000(j) |

showing more pronounced reciprocal relationship. Other variables do not show a significant influence on fertility behaviour. There is a sharp departure in the results of correlation for 1991, from the 1981 results where very few variables are showing significant association with fertility behaviour. The reason behind this will be explored in the following discussion.

In case of Tamil Nadu in 1981, female literacy upto secondary and above, level of urbanization, physical standard of living and proportion of main workers in the non-primary sector are negatively correlated with fertility behaviour. CMR and Sex Ratio are showing reverse direction of this relationship. In 1991, along with the similar variables, of negative influence, female literacy and female age at marriage are also added while at the same time, significance of CMR is eroded. Overall it can be inferred that in Tamil Nadu, the level of female literacy, urbanization, physical standard of living, female age at marriage, proportion of main workers in the non-primary sector are important explanatory variables influencing fertility behaviour. Along with these, female work participation especially in non-primary sector also has shown considerable negative impact on fertility behaviour.

In case of the stepwise regression analysis in which all the variables have been taken together, results for Rajasthan and Tamil Nadu for both 1981 and 91 are as follow:

The correlation matrix, which is given in table no. 4.1(a), shows a considerable relationship between the dependent and the independent variables in 1981. In the stepwise regression analysis (table 4.1b), it is found that around 75% variation in TFR is explained by only nine independent variables, which are included in the regression model. The value of adjusted $\bar{R}^2$ is also significant at 1% level. Among these variables female literacy, sex ratio and CMR are explaining maximum variation in fertility behaviour. Other variables are female work participation, % of SC population, IMR, land-man ratio, female literacy upto secondary and above and female age at marriage. However the t-test is not significant for these variables. For 1991 also a good association between TFR and other independent variables is found as indicated in table 4.2a. From stepwise regression analysis (table 4.2b), it is evident that again nine variables are included in the regression model. These are explaining more than 70% variation in fertility behaviour. The F-test is significant for $\bar{R}^2$ at 1%

**Table 4.2a:** Zero-Order Correlation co-efficient matrix between TFR and Independent variables for Rajasthan in 1991.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | | | | | | | | | | |
| X1 | -0.165 | 1 | | | | | | | | | | | | | | | |
| X2 | -0.24 | 0.654** | 1 | | | | | | | | | | | | | | |
| X3 | 0.249 | 0.231 | 0.009 | 1 | | | | | | | | | | | | | |
| X4 | -0.225 | -0.248 | 0.0001 | -0.738** | 1 | | | | | | | | | | | | |
| X5 | -0.154 | 0.819** | 0.695** | 0.306 | -0.45* | 1 | | | | | | | | | | | |
| X6 | -0.318 | 0.65** | 0.619** | -0.133 | -0.107 | 0.729** | 1 | | | | | | | | | | |
| X7 | -0.514** | 0.816** | 0.586** | 0.16 | -0.156 | 0.767** | 0.633** | 1 | | | | | | | | | |
| X8 | 0.152 | 0.469* | 0.49** | 0.169 | -0.188 | 0.486* | 0.337 | 0.359 | 1 | | | | | | | | |
| X9 | -0.059 | 0.764** | 0.606** | 0.182 | -0.393* | 0.826** | 0.668** | 0.714** | 0.67** | 1 | | | | | | | |
| X10 | -0.464* | -0.377 | -0.157 | -0.488** | 0.534** | -0.463* | -0.142 | -0.233 | -0.768** | -0.567** | 1 | | | | | | |
| X11 | -0.071 | -0.104 | -0.238 | 0.366 | -0.559** | 0.213 | 0.009 | 0.053 | 0.112 | 0.182 | -0.245 | 1 | | | | | |
| X12 | 0.13 | 0.514** | 0.369 | -0.116 | 0.255 | 0.174 | 0.346 | 0.278 | 0.234 | 0.316 | -0.165 | -0.587** | 1 | | | | |
| X13 | -0.107 | -0.292 | 0.063 | -0.141 | 0.247 | -0.28 | -0.041 | -0.279 | -0.262 | -0.351 | 0.413* | -0.479* | 0.053 | 1 | | | |
| X14 | -0.006 | -0.419* | -0.03 | -0.27 | 0.428* | -0.428* | -0.234 | -0.43* | -0.149 | -0.448* | 0.4* | -0.492** | -0.011 | 0.869** | 1 | | |
| X15 | -0.561** | -0.081 | -0.184 | -0.517** | 0.473* | -0.175 | 0.122 | 0.166 | -0.633** | -0.239 | 0.687** | -0.268 | 0.048 | 0.233 | 0.095 | 1 | |
| X16 | -0.261 | -0.029 | 0.136 | -0.257 | 0.275 | -0.051 | 0.228 | 0.083 | 0.313 | 0.19 | -0.31 | 0.139 | 0.283 | -0.01 | 0.077 | 0.026 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.2b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Independent Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X15 | -0.561 | -3.387 | 0.002 | 0.315 | 0.287 | 12.049 | 11.47 | 0.002(a) |
| Step II | | | | | | | | |
| X15 | -0.489 | -3.329 | 0.003 | 0.497 | 0.455 | 12.274 | 11.841 | 0.000(b) |
| X7 | -0.433 | -2.947 | 0.007 | | | | | |
| Step III | | | | | | | | |
| X15 | -0.066 | -0.336 | 0.74 | 0.626 | 0.578 | 8.928 | 12.856 | 0.000© |
| X7 | -0.635 | -4.298 | 0.0001 | | | | | |
| X10 | -0.566 | -2.827 | 0.01 | | | | | |
| Step IV | | | | | | | | |
| X15 | 0.017 | 0.091 | 0.928 | 0.69 | 0.634 | 7.936 | 12.25 | 0.000(d) |
| X7 | -1.029 | -4.46 | 0.0001 | | | | | |
| X10 | -0.537 | -2.87 | 0.009 | | | | | |
| X1 | 0.474 | 2.127 | 0.045 | | | | | |
| Step V | | | | | | | | |
| X15 | 0.023 | 0.129 | 0.898 | 0.733 | 0.67 | 11.39 | 11.544 | 0.000(e) |
| X7 | -0.992 | -4.513 | 0.0001 | | | | | |
| X10 | -0.55 | -3.091 | 0.006 | | | | | |
| X1 | 0.446 | 2.103 | 0.048 | | | | | |
| X16 | -0.209 | -1.842 | 0.08 | | | | | |
| Step VI | | | | | | | | |
| X15 | -0.073 | -0.411 | 0.685 | 0.772 | 0.704 | 13.572 | 11.291 | 0.000(f) |
| X7 | -0.807 | -3.487 | 0.002 | | | | | |
| X10 | -0.503 | -2.956 | 0.008 | | | | | |
| X1 | 0.167 | 0.666 | 0.513 | | | | | |
| X16 | -0.289 | -2.493 | 0.022 | | | | | |
| X12 | 0.27 | 1.846 | 0.08 | | | | | |
| Step VII | | | | | | | | |
| X15 | -0.065 | -0.37 | 0.716 | 0.784 | 0.704 | 13.83 | 9.855 | 0.000(g) |
| X7 | -0.871 | -3.639 | 0.002 | | | | | |
| X10 | -0.435 | -2.382 | 0.028 | | | | | |
| X1 | 0.072 | 0.271 | 0.789 | | | | | |
| X16 | -0.325 | -2.688 | 0.015 | | | | | |
| X12 | 0.29 | 1.968 | 0.064 | | | | | |
| X9 | 0.215 | 1.027 | 0.317 | | | | | |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step VIII | | | | | | | | |
| X15 | -0.168 | -0.851 | 0.406 | 0.798 | 0.709 | 14.289 | 8.915 | 0.000(h) |
| X7 | -0.825 | -3.422 | 0.003 | | | | | |
| X10 | -0.519 | -2.651 | 0.016 | | | | | |
| X1 | 0.067 | 0.253 | 0.803 | | | | | |
| X16 | -0.26 | -1.955 | 0.066 | | | | | |
| X12 | 0.295 | 2.014 | 0.059 | | | | | |
| X9 | 0.274 | 1.28 | 0.217 | | | | | |
| X8 | -0.26 | -1.135 | 0.271 | | | | | |
| Step IX | | | | | | | | |
| X15 | -0.311 | -1.437 | 0.169 | 0.82 | 0.725 | 16.198 | 8.618 | 0.000(I) |
| X7 | -0.84 | -3.581 | 0.002 | | | | | |
| X10 | -0.705 | -3.062 | 0.007 | | | | | |
| X1 | 0.154 | 0.58 | 0.569 | | | | | |
| X16 | -0.248 | -1.909 | 0.073 | | | | | |
| X12 | 0.173 | 1.042 | 0.312 | | | | | |
| X9 | 0.424 | 1.82 | 0.086 | | | | | |
| X8 | -0.549 | -1.828 | 0.085 | | | | | |
| X4 | 0.292 | 1.434 | 0.17 | | | | | |
| Step X | | | | | | | | |
| X15 | -0.365 | -1.53 | 0.146 | 0.824 | 0.714 | 16.855 | 7.497 | 0.000(j) |

level. Variables like female literacy, sex ratio, physical standard of living, and female work participation are giving the maximum explanation for the changes in fertility. These are followed by female age at marriage, proportion of main workers and females engaged in non-primary sector, infrastructure and proportion of Scheduled Tribe population, which are also included in the regression model.

Some changes have taken place during the 1980s, which are evident from the above analysis. The role of CMR was important during 1981, but it lost its importance during 1991while in 1991. However physical standard of living is recorded as an important variable. It was not so important during the previous decade.

During 1981, for Tamil Nadu, fertility behaviour and independent variables are significantly correlated, (table 4.3a). According to the stepwise regression analysis (table 4.3b), fourteen independent variables are explaining more than 90% changes in fertility behaviour. Here upto the XIth step of stepwise regression value of $\bar{R}^2$ is significant at 1% level of significance. In this case CMR explains the maximum proportion of variation in fertility behaviour. It is followed by level of urbanization and female work participation that are having significant relationship with fertility behaviour.

For 1991, correlation between fertility behaviour and independent variables is significant, (table 4.4a). Table 4.4b gives the results of stepwise regression where nine variables are included in the regression model. These nine variables are explaining more than 75% variation in fertility behaviour at 1% level. Among these variables, female literacy upto secondary and above explains the `maximum proportion of variation in fertility behaviour. It is followed by female work participation, female age at marriage, sex ratio. CMR and others.

During 1980s situation has changed considerably. In 1981, variables like level of urbanization and IMR are explaining maximum changes in fertility behaviour. However, it is not reflected so in case in 1991. Likewise during 1991, female literacy upto secondary and above and female age at marriage have become very important while these are not having considerable influence in 1981.

In this exercise where multicollinearity is prevalent, some variables are explaining significant variations in dependent variable. However, some variables are having high correlation with the variables explaining maximum variation in fertility

**Table 4.3a:** Zero-Order Correlation co-efficient matrix between TFR and Independent variables for Tamil Nadu in 1981.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | | | | | | | | | | |
| X1 | -0.43 | 1 | | | | | | | | | | | | | | | |
| X2 | -0.606* | 0.763** | 1 | | | | | | | | | | | | | | |
| X3 | 0.196 | -0.406 | -0.293 | 1 | | | | | | | | | | | | | |
| X4 | -0.057 | -0.301 | -0.053 | 0.248 | 1 | | | | | | | | | | | | |
| X5 | -0.532* | 0.671** | 0.867** | -0.038 | -0.118 | 1 | | | | | | | | | | | |
| X6 | -0.431 | 0.797** | 0.849** | -0.263 | -0.268 | 0.879** | 1 | | | | | | | | | | |
| X7 | -0.504* | 0.675** | 0.881** | -0.156 | -0.082 | 0.905** | 0.901** | 1 | | | | | | | | | |
| X8 | -0.355 | 0.841** | 0.796** | -0.573* | -0.35 | 0.686** | 0.831** | 0.74** | 1 | | | | | | | | |
| X9 | -0.503* | 0.757** | 0.892** | -0.291 | -0.267 | 0.918** | 0.89** | 0.89** | 0.89** | 1 | | | | | | | |
| X10 | 0.114 | 0.766** | -0.685** | 0.288 | 0.281 | -0.475 | -0.734** | -0.631** | -0.758** | -0.617* | 1 | | | | | | |
| X11 | -0.104 | 0.027 | -0.143 | 0.314 | 0.484 | -0.057 | -0.129 | -0.167 | -0.37 | -0.33 | 0.203 | 1 | | | | | |
| X12 | -0.397 | 0.627** | 0.831** | -0.25 | -0.248 | 0.839** | 0.929** | 0.89** | 0.839** | 0.905** | -0.699** | -0.336 | 1 | | | | |
| X13 | 0.481 | -0.375 | -0.627** | 0.453 | 0.001 | -0.458 | -0.556* | -0.553* | -0.54* | -0.543* | 0.537* | 0.176 | -0.65** | 1 | | | |
| X14 | 0.64** | -0.484 | -0.65** | 0.588* | 0.132 | -0.369 | -0.521* | -0.504* | -0.559* | -0.52* | 0.567* | 0.183 | -0.571* | 0.882** | 1 | | |
| X15 | 0.552* | -0.106 | -0.612* | -0.06 | -0.433 | -0.421 | -0.343 | -0.571* | -0.163 | -0.34 | 0.259 | -0.009 | -0.407 | 0.47 | 0.519* | 1 | |
| X16 | -0.368 | 0.829** | 0.426 | -0.532* | -0.419 | 0.307 | 0.445 | 0.24 | 0.608* | 0.422 | -0.473 | 0.163 | 0.244 | -0.197 | -0.39 | 0.234 | 1 |

* 2-tailed significant at the 0.05 level

** 2-tailed significant at the 0.01 level

**Table 4.3b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Independent Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X14 | 0.64 | 3.117 | 0.008 | 0.41 | 0.368 | 1.599 | 9.717 | 0.008(a) |
| Step II | | | | | | | | |
| X14 | 0.514 | 2.462 | 0.029 | 0.511 | 0.436 | 2.265 | 6.794 | .010(b) |
| X5 | -0.343 | -1.642 | 0.125 | | | | | |
| Step III | | | | | | | | |
| X14 | 0.772 | 4.01 | 0.002 | 0.704 | 0.63 | 2.732 | 9.518 | .0.002© |
| X5 | -0.517 | -2.872 | 0.014 | | | | | |
| X10 | -0.569 | -2.798 | 0.016 | | | | | |
| Step IV | | | | | | | | |
| X14 | 1.316 | 4.3 | 0.001 | 0.791 | 0.715 | 3.131 | 10.391 | 0.001(d) |
| X5 | -0.62 | -3.748 | 0.003 | | | | | |
| X10 | -0.573 | -3.211 | 0.008 | | | | | |
| X13 | -0.657 | -2.134 | 0.056 | | | | | |
| Step V | | | | | | | | |
| X14 | 1.503 | 4.593 | 0.001 | 0.822 | 0.733 | 3.108 | 9.253 | .002(e) |
| X5 | -0.578 | -3.553 | 0.005 | | | | | |
| X10 | -0.57 | -3.302 | 0.008 | | | | | |
| X13 | -0.7 | -2.34 | 0.041 | | | | | |
| X3 | -0.227 | -1.332 | 0.212 | | | | | |
| Step VI | | | | | | | | |
| X14 | 1.308 | 4.806 | 0.001 | 0.898 | 0.829 | 4.607 | 13.151 | 0.001(f) |
| X5 | -0.191 | -0.962 | 0.36 | | | | | |
| X10 | -0.965 | -4.674 | 0.001 | | | | | |
| X13 | -0.303 | -1.064 | 0.315 | | | | | |
| X3 | -0.451 | -2.785 | 0.021 | | | | | |
| X1 | -0.704 | -2.574 | 0.03 | | | | | |
| Step VII | | | | | | | | |
| X14 | 1.027 | 3.044 | 0.016 | 0.916 | 0.842 | 0.84 | 12.777 | 0.001(g) |
| X5 | -0.034 | -0.153 | 0.882 | | | | | |
| X10 | -1.032 | -5.037 | 0.001 | | | | | |
| X13 | -0.148 | -0.498 | 0.632 | | | | | |
| X3 | -0.392 | -2.425 | 0.042 | | | | | |
| X1 | -0.892 | -2.982 | 0.018 | | | | | |
| X15 | 0.223 | 1.319 | 0.224 | | | | | |
| | | | | | | | | Contd. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step VIII | | | | | | | | |
| X14 | 0.836 | 2.74 | 0.029 | 0.946 | 0.884 | 0.287 | 15.319 | 0.001(h) |
| X5 | 0.665 | 1.648 | 0.143 | | | | | |
| X10 | -1.491 | -5.119 | 0.001 | | | | | |
| X13 | -0.01 | -0.039 | 0.97 | | | | | |
| X3 | -0.541 | -3.429 | 0.011 | | | | | |
| X1 | -1.396 | -3.858 | 0.006 | | | | | |
| X15 | 0.345 | 2.192 | 0.062 | | | | | |
| X12 | -0.644 | -1.974 | 0.089 | | | | | |
| Step IX | | | | | | | | |
| X14 | 0.73 | 2.455 | 0.049 | -959 | 0.897 | -0.377 | 15.555 | 0.002(I) |
| X5 | 0.801 | 2.039 | 0.088 | | | | | |
| X10 | -1.646 | -5.548 | 0.001 | | | | | |
| X13 | 0.142 | 0.519 | 0.62 | | | | | |
| X3 | -0.645 | -3.869 | 0.008 | | | | | |
| X1 | -1.665 | -4.236 | 0.005 | | | | | |
| X15 | 0.408 | 2.63 | 0.039 | | | | | |
| X12 | -0.604 | -1.957 | 0.098 | | | | | |
| X11 | 0.164 | 1.374 | 0.219 | | | | | |
| Step X | | | | | | | | |
| X14 | 0.653 | 2.377 | 0.063 | 0.972 | 0.915 | -0.346 | 17.219 | 0.003(j) |
| X5 | 0.959 | 2.58 | 0.049 | | | | | |
| X10 | -1.74 | -6.295 | 0.001 | | | | | |
| X13 | 0.162 | 0.653 | 0.542 | | | | | |
| X3 | -0.534 | -3.176 | 0.025 | | | | | |
| X1 | -2.073 | -4.632 | 0.006 | | | | | |
| X15 | 0.428 | 3.027 | 0.029 | | | | | |
| X12 | -0.999 | -2.067 | 0.048 | | | | | |
| X11 | 0.263 | 2.077 | 0.092 | | | | | |
| X8 | 0.586 | 1.511 | 0.191 | | | | | |
| Step XI | | | | | | | | |
| X14 | 0.557 | 2.269 | 0.086 | 0.983 | 0.936 | -0.113 | 21.065 | .005(k) |
| X5 | 0.937 | 2.906 | 0.044 | | | | | |
| X10 | -1.742 | -7.267 | 0.002 | | | | | |
| X13 | 0.105 | 0.483 | 0.654 | | | | | |
| X3 | -1.333 | -1.745 | 0.156 | | | | | |
| X1 | -2.63 | -5.085 | 0.007 | | | | | |
| X15 | 0.438 | 3.565 | 0.023 | | | | | |
| X12 | -1.968 | -2.888 | 0.045 | | | | | |
| X11 | 0.262 | 2.387 | 0.075 | | | | | |
| X8 | 1.24 | 2.367 | 0.077 | | | | | |
| X6 | 0.807 | 1.628 | 0.179 | | | | | Contd. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step XII | | | | | | | | |
| X14 | 0.394 | 1.412 | 0.253 | 0.988 | 0.94 | 0.39 | 20.59 | .015(l) |
| X5 | 0.964 | 3.071 | 0.055 | | | | | |
| X10 | -1.707 | -7.273 | 0.005 | | | | | |
| X13 | 0.191 | 0.848 | 0.459 | | | | | |
| X3 | -0.366 | -1.951 | 0.146 | | | | | |
| X1 | -2.354 | -4.202 | 0.025 | | | | | |
| X15 | 0.551 | 3.518 | 0.039 | | | | | |
| X12 | -1.965 | -2.97 | 0.059 | | | | | |
| X11 | 0.304 | 2.689 | 0.074 | | | | | |
| X8 | 1.212 | 2.38 | 0.098 | | | | | |
| X6 | 0.734 | 1.512 | 0.228 | | | | | |
| X16 | -0.287 | -1.115 | 0.346 | | | | | |
| Step XIII | | | | | | | | |
| X14 | 0.722 | 2.768 | 0.11 | 0.996 | 0.969 | 6.207 | 37.291 | 0.026(m) |
| X5 | 0.742 | 2.948 | 0.098 | | | | | |
| X10 | -1.531 | -8.024 | 0.015 | | | | | |
| X13 | -0.101 | -0.459 | 0.691 | | | | | |
| X3 | -0.366 | -2.719 | 0.113 | | | | | |
| X1 | -2.073 | -4.864 | 0.04 | | | | | |
| X15 | 0.327 | 2.037 | 0.179 | | | | | |
| X12 | -2.031 | -4.272 | 0.051 | | | | | |
| X11 | 0.477 | 3.98 | 0.058 | | | | | |
| X8 | 1.497 | 3.81 | 0.062 | | | | | |
| X6 | 0.636 | 1.808 | 0.212 | | | | | |
| X16 | -0.503 | -2.339 | 0.144 | | | | | |
| X4 | -0.277 | -1.959 | 0.189 | | | | | |
| Step XIV | | | | | | | | |
| X14 | 0.724 | 3.087 | 0.199 | 0.998 | 0.975 | 4.601 | 42.953 | .119(m) |
| X5 | 0.361 | 0.932 | 0.522 | | | | | |
| X10 | -1.342 | -5.806 | 0.109 | | | | | |
| X13 | -0.161 | -0.792 | 0.574 | | | | | |
| X3 | -0.27 | -1.87 | 0.313 | | | | | |
| X1 | -2.002 | -5.165 | 0.122 | | | | | |
| X15 | 0.473 | 2.518 | 0.241 | | | | | |
| X12 | -2.208 | -4.89 | 0.128 | | | | | |
| X11 | 0.57 | 4.305 | 0.145 | | | | | |
| X8 | 0.661 | 4.393 | 0.142 | | | | | |
| X6 | 0.836 | 2.344 | 0.257 | | | | | |
| X16 | -0.74 | -2.693 | 0.226 | | | | | |
| X4 | -0.368 | -2.494 | 0.243 | | | | | |
| X2 | 0.448 | 1.214 | 0.439 | | | | | |

**Table 4.4a:** Zero-Order Correlation co-efficient matrix between TFR and Independent variables for Tamil Nadu in 1991.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | | | | | | | | | | |
| X1 | -0.44* | 1 | | | | | | | | | | | | | | | |
| X2 | -0.608** | 0.671** | 1 | | | | | | | | | | | | | | |
| X3 | 0.109 | -0.319 | -0.199 | 1 | | | | | | | | | | | | | |
| X4 | 0.002 | -0.319 | 0.024 | 0.407 | 1 | | | | | | | | | | | | |
| X5 | -0.527* | 0.628** | 0.819** | -0.011 | -0.109 | 1 | | | | | | | | | | | |
| X6 | -0.508* | 0.597** | 0.814** | -0.12 | -0.106 | 0.337** | 1 | | | | | | | | | | |
| X7 | -0.445* | 0.57** | 0.817** | -0.067 | -0.11 | 0.885** | 0.783** | 1 | | | | | | | | | |
| X8 | -0.369 | 0.79** | 0.748** | -0.49* | -0.295 | 0.711** | 0.747** | 0.722** | 1 | | | | | | | | |
| X9 | -0.563** | 0.717** | 0.851** | -0.211 | -0.17 | 0.936** | 0.815** | 0.862** | 0.871** | 1 | | | | | | | |
| X10 | 0.247 | -0.776** | -0.736** | 0.222 | 0.132 | -0.532* | -0.67** | -0.546* | -0.685** | -0.589** | 1 | | | | | | |
| X11 | -0.23 | 0.018 | -0.104 | 0.512* | 0.514* | -0.084 | -0.145 | -0.258 | -0.382 | -0.199 | 0.165 | 1 | | | | | |
| X12 | -0.333 | 0.549** | 0.797** | -0.207 | -0.156 | 0.789** | 0.94** | 0.74** | 0.798** | 0.779** | -0.695** | -0.34 | 1 | | | | |
| X13 | 0.365 | -0.712** | -0.548** | 0.353 | 0.07 | -0.456* | -0.5* | -0.372 | -0.532* | -0.507* | 0.749** | -0.098 | -0.458* | 1 | | | |
| X14 | 0.383 | -0.737** | -0.619** | 0.16 | 0.012 | -0.512* | -0.576** | -0.401 | -0.515* | -0.543* | 0.822** | -0.119 | -0.509* | 0.913** | 1 | | |
| X15 | 0.228 | 0.161 | -0.547** | 0.0001 | -0.416 | -0.272 | -0.397 | -0.369 | -0.127 | -0.256 | 0.265 | 0.165 | -0.34 | 0.086 | 0.124 | 1 | |
| X16 | -0.461* | 0.874** | 0.362 | -0.361 | -0.463* | 0.322 | -0.317 | 0.37 | 0.573** | 0.441* | -0.51* | 0.112 | 0.249 | 0.519* | -0.526* | 0.475* | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.4b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Independent Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X2 | -0.608 | -3.334 | 0.003 | 0.369 | 0.336 | 3.076 | 11.114 | 0.003(a) |
| Step II | | | | | | | | |
| X2 | -0.929 | -3.616 | 0.002 | 0.456 | 0.396 | 4.093 | 7.552 | 0.004(b) |
| X10 | -0.436 | -1.699 | 0.107 | | | | | |
| Step III | | | | | | | | |
| X2 | -0.943 | -4.264 | 0.001 | 0.619 | 0.552 | 8.15 | 9.22 | 0.001© |
| X10 | -0.686 | -2.863 | 0.011 | | | | | |
| X16 | -0.47 | -2.699 | 0.015 | | | | | |
| Step IV | | | | | | | | |
| X2 | -0.441 | -1.381 | 0.186 | 0.698 | 0.623 | 3.84 | 9.247 | 0.000(d) |
| X10 | -0.774 | -3.451 | 0.003 | | | | | |
| X16 | -1.016 | -3.26 | 0.005 | | | | | |
| X15 | 0.675 | 2.042 | 0.058 | | | | | |
| Step V | | | | | | | | |
| X2 | -0.415 | -1.37 | 0.191 | 0.745 | 0.661 | 2.979 | 8.785 | 0.000(e) |
| X10 | -1.06 | -3.883 | 0.001 | | | | | |
| X16 | -0.972 | -3.277 | 0.005 | | | | | |
| X15 | 0.691 | 2.205 | 0.044 | | | | | |
| X14 | 0.392 | 1.671 | 0.115 | | | | | |
| Step VI | | | | | | | | |
| X2 | -0.828 | -2.078 | 0.057 | 0.781 | 0.688 | 7.544 | 8.335 | 0.001(f) |
| X10 | -0.832 | -2.759 | 0.015 | | | | | |
| X16 | -1.327 | -3.6 | 0.003 | | | | | |
| X15 | 0.42 | 1.199 | 0.251 | | | | | |
| X14 | 0.461 | 2.005 | 0.065 | | | | | |
| X1 | 0.897 | 1.515 | 0.152 | | | | | |
| Step VII | | | | | | | | |
| X2 | -0.216 | -0.415 | 0.685 | 0.821 | 0.725 | 6.087 | 8.519 | 0.001(g) |
| X10 | -0.639 | -2.091 | 0.057 | | | | | |
| X16 | -1.783 | -4.071 | 0.001 | | | | | |
| X15 | 0.73 | 1.942 | 0.074 | | | | | |
| X14 | 0.414 | 1.901 | 0.08 | | | | | |
| X1 | 1.266 | 2.122 | 0.054 | | | | | |
| X5 | -0.502 | -1.699 | 0.113 | | | | | |
| | | | | | | | | Contd. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step VIII | | | | | | | | |
| X2 | -0.209 | -0.404 | 0.693 | 0.836 | 0.726 | 6.034 | 7.622 | 0.001(h) |
| X10 | -0.671 | -2.19 | 0.049 | | | | | |
| X16 | -1.834 | -4.174 | 0.001 | | | | | |
| X15 | 0.801 | 2.1 | 0.057 | | | | | |
| X14 | 0.59 | 1.798 | 0.099 | | | | | |
| X1 | 1.171 | 1.943 | 0.076 | | | | | |
| X5 | -0.442 | -1.471 | 0.167 | | | | | |
| X3 | -0.14 | -1.03 | 0.323 | | | | | |
| Step IX | | | | | | | | |
| X2 | -0.328 | -0.661 | 0.522 | 0.865 | 0.754 | 7.058 | 7.822 | 0.001(I) |
| X10 | -0.624 | -2.142 | 0.055 | | | | | |
| X16 | -1.952 | -4.611 | 0.001 | | | | | |
| X15 | 0.776 | 2.147 | 0.055 | | | | | |
| X14 | -0.079 | -0.214 | 0.835 | | | | | |
| X1 | 1.357 | 2.327 | 0.04 | | | | | |
| X5 | -0.412 | -1.444 | 0.177 | | | | | |
| X3 | -0.264 | -1.739 | 0.11 | | | | | |
| X13 | 0.516 | 1.544 | 0.151 | | | | | |
| Step X | | | | | | | | |
| X2 | -0.404 | -0.79 | 0.448 | 0.874 | 0.748 | 7.342 | 6.927 | 0.003(j) |

behaviour. Because of this, these variables are not giving significant results. It is so because their effect on fertility behaviour is already explained and the influence of these variables is undermined. Therefore, in the successive analysis all the independent variables are not treated as one set. In the subsequent exercise social, economic and demographic variables are taken separately for the stepwise regression analysis.

**EXPLANATIONS OF FRTILITY BEHAVIOUR THROUGH SOCIAL ASPECTS:**

In this section the influence of social variables on fertility behaviour is examined by the statistical tools viz. correlation and stepwise regression. Here changes in dependent variable with changing social aspects have been examined. These social variables are independent in nature.

For Rajasthan during 1981, the correlation matrix (table 4.5a) shows significant relationship of TFR with social variables. The correlation coefficients are also supporting our hypothetical base. According to the stepwise regression analysis (table 4.5b), the estimated regression equation for the same period for Rajasthan is as follows.

$$Y = 6.46 - 0.54X_1$$

$$(-3.140)$$

$\bar{R}^2 = 0.262$ F value = 9.862

Here it is evident from the above equation that only female literacy is an important explanatory variable, explaining more than 26% change in fertility behaviour. In this equation it is clear that a unit change in female literacy can bring down fertility by 0.54 units.

Table 4.6a shows that the correlation coefficients for 1991, between TFR and social variables are statistically insignificant. Their direction of influence is asserting our hypothetical assumptions. Estimated regression equation for the same period is as follows which is drawn from the stepwise regression analysis, (table 4.6b).

$$Y = 6.10 - 1.11X_7 + 0.68X_1 + 0.27X_3$$

$$(-4.476) \quad (2.701) \quad (1.818)$$

$\bar{R}^2 = 0.465$ F value = 8.525

**Table 4.5a:** Zero-Order Correlation co-efficient matrix between TFR and Social variables for Rajasthan in 1981.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | |
| X1 | -0.54** | 1 | | | | | | |
| X2 | -0.39* | 0.746** | 1 | | | | | |
| X3 | -0.005 | 0.244 | 0.118 | 1 | | | | |
| X4 | 0.076 | -0.224 | -0.085 | -0.731** | 1 | | | |
| X5 | -0.508** | 0.875** | 0.696** | 0.325 | -0.457* | 1 | | |
| X6 | -0.436* | 0.785** | 0.561** | -0.061 | -0.168 | 0.807** | 1 | |
| X7 | -0.506** | 0.812** | 0.767** | 0.089 | -0.087 | 0.719** | 0.662** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.5b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Social Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X1 | -0.54 | -3.14 | 0.004 | 0.291 | 0.262 | 6.633 | 9.862 | 0.004(a) |
| Step II | | | | | | | | |
| X1 | -0.573 | -3.203 | 0.004 | 0.308 | 0.248 | 6.458 | 5.129 | 0.014(b) |

**Table 4.6a:** Zero-Order Correlation co-efficient matrix between TFR and Social variables for Rajasthan in 1991.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| **Y1** | | | | | | | | |
| **X1** | -0.165 | 1 | | | | | | |
| **X2** | -0.24 | 0.654** | 1 | | | | | |
| **X3** | 0.249 | 0.231 | 0.009 | | | | | |
| **X4** | -0.225 | -0.248 | 0 | -0.738** | 1 | | | |
| **X5** | -0.154 | 0.819** | 0.695** | 0.306 | -0.45* | 1 | | |
| **X6** | -0.318 | 0.65** | 0.619** | -0.133 | -0.107 | 0.729** | 1 | |
| **X7** | -0.514** | 0.816** | 0.586** | 0.16 | -0.156 | 0.767** | 0.633** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.6b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Social Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X7 | -0.514 | -2.996 | 0.0001 | 0.264 | 0.235 | 6.469 | 8.976 | 0.006(a) |
| Step II | | | | | | | | |
| X7 | -1.137 | -4.372 | 0.0001 | 0.458 | 0.413 | 6.608 | 10.16 | 0.001(b) |
| X1 | 0.763 | 2.934 | 0.007 | | | | | |
| Step III | | | | | | | | |
| X7 | -1.113 | -4.476 | 0.0001 | 0.526 | 0.465 | 6.103 | 8.525 | 0.001© |
| X1 | 0.682 | 2.701 | 0.013 | | | | | |
| X3 | 0.268 | 1.818 | 0.082 | | | | | |
| Step IV | | | | | | | | |
| X1 | -1.178 | 4.453 | 0.0001 | 0.539 | 0.455 | 6.254 | 6.432 | 0.001(d) |

**Table 4.7a:** Zero-Order Correlation co-efficient matrix between TFR and Social variables for Tamil Nadu in 1981.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | |
| X1 | -0.43 | 1 | | | | | | |
| X2 | -0.606* | 0.763** | 1 | | | | | |
| X3 | 0.196 | -0.406 | -0.293 | 1 | | | | |
| X4 | -0.057 | -0.301 | -0.053 | 0.248 | 1 | | | |
| $X_5$ | -0.532* | 0.671** | 0.867** | 0.038 | 0.118 | 1 | | |
| X6 | -0.431 | 0.797** | 0.849** | -0.263 | -0.268 | 0.879** | 1 | |
| X7 | -0.504* | 0.676** | 0.881** | -0.156 | -0.082 | 0.905** | 0.901** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.7b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Social Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X2 | -0.606 | -2.851 | 0.013 | 0.367 | 0.322 | 4.589 | 8.125 | 0.013(a) |
| Step II | | | | | | | | |
| X2 | -0.858 | -2.097 | 0.056 | 0.392 | 0.298 | 4.833 | 4.188 | .039(b) |

**Table 4.8a:** Zero-Order Correlation co-efficient matrix between TFR and Social variables for Tamil Nadu in 1991.

| Variables | Y1 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | | | |
| X1 | -0.444* | 1 | | | | | | |
| X2 | -0.608** | 0.671** | 1 | | | | | |
| X3 | 0.109 | -0.319 | -0.199 | 1 | | | | |
| X4 | 0.002 | -0.319 | 0.024 | 0.407 | 1 | | | |
| X5 | -0.527* | 0.628** | 0.819** | -0.011 | -0.109 | 1 | | |
| X6 | -0.508* | 0.597** | 0.814** | -0.12 | -0.106 | 0.837** | 1 | |
| X7 | -0.445* | 0.57** | 0.817** | -0.067 | -0.11 | 0.885** | 0.783** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.8b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Social Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X2 | -0.608 | -3.334 | 0.003 | 0.369 | 0.336 | 3.076 | 11.114 | 0.003(a) |
| Step II | | | | | | | | |
| X2 | -0.733 | -2.271 | 0.036 | 0.377 | 0.308 | 2.966 | 5.444 | 0.014(b) |

In this equation it is found that around 47% variation in fertility behaviour is explained by three social variables like physical standard of living, female literacy and % of SC population to the total population. Here the maximum influence on fertility is seen of physical standard of living and female literacy. Here it is clear that, in the period of 1980s physical standard of living and the proportion of scheduled caste population have emerged as important variables along with the status of female literacy.

In case of Tamil Nadu in 1981, the fertility behaviour is found to be significantly correlated with the social variables. This relationship is also found similar as hypothetically presumed (table 4.7a). According to table 4.7b, the estimated regression equation for the similar period for Tamil Nadu is as follows.

$$Y = 4.59 - 0.61X_2$$

$$(-2.851)$$

$$\bar{R}^2 = 0.322 \qquad F = 8.125$$

Here in this equation it is inferred that more than 32% variation in fertility behaviour is explained by female literacy upto secondary and above and F-test is significant for $\bar{R}^2$ at 5% level. It is found that a unit change in female literacy upto secondary and above can bring 0.61 unit reduction in fertility behaviour.

Again in 1991 for Tamil Nadu the pattern of correlation coefficient is supporting the hypotheses and a considerable correlation is found between TFR and social variables. This can be seen in correlation matrix given in table 4.8a. Estimated regression equation is drawn from the results of stepwise regression (table 4.8b).

$$Y = 3.076 - 0.61X_2$$

$$(-3.334)$$

$$\bar{R}^2 = 0.336 \qquad \text{F- value} = 11.114$$

In 1991 also, female literacy upto secondary and above is explaining around 34% change in fertility behaviour. Regression coefficient is also significant at 1% level. Here too a unit change in female literacy upto secondary and above can lower fertility by 0.61 units. So the situation regarding to the influence of social variables on fertility is remained similar during 1980s.

**EXPLANATIONS OF FRTILITY BEHAVIOUR THROUGH ECONOMIC ASPECTS:**

In this part of analysis influence of economic aspects on fertility behaviour is examined in quantitative manner. Here it is envisaged that how much change in fertility behaviour can be explained through the economic variables.

In the correlation matrix for Rajasthan during 1981, considerable association between fertility and economic variables is found, (table 9a). From the results of stepwise regression (table 9b) estimated regression equation is drawn as follows.

$$Y = 8.16 - 0.64X_9 - 0.67X_{10} - 0.36X_{11}$$

$$(-2.208) \quad (-3.181) \quad (-2.196)$$

$\bar{R}^2 = 0.277$ F-value = 4.196

Here it is evident that more than 27% variation in fertility behaviour is explained through percentage of main workers engaged in non-primary sector, female work participation and land-man ratio. F-test is significant for $\bar{R}^2$ at 5% level. Maximum change in fertility behaviour is revealed by proportion of main workers in non-primary sector, where unit change in this can bring down fertility by 0.64 units.

For the period of 1991, correlation matrix is depicting considerable correlation between fertility behaviour and variables related to economic aspects in Rajasthan, (table 4.10a). The estimated regression equation is drawn for the same period of time from the stepwise regression analysis (table 4.10b), which is given below.

$$Y = 8.86 - 0.97X_{10} - 0.34X_9 - 0.21X_{11} - 0.34X_8$$

$$(-3.753) \quad (-1.574) \quad (-1.246) \quad (-1.207)$$

$\bar{R}^2 = 0.333$ F-value = 4.238

In this equation four economic variables are explaining more than 33% variation in fertility behaviour. These are female work participation, proportion of female workers in non-primary sector, land-man ratio and proportion of main workers in non-primary sector. Here F-test is significant for $\bar{R}^2$ at 5% level of significance. During this time female work participation has emerged as the most important economic variable influencing fertility behaviour. A unit change in this economic aspect can bring 0.97 units reduction in fertility behaviour.

**Table 4.9a:** Zero-Order Correlation co-efficient matrix between TFR and Economic variables for Rajasthan in 1981.

| Variables | Y1 | X8 | X9 | X10 | X11 | X12 |
|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | |
| X8 | 0.052 | 1 | | | | |
| X9 | -0.338 | 0.578** | 1 | | | |
| X10 | -0.166 | -0.6** | -0.51** | 1 | | |
| X11 | -0.098 | 0.258 | 0.117 | -0.502** | 1 | |
| X12 | -0.171 | 0.056 | 0.337 | 0.125 | -0.503** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.9b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Economic Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X9 | -0.338 | -1.762 | 0.091 | 0.115 | 0.078 | 6.502 | 3.104 | 0.091(a) |
| Step II | | | | | | | | |
| X9 | -0.572 | -2.76 | 0.011 | 0.269 | 0.206 | 7.465 | 4.24 | 0.027(b) |
| X10 | -0.458 | | | | | | | |
| Step III | | | | | | | | |
| X9 | -0.64 | -2.208 | 0.037 | 0.364 | 0.277 | 8.157 | 4.196 | 0.017© |
| X10 | -0.674 | -3.181 | 0.004 | | | | | |
| X11 | -0.362 | -2.916 | 0.008 | | | | | |
| Step IV | | | | | | | | |
| X9 | -0.716 | -1.808 | 0.084 | 0.387 | 0.27 | 7.976 | 3.31 | 0.030(d) |

**Table 4.10a:** Zero-Order Correlation co-efficient matrix between TFR and Economic variables for Rajasthan in 1991.

| Variables | Y1 | X8 | X9 | X10 | X11 | X12 |
|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | |
| X8 | 0.152 | 1 | | | | |
| X9 | -0.059 | 0.67** | 1 | | | |
| X10 | -0.464* | -0.768** | -0.567** | 1 | | |
| X11 | -0.071 | 0.112 | 0.182 | -0.245 | 1 | |
| X12 | 0.13 | 0.234 | 0.316 | -0.165 | -0.587** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.10b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Economic Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X10 | -4.64 | -2.62 | 0.015 | 0.215 | 0.184 | 6.244 | 6.865 | 0.015(a) |
| Step II | | | | | | | | |
| X10 | -0.734 | -3.728 | 0.001 | 0.369 | 0.316 | 7.832 | 7.014 | 0.004(b) |
| X9 | -0.476 | -2.416 | 0.024 | | | | | |
| Step III | | | | | | | | |
| X10 | -0.771 | -3.862 | 0.001 | 0.398 | 0.319 | 8.143 | 5.065 | 0.008© |
| X9 | -0.465 | -2.361 | 0.027 | | | | | |
| X11 | -0.176 | -1.051 | 0.304 | | | | | |
| Step IV | | | | | | | | |
| X10 | -0.973 | -3.753 | 0.001 | 0.435 | 0.333 | 8.863 | 4.238 | 0.011(d) |
| X9 | -0.344 | -1.574 | 0.13 | | | | | |
| X11 | -0.209 | -1.246 | 0.226 | | | | | |
| X8 | -0.342 | -1.207 | 0.24 | | | | | |
| Step V | | | | | | | | |
| X10 | -0.959 | -3.574 | 0.002 | 0.438 | 0.304 | 8.723 | 3.273 | 0.024(e) |

In case of Rajasthan for 1981 and 1991 pattern is more or less similar. The only difference is that in 1991 model, proportion of female workers in non-primary sector is also included as an important variable influencing fertility. However it is not included in the regression model of 1981.

For Tamil Nadu during 1981, correlation coefficients between TFR and economic variables are statistically insignificant except for proportion of main workers in non-primary sector. However, in general their direction of association is supporting our hypotheses, (table 4.11a). According to the stepwise regression analysis (table 4.11b), estimated regression equation for the same period is as follows.

$$Y = 5.21 - 0.8X_9 - 0.30X_{11} - 0.32X_{10}$$

$$(-2.704) \quad (-1.277) \quad (-1.112)$$

$\bar{R}^2 = 0.247$ F-value = 2.636

In this equation three variables, like proportion of main workers in non-primary sector, land-man ratio and female work participation are explaining around 25% variation in fertility behaviour. The proportion of main workers in non-primary sector is seen to explain the maximum change in fertility behaviour. A unit change in this variable can reduce fertility by 0.8 units. However, it is clear that there are some other economic variables also, outside the considered variables, which are influencing fertility behaviour.

The correlation coefficients between TFR and economic variables for 1991 are showing similar results as these were found in 1981 for Tamil Nadu, (table 4.12a). According to the stepwise regression analysis (table 4.12b), estimated regression equation for the same period is as follows.

$$Y = 3.06 - 0.63X_9 - 0.36X_{11}$$

$$(-3.516) \quad (-1.974)$$

$\bar{R}^2 = 0.376$ F-value = 7.025

Here it is found that variables like proportion of main workers in non-primary sector and land-man ratio are explaining more than 37% variation in fertility behaviour and F-test is also significant at 1% level for $\bar{R}^2$. Proportion of main workers

**Table 4.11a:** Zero-Order Correlation co-efficient matrix between TFR and Economic variables for Tamil Nadu in 1981.

| Variables | Y1 | X8 | X9 | X10 | X11 | X12 |
|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | |
| X8 | –0.355 | 1 | | | | |
| X9 | -0.503* | 0.89** | 1 | | | |
| X10 | 0.114 | -0.758** | -0.617* | 1 | | |
| X11 | -0.104 | -0.37 | -0.33 | 0.203 | 1 | |
| X12 | -0.397 | 0.839** | 0.905** | -0.699** | -0.336 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.11b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Economic Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X9 | -0.503 | -2.18 | 0.047 | 0.253 | 0.2 | 4.041 | 4.751 | 0.047(a) |
| Step II | | | | | | | | |
| X9 | -0.603 | -2.518 | 0.026 | 0.335 | 0.233 | 4.388 | 3.276 | 0.070(b) |
| X11 | -0.303 | -1.264 | 0.228 | | | | | |
| Step III | | | | | | | | |
| X9 | -0.799 | -2.704 | 0.019 | 0.397 | 0.247 | 5.207 | 2.636 | 0.098© |
| X11 | -0.303 | -1.277 | 0.226 | | | | | |
| X10 | -0.317 | -1.112 | 0.288 | | | | | |
| Step IV | | | | | | | | |
| X9 | -0.82 | -1.564 | 0.146 | 0.397 | 0.178 | 5.188 | 1.813 | 0.197(d) |

**Table 4.12a:** Zero-Order Correlation co-efficient matrix between TFR and Economic variables for Tamil Nadu in 1991.

| Variables | Y1 | X8 | X9 | X10 | X11 | X12 |
|---|---|---|---|---|---|---|
| Y1 | 1 | | | | | |
| X8 | -0.369 | 1 | | | | |
| X9 | -0.563** | 0.871** | 1 | | | |
| X10 | 0.247 | -0.685** | -0.589** | 1 | | |
| X11 | -0.23 | -0.382 | -0.199 | 0.165 | 1 | |
| X12 | -0.333 | 0.798** | 0.779** | -0.655** | -0.34 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.12b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Economic Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X9 | -0.563 | -2.968 | 0.008 | 0.317 | 0.281 | 2.774 | 8.809 | 0.008(a) |
| Step II | | | | | | | | |
| X9 | -0.634 | -3.516 | 0.002 | 0.438 | 0.376 | 3.06 | 7.025 | 0.006(b) |
| X11 | -0.356 | -1.974 | 0.064 | | | | | |
| Step III | | | | | | | | |
| X9 | -0.834 | -2.176 | 0.044 | 0.45 | 0.353 | 3.091 | 4.633 | 0.015© |

in non-primary sector has shown maximum influence on fertility behaviour and unit change in this can bring down fertility level by 0.63 units.

The only difference between 1981 and 1991 results is that, during 1981 female work participation is also included in the regression model as an important factor influencing factor. However, value of $\bar{R}^2$ was significant at 10% level. Whereas in 1991, female work participation is not found significant but for the other variables F-test is significant for $\bar{R}^2$ at 1% level.

**EXPLANATIONS OF FRTILITY BEHAVIOUR THROUGH DEMOGRAPHIC ASPECTS:**

In this section, the influence of demographic variables on fertility behaviour is investigated through statistical methods. In this section, it is studied that how much variation in fertility behaviour can be explained by the demographic aspects and which are the demographic variables having maximum influence on fertility.

The table 4.13a shows correlation coefficients between TFR and demographic variables for Rajasthan in 1981. The CMR and sex ratio have good association with fertility behaviour. The estimated regression equation for the same period is drawn from the stepwise regression analysis (table 4.13b), which is as follows.

$$Y = 5.13 + 0.49X_{14} + 0.27X_{16} - 0.25X_{15}$$

$$(2.463) \quad (1.359) \quad (-1.348)$$

$\bar{R}^2 = 0.178$ F-value = 2.805

Here it is clear from the above equation that, CMR, female age at marriage and sex ratio are together explaining only 18% variation in fertility behaviour. The value of $\bar{R}^2$ is also significant only on 10% level of significance. In this equation it has seen that female age at marriage is not in accordance to our hypotheses. So it is obvious that there are some other important demographic variables, other than the considered variables, which have significant influence on fertility too.

For Rajasthan in 1991, the correlation coefficients between fertility behaviour and demographic variables also show that sex ratio and female age at marriage are strengthening our hypothetical base. These variables are negatively associated with fertility behaviour, (table 4.14a). On the other hand, IMR and CMR are giving

**Table 4.13a:** Zero-Order Correlation co-efficient matrix between TFR and Demographic variables for Rajasthan in 1981.

| Variables | Y1 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|
| Y1 | 1 | | | | |
| X13 | 0.18 | 1 | | | |
| X14 | 0.39* | 0.506** | 1 | | |
| X15 | -0.27 | -0.107 | -0.045 | 1 | |
| X16 | 0.07 | -0.066 | -0.415* | -0.01 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.13b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Demographic Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| | | | | Step I | | | | |
| X14 | 0.39 | 2.077 | 0.049 | 0.152 | 0.117 | 5.177 | 4.313 | 0.049(a) |
| | | | | Step II | | | | |
| X14 | 0.506 | 2.496 | 0.02 | 0.217 | 0.149 | 2.882 | 3.187 | 0.060(b) |
| X16 | 0.279 | 1.378 | 0.181 | | | | | |
| | | | | Step III | | | | |
| X14 | 0.492 | 2.463 | 0.022 | 0.277 | 0.178 | 5.133 | 2.805 | 0.063© |
| X16 | 0.271 | 1.359 | 0.188 | | | | | |
| X15 | -0.245 | -1.348 | 0.192 | | | | | |
| | | | | Step IV | | | | |
| X14 | 0.553 | 2.319 | 0.031 | 0.285 | 0.149 | 5.16 | 2.092 | 0.118(d) |

**Table 4.14a:** Zero-Order Correlation co-efficient matrix between TFR and Demographic variables for Rajasthan in 1991.

| Variables | Y1 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|
| Y1 | | | | | |
| X13 | -0.107 | 1 | | | |
| X14 | -0.006 | 0.869** | 1 | | |
| X15 | -0.561** | 0.223 | 0.095 | 1 | |
| X16 | -0.261 | -0.01 | 0.077 | 0.026 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.14b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Demographic Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X15 | -0.561 | -3.387 | 0.002 | 0.315 | | 12.048 | 11.47 | 0.002(a) |
| Step II | | | | | | | | |
| X15 | -0.554 | -3.434 | 0.002 | 0.375 | 0.323 | 16.14 | 7.206 | 0.004(b) |
| X16 | -0.246 | -1.527 | 0.14 | | | | | |
| Step III | | | | | | | | |
| X15 | -0.561 | -3.397 | 0.002 | 0.38 | 0.299 | 16.096 | 4.691 | 0.011© |

insignificant results and contradicting our hypothetical statements. From the stepwise regression analysis (table 4.14b), estimated regression equation for this period is as follows.

$$Y = 16.14 - 0.55X_{15} - 0.25X_{16}$$

$$(-3.434) \quad (-1.527)$$

$$\bar{R}^2 = 0.323 \qquad \text{F-value} = 7.206$$

Here, it is evident that sex ratio and female age at marriage are explaining more than 32% variation in fertility behaviour and F-test is significant for $\bar{R}^2$ at 1% level. Sex ratio is giving the maximum explanation for fertility change.

From 1981 to 1991, there is considerable difference in results. In 1981, CMR and female age at marriage are having direct relationship with fertility. While in 1991, CMR influence is coming insignificant and female age at marriage is showing inverse relationship with fertility behaviour. As a result, we can infer that the influence of demographic variables, chosen for this exercise is not predictable for Rajasthan.

In case of Tamil Nadu, during 1981, the correlation matrix (table 4.15a) has shown significant relationship between fertility and demographic aspects. The correlation coefficients are also asserting our hypotheses. From the stepwise regression analysis (table 4.15b), estimated regression equation for 1981 is given below.

$$Y = -3.53 + 0.19X_{14} + 0.55X_{15} - 0.43X_{16}$$

$$(0.676) \quad (2.114) \quad (-1.745)$$

$$\bar{R}^2 = 0.477 \qquad \text{F-value} = 5.568$$

In this equation it is found that around 48% variation in fertility behaviour is elucidated by three demographic variables like CMR, sex ratio and female age at marriage. F-test is significant for $\bar{R}^2$ at 5% level. Here, it has been found that female age at marriage is negatively related with fertility but CMR and sex ratio are having direct relationship. These results are in accordance to our hypotheses.

For the same state in 1991, correlation results are showing similar pattern as found in 1981, (table 4.16a). From the stepwise regression analysis (table 4.16b), estimated regression equation is drawn for the similar period, which is as follows.

**Table 4.15a:** Zero-Order Correlation co-efficient matrix between TFR and Demographic variables for Tamil Nadu in 1981.

| Variables | Y1 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|
| Y1 | 1 | | | | |
| X13 | 0.481 | 1 | | | |
| X14 | 0.64** | 0.882** | 1 | | |
| X15 | 0.552* | 0.47 | 0.519* | 1 | |
| X16 | -0.368 | -0.197 | -0.39 | 0.234 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.15b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Demographic Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X14 | 0.64 | 3.117 | 008 | 0.41 | 0.368 | 1.599 | 9.717 | 0.008(a) |
| Step II | | | | | | | | |
| X14 | 0.484 | 2.061 | 0.06 | 0.476 | 0.395 | -3.83 | 5.901 | 0.015(b) |
| X15 | 0.301 | 1.281 | 0.223 | | | | | |
| Step III | | | | | | | | |
| X14 | 0.187 | 0.676 | 0.512 | 0.582 | 0.477 | -3.532 | 5.568 | 0.013© |
| X15 | 0.554 | 2.114 | 0.056 | | | | | |
| X16 | -0.425 | -1.745 | 0.106 | | | | | |
| Step IV | | | | | | | | |
| X14 | 0.345 | 0.63 | 0.541 | 0.586 | 0.436 | -3.557 | 3.897 | 0.033(d) |

**Table 4.16a:** Zero-Order Correlation co-efficient matrix between TFR and Demographic variables for Tamil Nadu in 1991.

| Variables | Y1 | X13 | X14 | X15 | X16 |
|---|---|---|---|---|---|
| Y1 | 1 | | | | |
| X13 | 0.365 | 1 | | | |
| X14 | 0.383 | 0.913** | 1 | | |
| X15 | 0.228 | 0.086 | 0.134 | 1 | |
| X16 | -0.461* | -0.519* | -0.526* | 0.475* | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.16b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Demographic Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| X16 | -0.461 | -2.361 | 0.036 | 0.212 | 0.171 | 5.899 | 5.114 | 0.036(a) |
| Step II | | | | | | | | |
| X16 | -0.735 | -3.768 | 0.001 | 0.47 | 0.411 | 1.155 | 7.981 | 0.003(b) |
| X15 | 0.577 | 2.96 | 0.008 | | | | | |
| Step III | | | | | | | | |
| X16 | -0.851 | -3.161 | 0.006 | 0.482 | 0.391 | 1.428 | 5.282 | 0.009© |

$$Y = 1.16 - 0.74X_{16} + 0.58X_{15}$$

$$(-3.768) \quad (2.961)$$

$\bar{R}^2 = 0.411$ F- value = 7.981

Here, the maximum variation in fertility is explained by female age at marriage. A unit change in this can reduce fertility by 0.74 units. This variable along with sex ratio is explaining 41% change in fertility behaviour and F-test is significant for $\bar{R}^2$ at 1% level.

For 1981, CMR is providing the maximum explanation for variation in fertility whereas in 1991, influence of female age at marriage on fertility is observed to be the most effective and CMR is statistically insignificant.

Further it is also important to see the collective influence of social, economic and demographic variables separately. In the subsequent analysis, more closely associated variables such as the social, economic and demographic variables are combined within a single factor. These factor scores for social, economic and demographic variables separately, are computed through modified Principal Component Analysis.

For Rajasthan, in 1981, correlation coefficients between fertility and all the three factor scores show that the only factor score for the social variables has significant reciprocal relationship with fertility. On the other side, the rest two are statistically insignificant, (table 4.17a). According to the stepwise regression analysis (table 4.17b), estimated regression equation is as follows for the same time period.

$$Y = 6.75 - 0.53FSSOC$$

$$(-3.042)$$

$\bar{R}^2 = 0.248$ F-value = 9.252

Here, it is found that around 25% variation in fertility behaviour is elucidated by social factors and F-test is significant at 1% level for the value of $\bar{R}^2$. From this equation, it is inferred that a unit change in combined social factor can bring down fertility by 0.53 units.

**Table 4.17a:** Zero-Order Correlation co-efficient matrix between TFR and factor scores for Rajasthan in 1981.

| Variables | TFR | FSSOC | FSECO | FSDEMO |
|---|---|---|---|---|
| TFR | 1 | | | |
| | | | | |
| FSSOC | -0.527** | 1 | | |
| | | | | |
| FSECO | -0.299 | -0.681** | 1 | |
| | | | | |
| FSDEMO | 0.167 | 0.006 | -0.185 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.17b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Independent (Factor Score) Variables, 1981

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| FSSOC | -0.527 | -3.042 | 0.006 | 0.278 | 0.248 | 6.751 | 9.252 | 0.006(a) |
| Step II | | | | | | | | |
| FSSOC | -0.528 | -3.045 | 0.006 | 0.307 | 0.247 | 6.245 | 5.103 | 0.015(b) |
| FSDEMO | 0.171 | 0.983 | 0.336 | | | | | |
| Step III | | | | | | | | |
| FSSOC | -0.654 | -2.689 | 0.013 | 0.324 | 0.232 | 5.879 | 3.522 | 0.032© |
| FSDEMO | 0.206 | 1.133 | 0.269 | | | | | |
| FSECO | 0.185 | 0.746 | 0.464 | | | | | |

**Table 4.18a:** Zero-Order Correlation co-efficient matrix between TFR and factor scores for Rajasthan in 1991.

| Variables | TFR | FSSOC | FSECO | FSDEMO |
|---|---|---|---|---|
| TFR | 1 | | | |
| | | | | |
| FSSOC | -0.367 | 1 | | |
| | | | | |
| FSECO | 0.02 | 0.691** | 1 | |
| | | | | |
| FSDEMO | -0.147 | -0.176 | -0.39** | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.18b:** Predictor variable selected on the basis of Stepwise Regression Method for Rajasthan with TFR and Independent (Factor Score) Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| FSSOC | -0.367 | -1.971 | 0.06 | 0.134 | 0.1 | 6.095 | 3.885 | 0.060(a) |
| Step II | | | | | | | | |
| FSSOC | -0.729 | -3.037 | 0.006 | 0.278 | 0.218 | 5.471 | 4.617 | 0.020(b) |
| FSECO | 0.524 | 2.183 | 0.039 | | | | | |
| Step III | | | | | | | | |
| FSSOC | -0.713 | -2.984 | 0.008 | 0.284 | 0.191 | 6.062 | 3.041 | 0.049© |
| FSECO | 0.48 | 1.822 | 0.082 | | | | | |
| FSDEMO | -0.086 | -0.443 | 0.662 | | | | | |

For 1991, correlation coefficients between fertility and factor scores are not statistically significant, (table 4.18a). According to the stepwise regression analysis (table 4.18b), the estimated regression equation for this is given below.

$$Y = 5.47 - 0.73FSSOC + 0.52FSECO$$

$$(-3.037) \qquad (2.183)$$

$\bar{R}^2 = 0.218$ F -value = 4.167

In this equation, social and economic variables together are explaining around 22% change in fertility behaviour. F-test is significant at 5% level for the value of $\bar{R}^2$. Here again, social variables are providing maximum explanation whereas a unit change in this brings 0.73 units reduction in fertility behaviour. However, in this equation, economic factor is indicating a positive relation with TFR. This is going against to our hypothetical assumption.

For Tamil Nadu in 1981, correlation coefficients between fertility and factor scores are statistically significant, (table 4.19a). From the stepwise regression analysis (table 4.19b), the estimated regression equation is calculated for this period, which is given below.

$$Y = 1.98 + 0.40FSDEMO - 0.39FSSOC$$

$$(1.757) \qquad (-1.695)$$

$\bar{R}^2 = 0.351$ F-value = 5.060

From this equation, maximum variation in fertility is explained by a combination of demographic variables. This factor along with the effects of the social variables is explaining 35% variation in fertility behaviour. The value of $\bar{R}^2$ is statistically significant at 5% level for F-test. Here the combinational effect of social variables is negatively associated with fertility behaviour while the demographic factors jointly have direct relationship with fertility.

In Tamil Nadu, during 1991, the correlation matrix (table 4.20a) shows statistically significant relationship between TFR and factor scores for social and economic variables. According to the stepwise regression analysis table 4.20b, the estimated regression equation for the same is as follows.

**Table 4.19a:** Zero-Order Correlation co-efficient matrix between TFR and factor scores for Tamil Nadu in 1981.

| Variables | TFR | FSSOC | FSECO | FSDEMO |
|---|---|---|---|---|
| TFR | 1 | | | |
| | | | | |
| FSSOC | -0.552* | 1 | | |
| | | | | |
| FSECO | -0.43 | 0.731** | 1 | |
| | | | | |
| FSDEMO | -0.56* | -0.411 | 0.576* | |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.19b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Independent (Factor Score) Variables, 1981.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| FSDEMO | 0.56 | 2.528 | 0.024 | 0.313 | 0.264 | 0.19 | 6.391 | 0.024(a) |
| Step II | | | | | | | | |
| FSDEMO | 0.401 | 1.757 | 0.102 | 0.438 | 0.351 | 1.977 | 5.06 | 0.024(b) |
| FSSOC | -0.387 | -1.695 | 0.114 | | | | | |
| Step III | | | | | | | | |
| FSDEMO | 0.475 | 1.825 | 0.093 | 0.456 | 0.321 | 1.654 | 3.36 | 0.055© |
| FSSOC | -0.52 | -1.667 | 0.121 | | | | | |
| FSECO | 0.224 | 0.644 | 0.532 | | | | | |

**Table 4.20a:** Zero-Order Correlation co-efficient matrix between TFR and factor scores for Tamil Nadu in 1991.

| Variables | TFR | FSSOC | FSECO | FSDEMO |
|---|---|---|---|---|
| TFR | 1 | | | |
| | | | | |
| FSSOC | -0.533* | 1 | | |
| | | | | |
| FSECO | -0.453* | 0.805** | 1 | |
| | | | | |
| FSDEMO | 0.172 | -0.563** | -0.362 | 1 |

* 2-tailed significant at the 0.05 level
** 2-tailed significant at the 0.01 level

**Table 4.20b:** Predictor variable selected on the basis of Stepwise Regression Method for Tamil Nadu with TFR and Independent (Factor Score) Variables, 1991.

| Variables | Regression Coefficient | t-value | t-sign. | $R^2$ | $\bar{R}^2$ | Intercept Value | F-value | F-sign |
|---|---|---|---|---|---|---|---|---|
| Step I | | | | | | | | |
| FSSOC | -0.533 | -2.743 | 0.013 | 0.284 | 0.246 | 2.984 | 7.524 | 0.013(a) |
| Step II | | | | | | | | |
| FSSOC | -0.637 | -2.686 | 0.015 | 0.307 | 0.23 | 3.692 | 3.994 | 0.037(b) |
| FSDEMO | -0.186 | -0.785 | 0.443 | | | | | |
| Step III | | | | | | | | |
| FSSOC | -0.617 | -1.582 | 0.132 | 0.308 | 0.185 | 3.672 | 2.517 | 0.093© |
| FSDEMO | -0.183 | -0.738 | 0.471 | | | | | |
| FSECO | -0.023 | -0.067 | 0.947 | | | | | |

$$Y = 2.98 - 0.53FSSOC$$

$$(-2.743)$$

$\bar{R}^2 = 0.246$ F-value = 7.524

Here the combined effect of social variables is explaining maximum variation in fertility behaviour. It explains around 25% change in fertility behaviour and F-test is significant for the value of $\bar{R}^2$ at 5% level.

So in this analysis where the collective influence of social, economic and demographic variables have been examined separately, it is found that in both the states for 1981 and 1991, social aspects are providing the maximum influence on fertility behaviour.

The stepwise regression technique is adopted to select the predictor variables, which determine the maximum variation in fertility behaviour. According to the results of this analysis it is found that among all the considered variables, only few variables have emerged influential. These are important in determining fertility behaviour. Among these variables for both the states and also for the different reference time periods, different sets of predictors are emerging for explaining fertility behaviour. The independent variables, which emerged as predictor variables for explaining fertility behaviour, are as follows.

| Variables | Rajasthan | | | Tamil Nadu | | |
|---|---|---|---|---|---|---|
| | Social | Economic | Demographic | Social | Economic | Demographic |
| 1981 | PFLIT | PMWINNPS | CMR | PFLITSEC | PMWINNPS | CMR |
| | | FWPART | SMAMFE | | LMR | SEX RATIO |
| | | LMR | SEX RATIO | | FWPART | SMAMFE |
| 1991 | PFLIT | FWPART | SEX RATIO | PFLITSEC | PMWINNPS | SMAMFE |
| | | PMWINNPS | SMAMFE | | LMR | SEX RATIO |
| | | LMR | | | | |

In this study it is revealed that the magnitude of social variables are more important in determining the fertility behaviour and then followed by economic and demographic variables for both Rajasthan and Tamil Nadu during 1981 and 1991.

Further to test a chain of causal relationship and to assess the importance of causal links, path analysis technique is adopted in the subsequent analysis.

# CHAPTER V

## PATH ANALYSIS

Path Analysis is an important tool of multivariate analysis, which is an extension of regression technique. This popular exercise is frequently used in social science research to understand the nature of causal relationship between social, economic and various other variables. This is neglected in correlation and regression analysis. But it is true that the effect of all possible irrelevant source of co-variation cannot be controlled statistically to reveal the true causal relationship between a pair of variables. Further even in regression analysis it is possible that a number of meaningful variables, which have considerable influence on the dependent variable under observation, are not included in the equation. It might so because, either they are not known or they cannot be measured. Thus, it is realised that to get the meaningful results and to establish causal links between socio-economic, demographic variables and fertility behaviour, path analysis is a more appropriate technique.

Path Analysis is a standardized multiple regression technique (in which standardized form of dependent and explanatory variables is used with zero mean and unit variance) in which a chain relationship among the variables arranged in an orderly manner, is examined through a series of regression equations. Firstly a conceptualized path diagram based on the theories of social science is drawn for analysing the variables. In this diagram the variables are arranged from left to right in such a manner that, any variable is influenced by one or more variables appearing on its left and not by any of the variable on its right. Dependent variable is always placed on the extreme right in such diagrams. Further path analysis also shows the magnitude of the causal links. In path diagram, one-way arrows leading from each explanatory variable to dependent variable represents the path and the numerical values or quantities entered on the diagram represent the path coefficients. At the same time causal links among the independent variables are also shown and indirect effects of some independent variables on dependent variables is also analysed.

Here the causal ordering cannot be decided by the empirical findings. The same can be based on the prior theoretical knowledge in a specific problem. On the basis of this causal ordering, explanations for specific cases on the basis of empirical data are formulated.

**MODEL SPECIFICATION:**

The fundamental task of Path Analysis is to construct a path diagram in which directions should be causally meaningful. In this study, a path model has been employed related to fertility and some of its determinants. Through it an attempt has been made to explain the fertility behaviour in a schematic form based on theoretical framework. In this path model in its extreme left, three variables are placed which are having direct relationship with fertility behaviour and along with this, these variables are also affecting fertility behaviour indirectly through the intermediate variables. These are placed in the center in this model. In the extreme right, the fertility behaviour has been put. The causal relationships between the explanatory variables and the dependent variable are presented in figure 4.1. In case of female education it is widely accepted that it has inverse relationship with fertility behaviour because educational attainment opens up new avenues and develop rationality in behaviour, which ultimately affects fertility. Education is also seen to influence the intermediate variables, which in turn affect fertility. Education also helps in creating awareness regarding the physical standard of living and provides more opportunities through which economic status is strengthened. It also results in the creation of new job profiles for females and improving their status in society, which in turn helps in fertility reduction. Educational attainment results in better access to medical facilities and better sanitation level through which child mortality can be reduced. It generates an assured environment for survival of children, which ultimately reduces fertility. Expanded facilities for female education might contribute in increasing the female age at marriage. This in turn reduces the reproductive span, as a result of which fertility declines.

Caste is also an important explanatory variable in determining the fertility behaviour of a society. It influences fertility behaviour both directly and indirectly. The increasing proportion of scheduled population results in higher fertility, which reflects their positive association. Generally scheduled caste population has lower income levels and poor physical standard of living. They are usually engaged in agriculture and other primary activities, which are responsible for their weak economic status. Preference for sons prevails in such societies, as they are valued as economic assets. Status of females is also not appreciable in these groups and they have very little role in decision-making. The scheduled population has poor access to sanitation and medical facilities where survival of children is an uncertainty. These factors have contributed indirectly in raising fertility. Such environment encourages higher births. Among the scheduled caste population female age at marriage is found to be very low. This is because of their socio-cultural norms, lack of better education, poor status of females and others. The consequential effects of these are the long duration of the reproductive span, which ultimately results in higher fertility levels.

The agricultural density of any region, which is indicated by the pressure on land, has an impact on the fertility behaviour, both directly and indirectly. Generally with increasing pressure on land level of fertility should decline because of the shrinking capacity of the land to absorb further increase in population. It also affects fertility through other explanatory economic variables. Because of more pressure on land, people move from agriculture to other non- agricultural activities, thereby bringing about a transformation in their economic status. Status of females is also improved through their participation in non- agricultural activities and thus leading to fertility decline.

All these intermediate variables in this model are contributing directly in determining the fertility behaviour. Here, variables like physical standard of living, levels of economic development, status of females in society and female age at marriage are inversely related to fertility. On the other hand, child mortality is positively related to fertility. The residual effect of these explanatory variables is included in 'indirect effect' in directing fertility behaviour.

A few important socio-economic and demographic variables have been selected which have the maximum influence on fertility through the correlation and the step-wise regression technique. Among these variables nine significant variables have been included for the path analysis. These are PFLIT ($X_1$, percentage of female literates to the total population), PFLITSEC ($X_2$, percentage of female literates secondary and above to the total female literates), PSC ($X_3$, proportion of scheduled caste to the total population), IPSL ($X_7$, index of physical standard of living), PMWINNPS ($X_9$, percentage of main workers in non-primary sector), FWPART ($X_{10}$, rate of female work participation), LMR ($X_{11}$, proportion of agricultural workers to the total cultivated area), CMR ($X_{14}$, child mortality rate) and SMANFE ($X_{16}$, female singulate mean age at marriage). In case of Rajasthan, female literacy has maximum influence on fertility behaviour. In Tamil Nadu, female literacy is widely spread. So it is not significant in influencing fertility behaviour. Here the level of education is more important. That is why, the proportion of female literates - secondary and above to the total female literates has emerged as a dominant social variable influencing fertility. Therefore for every year, two path diagrams have been drawn for each state by taking two different parameters ($X_1$ and $X_2$) for female education in conceptual framework.

Here for the conceptualisation of the path model it is assumed that fertility is causally influenced by all the considered explanatory variables directly or indirectly. In this study all the considered variables are assumed to have direct influence in determining fertility behaviour. Some of the variables are also working as intermediate variables. In this exercise five such variables are assumed like physical standard of living, level of economic development, status of females in the society, child mortality rate and female age at marriage. These intermediate variables are influenced by female education, caste and pressure on land and gives idea about the indirect influence of these variables on fertility. On the basis of the above discussion following conceptual framework for path analysis is prepared, (fig. no. 5.1).

PATH DIAGRAM

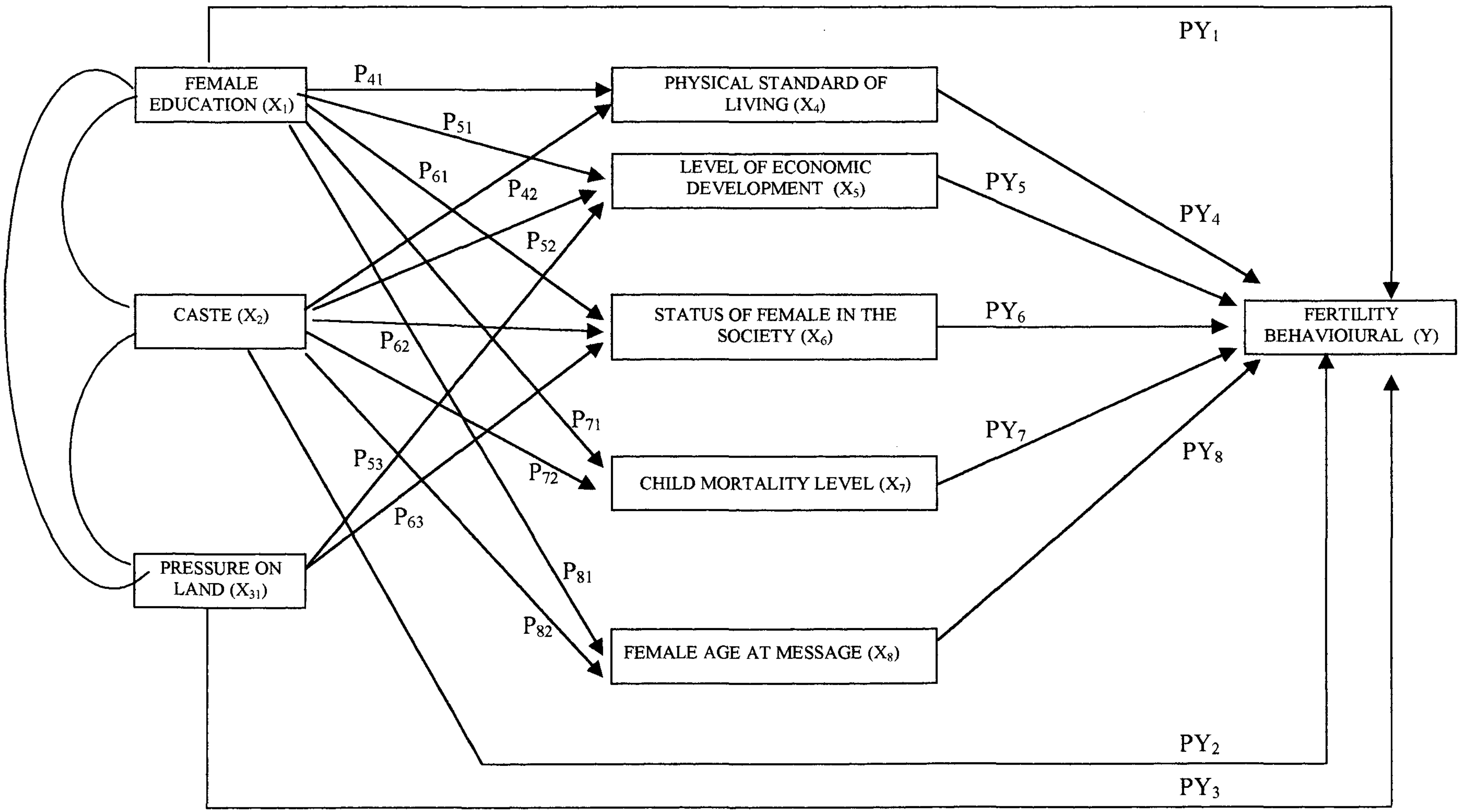


Fig. 5.1. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR

## *PATH ANALYSIS FOR RAJASTHAN:*

The path diagrams, which are given in figure nos. 5.2 to 5.5, show the path coefficients and effects of the different variables. These are given in table nos. 5.1 to 5.3 represent the direct and indirect effects of the each selected explanatory (predetermined) variable on fertility for Rajasthan during 1981 and 1991. Here our focus is on the explanation of path diagrams given in figure nos. 5.2 and 5.4 because these diagrams include percentage of female literates as an indicator of female education. This is more significant in case of Rajasthan than female literacy up to secondary and above. Female literates ($X_1$), has total effect of –0.540 on fertility behaviour (Y) in 1981, of which –0.256 is transmitted through indirect effects via intermediate variables like index of physical standard of living, percentage of main workers in non-primary sector, rate of female work participation, child mortality rate and female age at marriage and jointly with others. The remaining –0.264 effect has remained unexplained. This is showing the direct effect of female literacy on fertility. It is to be noted that in 1991, indirect effect shows the similar direction as 1981. During this period, the total effect on female literacy on fertility is found to be –0.165 of which –0.352 is transmitted through indirect ways but the direct effect is coming unexpectedly positive. Here it is evident that female literacy has consequent effect on fertility reduction in Rajasthan. The total effect of female literacy is found to be higher in 1981 than 1991. It might be so because some other explanatory variables emerged more significant for reduction in fertility in due coarse of time.

The percentage of scheduled caste population to the total population shows negligible effect on fertility during 1981 (-0.005) because fertility level was high throughout the region among all the social groups. However the indirect effect of caste is observed to be 0.517, which shows that the increasing proportion of scheduled caste population indirectly contributes in raising fertility. In 1991, the total effect of this is found to be 0.249 where caste became an important factor in the explanation of fertility behaviour. This time both direct and indirect effects are having positive effects on fertility.

Both the periods are showing that with the improvement in the physical standard of living fertility declines. The total effect and the direct effect are indicating a negative

PATH DIAGRAM

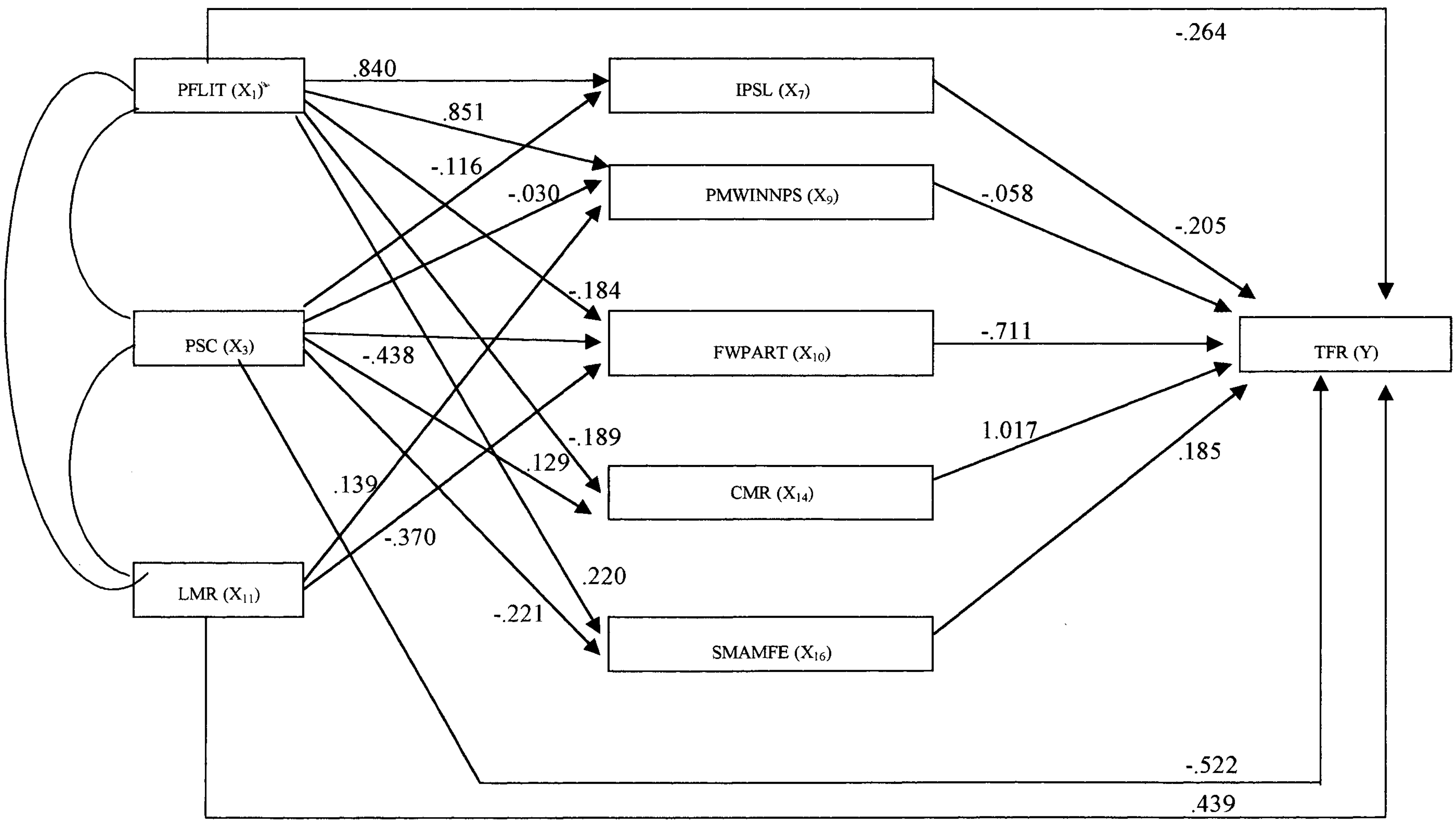


Fig. 5.2. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR RAJASTHAN, 1981

PATH DIAGRAM

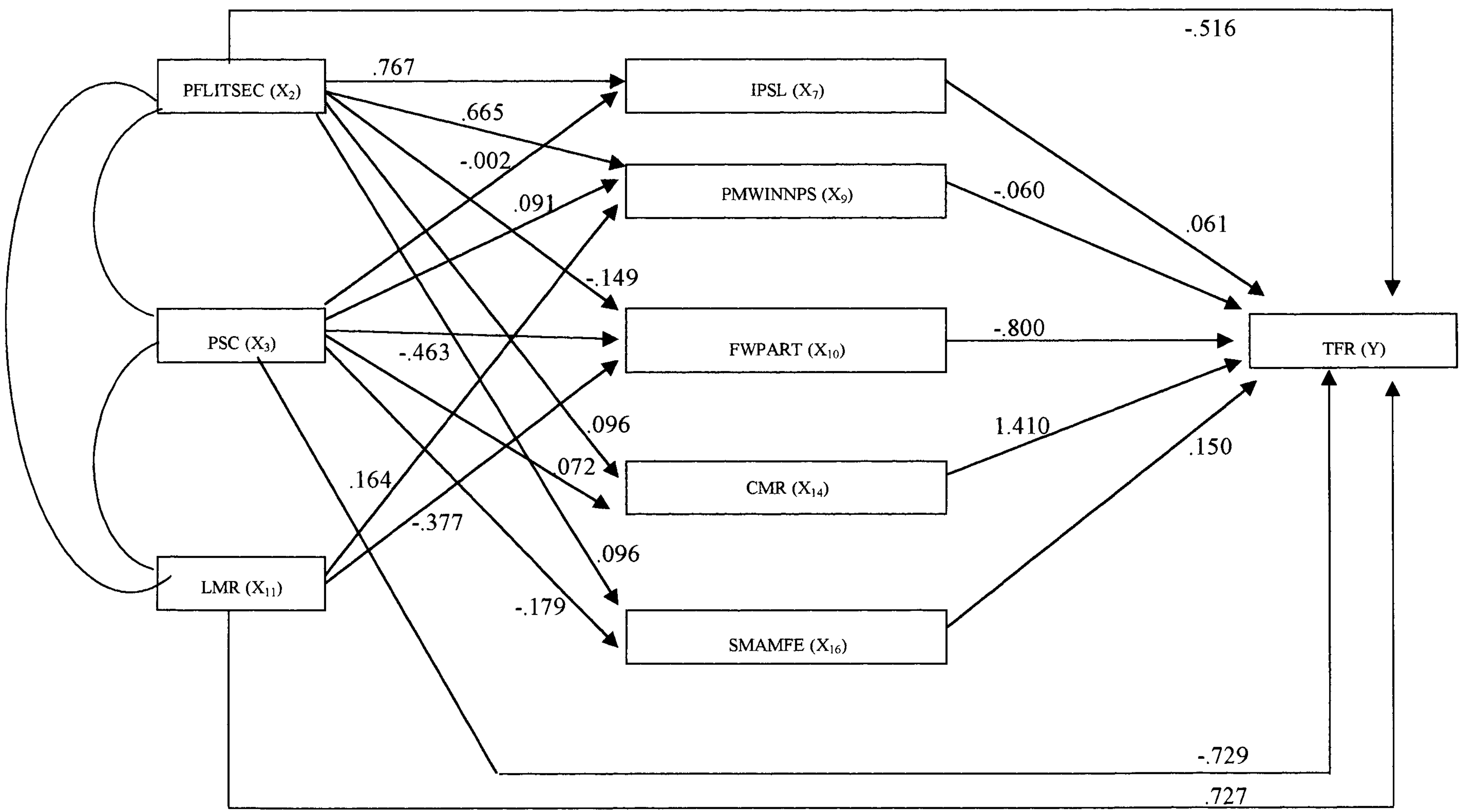


Fig. 5.3. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR RAJASTHAN, 1981

PATH DIAGRAM

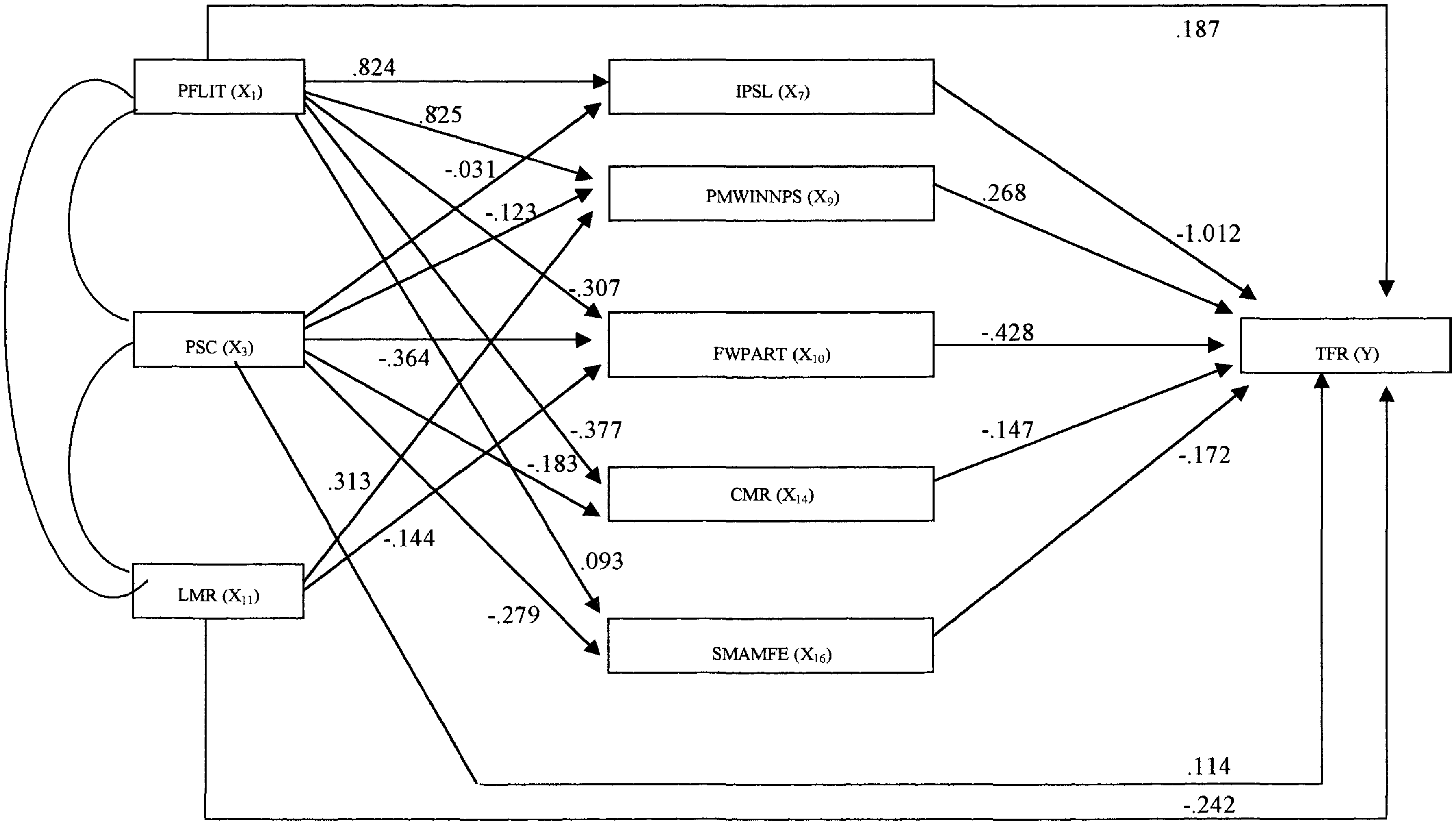


Fig. 5.4. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR RAJASTHAN, 1991

PATH DIAGRAM

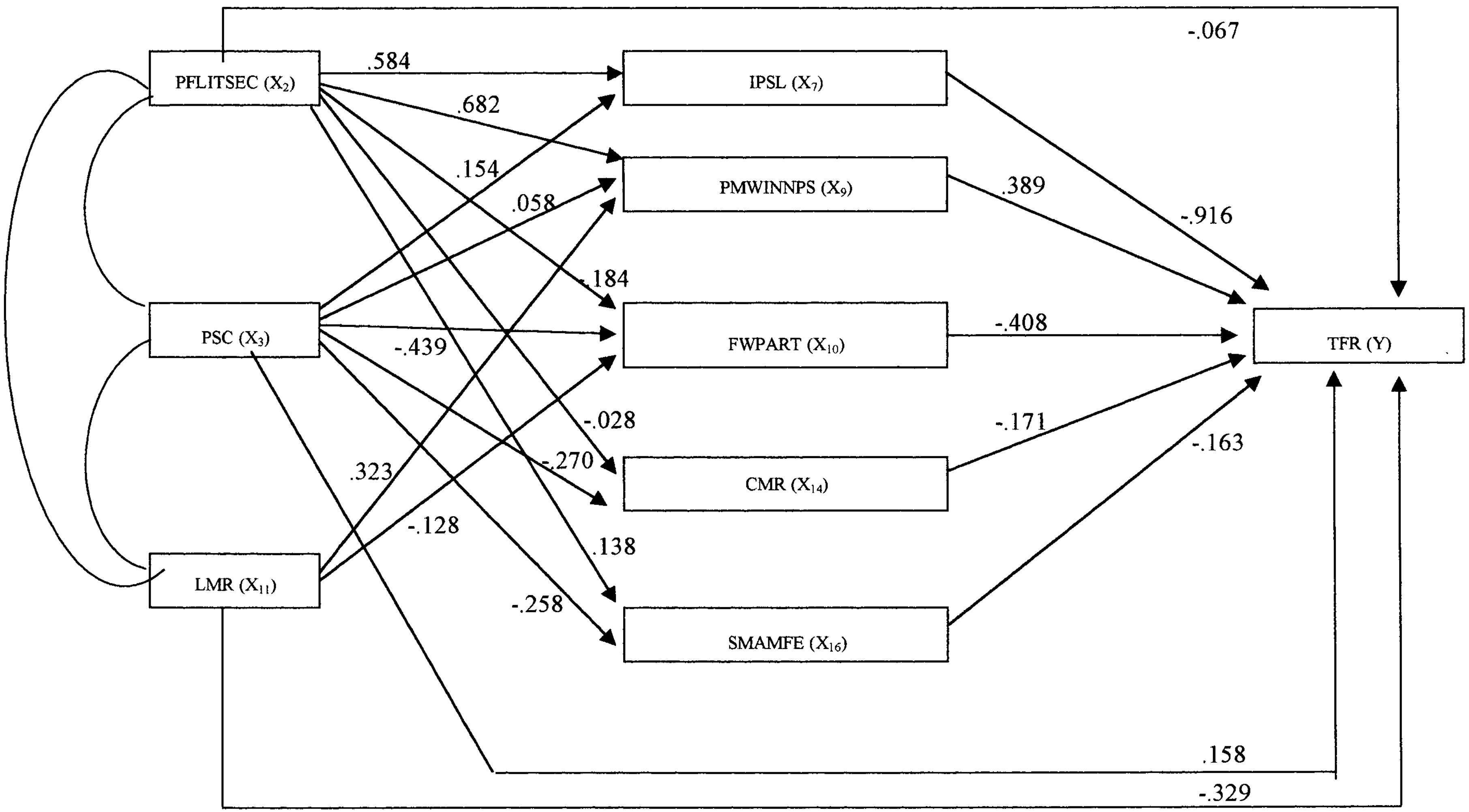


Fig. 5.5. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR RAJASTHAN, 1991

impact on fertility. On the other hand, indirect effect is inconsistent, whereas it is negative 1981,and positive for 1991.

**Table 5.1:** The Network of the Relationships of $X_1$, $X_2$, $X_3$, $X_7$, $X_9$, $X_{10}$, $X_{11}$, $X_{14}$, and $X_{16}$ with TFR in the Path Model for Rajasthan.

| Indirect Effect | 1981 | 1991 |
|---|---|---|
| | Value | Value |
| $X_1 \rightarrow X_7 \rightarrow Y$ | -0.172 | -0.834 |
| $X_1 \rightarrow X_9 \rightarrow Y$ | -0.049 | 0.221 |
| $X_1 \rightarrow X_{10} \rightarrow Y$ | 0.131 | 0.131 |
| $X_1 \rightarrow X_{14} \rightarrow Y$ | -0.192 | 0.055 |
| $X_1 \rightarrow X_{16} \rightarrow Y$ | 0.041 | -0.016 |
| $X_3 \rightarrow X_7 \rightarrow Y$ | 0.024 | 0.031 |
| $X_3 \rightarrow X_9 \rightarrow Y$ | 0.002 | -0.033 |
| $X_3 \rightarrow X_{10} \rightarrow Y$ | 0.311 | 0.156 |
| $X_3 \rightarrow X_{14} \rightarrow Y$ | 0.131 | 0.027 |
| $X_3 \rightarrow X_{16} \rightarrow Y$ | -0.041 | 0.048 |
| $X_{11} \rightarrow X_9 \rightarrow Y$ | -0.008 | 0.084 |
| $X_{11} \rightarrow X_{10} \rightarrow Y$ | 0.263 | 0.062 |
| **Indirect Effect** | **1981** | **1991** |
| | **Value** | **Value** |
| $X_2 \rightarrow X_7 \rightarrow Y$ | 0.047 | -0.535 |
| $X_2 \rightarrow X_9 \rightarrow Y$ | -0.040 | 0.265 |
| $X_2 \rightarrow X_{10} \rightarrow Y$ | 0.119 | 0.075 |
| $X_2 \rightarrow X_{14} \rightarrow Y$ | 0.135 | 0.005 |
| $X_2 \rightarrow X_{16} \rightarrow Y$ | 0.014 | -0.022 |
| $X_3 \rightarrow X_7 \rightarrow Y$ | -0.0001 | -0.141 |
| $X_3 \rightarrow X_9 \rightarrow Y$ | -0.005 | 0.023 |
| $X_3 \rightarrow X_{10} \rightarrow Y$ | 0.370 | 0.179 |
| $X_3 \rightarrow X_{14} \rightarrow Y$ | 0.102 | 0.046 |
| $X_3 \rightarrow X_{16} \rightarrow Y$ | -0.027 | 0.042 |
| $X_{11} \rightarrow X_9 \rightarrow Y$ | -0.010 | 0.126 |
| $X_{11} \rightarrow X_{10} \rightarrow Y$ | 0.302 | 0.052 |

The level of economic development, which is elicited through the proportion of main workers in the non-primary sector, is showing a significant effect on fertility during

1981 only. In 1981, it emerged as the most important variable among the economic variables in determining fertility. However, it might be one of the preconditions for getting access to education and infrastructural facilities. In the 1990s the government efforts in the fields of large scale spread of education, medical facilities, infrastructure for common man might have undermined the influence of this aspect on fertility. The effect of female work participation on fertility is providing inconsistent and insignificant results. The large proportion of female work force is engaged in the primary sector in Rajasthan might not contribute much in fertility reduction. Pressure on land also seems to have an insignificant influence on fertility.

**Table 5.2:** Component Effect of Different Variables on Fertility in Rajasthan 1981.

| Variables | Direct | Effect Indirect | Total | Variables | Direct | Effect Indirect | Total |
|---|---|---|---|---|---|---|---|
| PFLIT | -0.264 | -0.276 | -0.54 | PFLITSEC | -0.516 | 0.126 | -0.39 |
| PSC | -0.522 | 0.517 | -0.005 | PSC | -0.729 | 0.724 | -0.005 |
| IPSL | -0.205 | -0.301 | -0.506 | IPSL | 0.061 | -0.567 | -0.506 |
| PMWINNPS | -0.058 | -0.28 | -0.338 | PMWINNPS | -0.06 | -0.278 | -0.338 |
| FWPART | -0.711 | 0.545 | -0.166 | FWPART | -0.8 | 0.634 | -0.166 |
| LMR | 0.439 | -0.537 | -0.098 | LMR | 0.729 | -0.827 | -0.098 |
| CMR | 1.017 | -0.627 | 0.39 | CMR | 1.41 | -1.02 | 0.39 |
| SMAMFE | 0.185 | -0.115 | 0.07 | SMAMFE | 0.15 | -0.08 | 0.07 |

**Table 5.3:** Component Effect of Different Variables on Fertility in Rajasthan 1991.

| Variables | Direct | Effect Indirect | Total | Variables | Direct | Effect Indirect | Total |
|---|---|---|---|---|---|---|---|
| PFLIT | 0.187 | -0.352 | -0.165 | PFLITSEC | -0.067 | -0.173 | -0.24 |
| PSC | 0.114 | 0.135 | 0.249 | PSC | 0.159 | 0.09 | 0.249 |
| IPSL | -1.012 | 0.498 | -0.514 | IPSL | -0.916 | 0.402 | -0.514 |
| PMWINNPS | 0.268 | -0.327 | -0.059 | PMWINNPS | 0.389 | -0.448 | -0.059 |
| FWPART | -0.428 | 0.892 | 0.464 | FWPART | -0.408 | 0.872 | 0.464 |
| LMR | -0.242 | 0.171 | -0.071 | LMR | -0.329 | 0.258 | -0.071 |
| CMR | -0.147 | 0.153 | 0.006 | CMR | -0.171 | 0.177 | 0.006 |
| SMAMFE | -0.172 | -0.089 | -0.261 | SMAMFE | -0.163 | -0.098 | -0.261 |

Child mortality is observed to be an important factor in determining fertility during 1981 when the total effect has been computed as 0.390. It is showing a good positive association of CMR with fertility. Here direct effect of CMR is emerging more powerful. However in 1991 it has become insignificant. It might be so because of improvement in medical facilities. Female age at marriage was not providing much explanation for the variation in fertility behaviour during 1981; it is so because of the usual practice of marriages at younger ages. In 1991, it has emerged as an important explanatory behaviour in determining fertility where increase in female age at marriage has induced the lowering of fertility rates. In 1991, differences in female age at marriage among the different groups became more pronounced.

### *PATH ANALYSIS FOR TAMIL NADU:*

In case of Tamil Nadu the path coefficients are shown in figure nos. 5.5 to 5.9 and effects of the different variables are given in table nos. 5.4 to 5.6. In these tables direct and indirect effects of each selected explanatory (predetermined) variables on fertility for 1981 and for 1991 are tabulated. Female literacy is very high in Tamil Nadu. Therefore, it is not influencing fertility to a great extent. That is why, the level of female education is more important here and the proportion of female literates secondary and above to the total female literates is depicting more meaningful explanation for variation in fertility behaviour. In this section, our focus will be on figure nos. 5.7 and 5.9 to explain the relationship of fertility and its determinants.

Level of female education ($X_2$) has a total effect of –0.606 on fertility (Y) of which –0.161 is transmitted through indirect effects via intermediate variables like index of physical standard of living, percentage of main workers in non-primary sector, rate of female work participation, child mortality rate and female age at marriage and jointly with others. The rest –0.45, effect is transmitted directly. In 1991 also the overall effect of this is found to be –0.608 but this time the indirect effect of level of female education is 0.564, which is transmitted, in the opposite direction. It shows that there may be some other explanatory variables, other than the considered variables, which explain the indirect effect of level of female education on fertility in a more appropriate manner.

**Table 5.4:** The Network of the Relationships of $X_1$, $X_2$, $X_3$, $X_7$, $X_9$, $X_{10}$, $X_{11}$, $X_{14}$, and $X_{16}$ with TFR in the Path Model for Tamil Nadu.

| Indirect Effect | 1981 | 1991 |
|---|---|---|
| | **Value** | **Value** |
| $X_1 \rightarrow X_7 \rightarrow Y$ | -0.308 | -0.394 |
| $X_1 \rightarrow X_9 \rightarrow Y$ | 0.403 | -0.604 |
| $X_1 \rightarrow X_{10} \rightarrow Y$ | 1.073 | -0.265 |
| $X_1 \rightarrow X_{14} \rightarrow Y$ | -0.333 | -0.227 |
| $X_1 \rightarrow X_{16} \rightarrow Y$ | -0.010 | -1.421 |
| $X_3 \rightarrow X_7 \rightarrow Y$ | -0.059 | -0.083 |
| $X_3 \rightarrow X_9 \rightarrow Y$ | 0.085 | -0.154 |
| $X_3 \rightarrow X_{10} \rightarrow Y$ | 0.169 | -0.059 |
| $X_3 \rightarrow X_{14} \rightarrow Y$ | 0.530 | -0.025 |
| $X_3 \rightarrow X_{16} \rightarrow Y$ | 0.003 | 0.153 |
| $X_{11} \rightarrow X_9 \rightarrow Y$ | -0.196 | 0.243 |
| $X_{11} \rightarrow X_{10} \rightarrow Y$ | -0.346 | 0.087 |
| **Indirect Effect** | **1981** | **1991** |
| | **Value** | **Value** |
| $X_2 \rightarrow X_7 \rightarrow Y$ | -0.551 | 0.058 |
| $X_2 \rightarrow X_9 \rightarrow Y$ | 0.415 | 0.155 |
| $X_2 \rightarrow X_{10} \rightarrow Y$ | 0.639 | 0.727 |
| $X_2 \rightarrow X_{14} \rightarrow Y$ | -0.452 | -0.229 |
| $X_2 \rightarrow X_{16} \rightarrow Y$ | -0.204 | -0.149 |
| $X_3 \rightarrow X_7 \rightarrow Y$ | -0.068 | 0.007 |
| $X_3 \rightarrow X_9 \rightarrow Y$ | 0.015 | 0.003 |
| $X_3 \rightarrow X_{10} \rightarrow Y$ | -0.069 | -0.045 |
| $X_3 \rightarrow X_{14} \rightarrow Y$ | 0.375 | 0.015 |
| $X_3 \rightarrow X_{16} \rightarrow Y$ | 0.307 | 0.148 |
| $X_{11} \rightarrow X_9 \rightarrow Y$ | -0.103 | -0.022 |
| $X_{11} \rightarrow X_{10} \rightarrow Y$ | -0.086 | -0.068 |

The total effect of proportion of scheduled caste to the total population is found to be insignificant but at the same time it is showing an inverse relation with fertility. In both the cases the direct effect is coming to be negative, which is unexplained while the indirect effect is positively transmitted.

PATH DIAGRAM

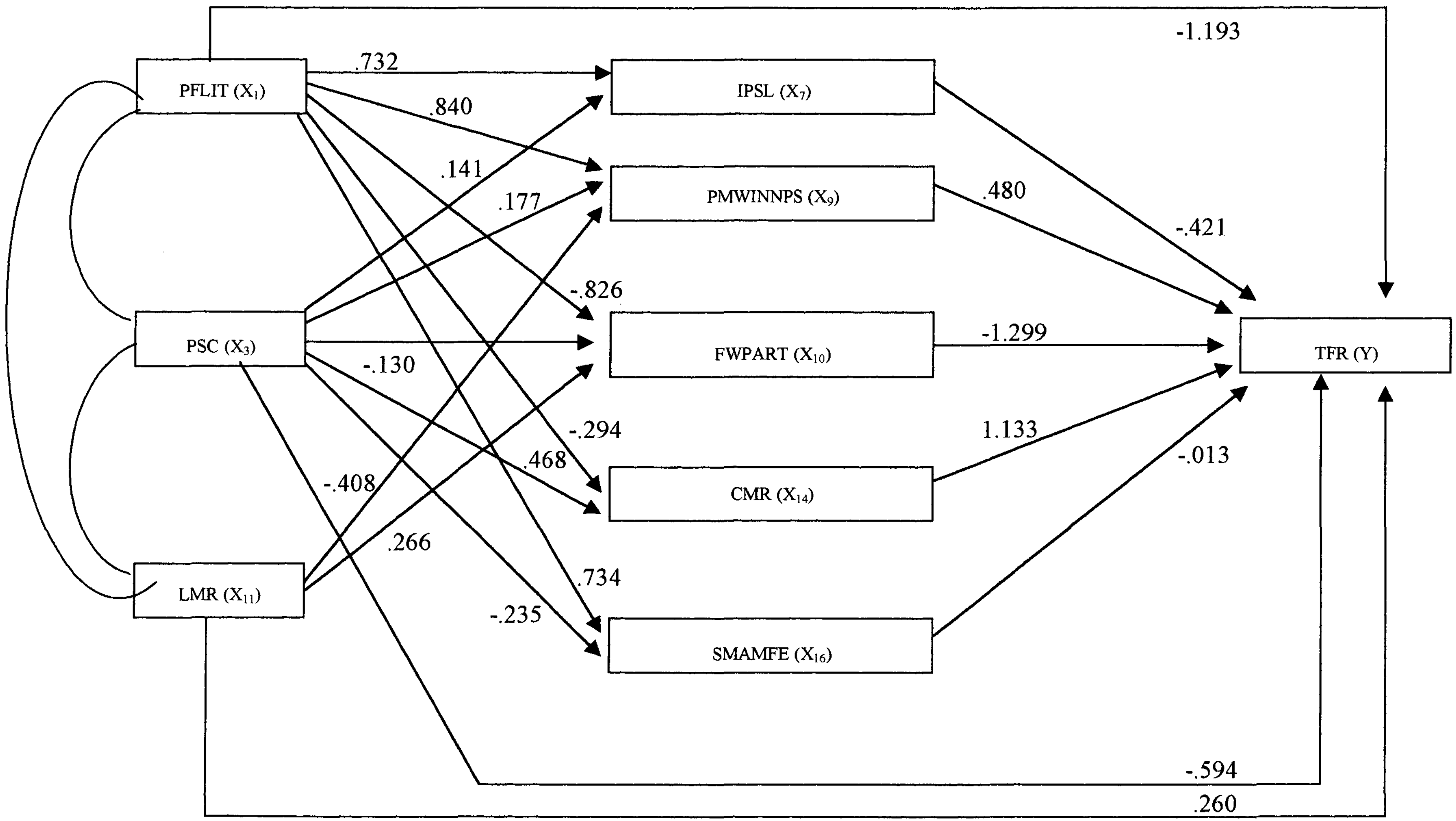


Fig. 5.6. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR TAMIL NADU, 1981

PATH DIAGRAM

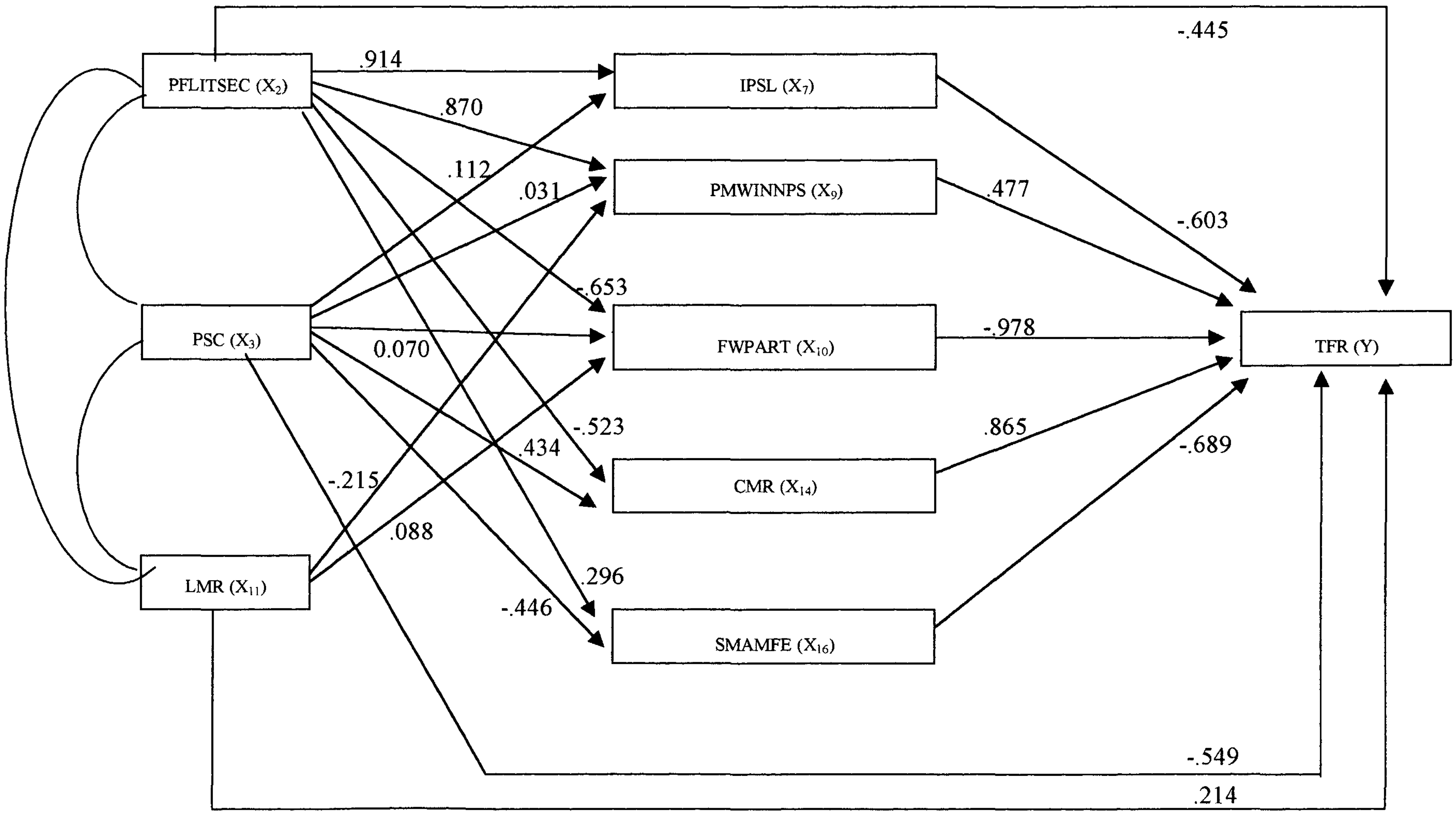


Fig. 5.7. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR TAMIL NADU, 1981

PATH DIAGRAM

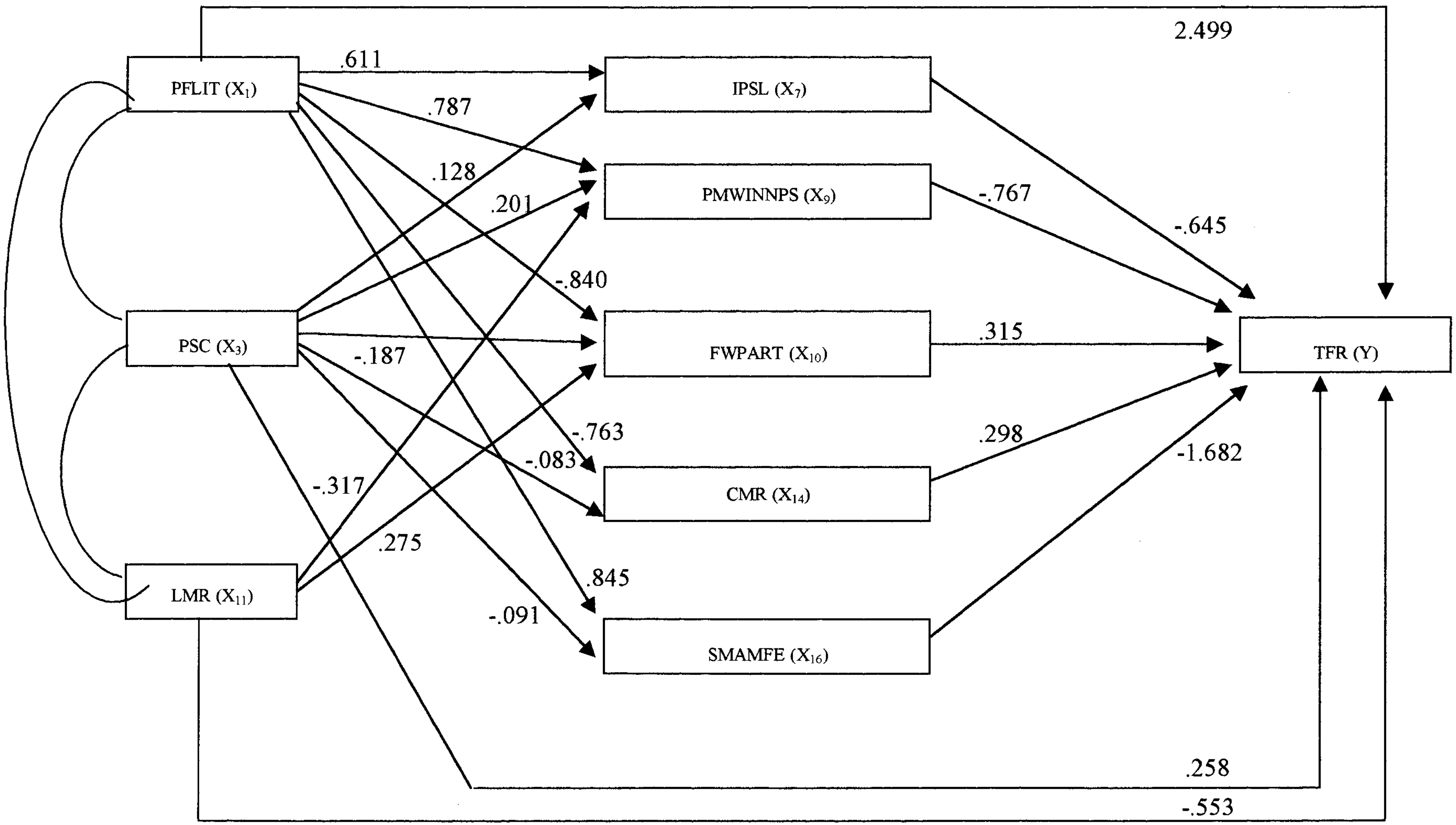


Fig. 5.8. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR TAMIL NADU, 1991

PATH DIAGRAM

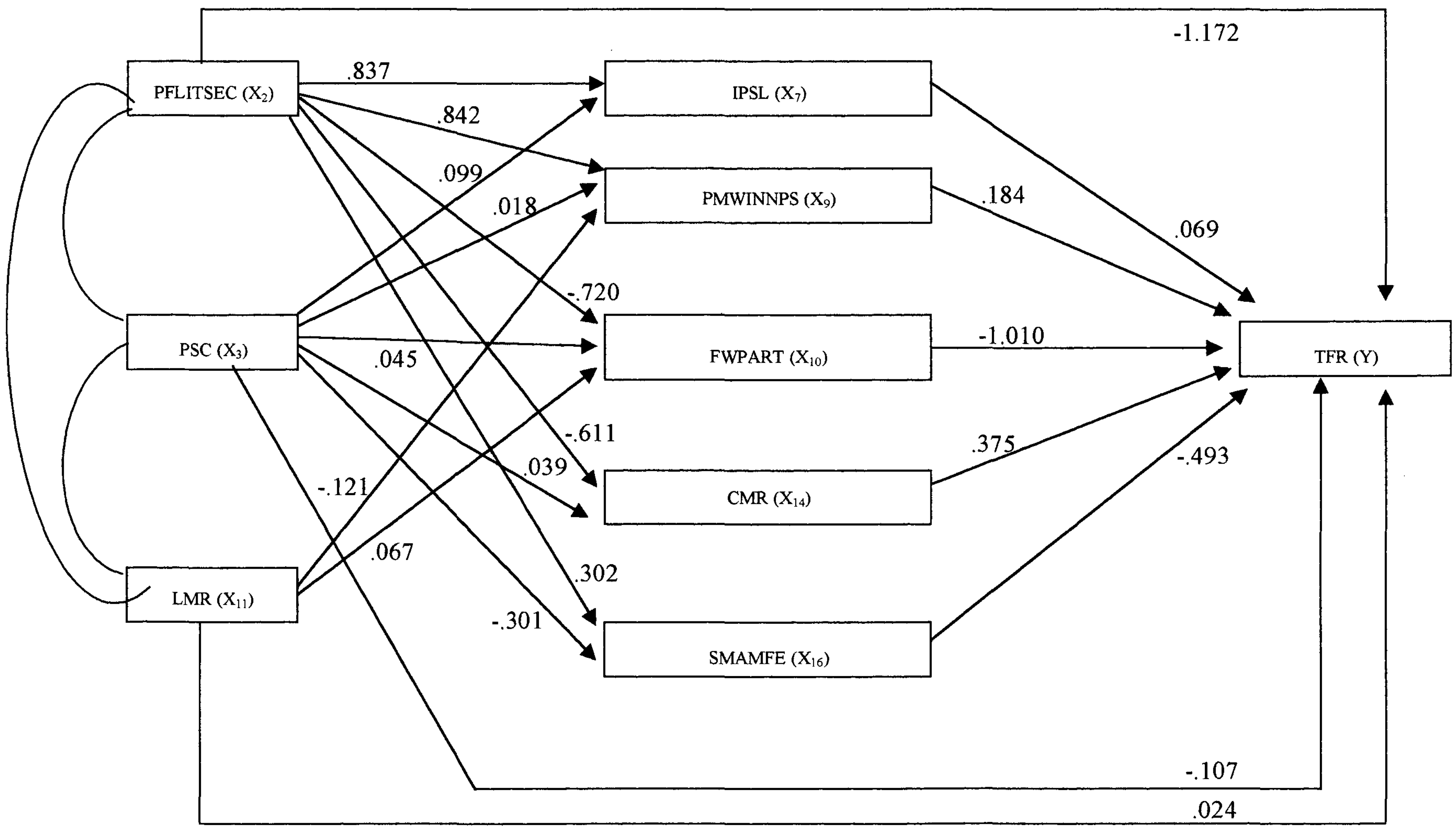


Fig. 5.9. A CAUSAL MODEL FOR FACTORS AFFECTING FERTILITY BEHAVIOUR FOR TAMIL NADU, 1991

**Table 5.5:** Component Effect of Different Variables on Fertility in Tamil Nadu 1981.

| Variables | Direct | Effect Indirect | Total | Variables | Direct | Effect Indirect | Total |
|---|---|---|---|---|---|---|---|
| PFLIT | -1.193 | 0.763 | -0.43 | PFLITSEC | -0.445 | -0.161 | -0.606 |
| PSC | -0.594 | 0.79 | 0.196 | PSC | -0.549 | 0.745 | 0.196 |
| IPSL | -0.421 | -0.083 | -0.504 | IPSL | -0.603 | 0.099 | -0.504 |
| PMWINNPS | 0.48 | -0.983 | -0.503 | PMWINNPS | 0.477 | -0.98 | -0.503 |
| FWPART | -1.299 | 1.413 | 0.114 | FWPART | -0.978 | 1.092 | 0.114 |
| LMR | 0.26 | -0.364 | -0.104 | LMR | 0.214 | -0.318 | -0.104 |
| CMR | 1.133 | -0.493 | 0.64 | CMR | 0.865 | -0.225 | 0.64 |
| SMAMFE | -0.013 | -0.355 | -0.368 | SMAMFE | -0.689 | 0.321 | -0.368 |

**Table 5.6:** Component Effect of Different Variables on Fertility in Tamil Nadu 1991.

| Variables | Direct | Effect Indirect | Total | Variables | Direct | Effect Indirect | Total |
|---|---|---|---|---|---|---|---|
| PFLIT | 2.499 | -2.943 | -0.444 | PFLITSEC | -1.172 | 0.564 | -0.608 |
| PSC | 0.258 | -0.149 | 0.109 | PSC | -0.107 | 0.216 | 0.109 |
| IPSL | -0.645 | 0.2 | -0.445 | IPSL | 0.068 | -0.513 | -0.445 |
| PMWINNPS | -0.767 | 0.204 | -0.563 | PMWINNPS | 0.184 | -0.747 | -0.563 |
| FWPART | 0.315 | -0.068 | 0.247 | FWPART | -1.01 | 1.257 | 0.247 |
| LMR | -0.553 | 0.323 | -0.23 | LMR | 0.024 | -0.254 | -0.23 |
| CMR | 0.298 | 0.085 | 0.383 | CMR | 0.375 | 0.008 | 0.383 |
| SMAMFE | -1.682 | 1.221 | -0.461 | SMAMFE | -0.493 | 0.032 | -0.461 |

The overall effect of the physical standard of living on fertility is –0.504 during 1981 and –0.445 in 1991. For 1981, the direct influence of this aspect has been important due to the poor living standard of the majority of population of the state. But in 1991, it has improved considerably and its indirect effect became more evident during the same period. In total one can infer that the improvement in physical standard of living has consequential effect on reducing fertility rates.

In case of level of economic development of the society it has been examined that the total effect of it on fertility is inversely related which is –0.503 and –0.563 for 1981 and 1991 respectively. The role of female work participation is again found to be insignificant. The maximum female workers might have been engaged in the primary sector in this region and they do not have much influence on determining fertility behaviour. The pressure on land is also inversely related to fertility while it is found to be positively related in case of Rajasthan. In Rajasthan agricultural density is low in comparison to Tamil Nadu, which might be a contributing factor for the above scenario.

In Tamil Nadu high rate of child mortality has been encouraging higher fertility levels but with improvement in the medical infrastructure these rates have slowed down and consequently, fertility rates are also lowered in 1991. For female age at marriage the direct effect is more important because it determines the stretch of reproductive span and ultimately controls fertility. The total effect of this is found to be –0.368 and -0.467 for 1981 and 1991 respectively. The female age at marriage is an important explanatory variable for fertility control in Tamil Nadu than Rajasthan because marriages at younger ages are still prevalent in the latter.

In the above techniques of correlation, stepwise regression and path analysis, the potential influences of various socio economic and demographic variables are evaluated. In these methods more or less similar variables have emerged as important ones influencing fertility behaviour. Among the social variables, female literacy has emerged as the most important determinant having the maximum potential to influence fertility in Rajasthan among all the selected variables. Further it is followed by the physical standard of living. In Tamil Nadu, level of female education (female literates secondary and above), provides the maximum explanation for the variation in fertility behaviour.

Among the economic variables, proportion of main workers in non-primary sector is found to be the most influential economic variable. It is an indicator of level of economic development. This followed by female work participation especially in the non-primary sector. In Tamil Nadu too, proportion of main workers in non-primary sector has emerged as a dominant explanatory variable, followed by pressure on land and proportion of females in the non-primary sector.

In case of demographic variables, CMR has emerged more important in determining fertility behaviour in both the states. It is followed by female age at marriage.

If the influence of social, economic and demographic variables is considered as three different sets separately, then the influence of social aspect is providing the maximum degree of explanation for the variation in fertility behaviour.

# CHAPTER VI

## SUMMARY AND CONCLUSION

In India efforts to control population growth have been made since independence. Nevertheless even after sustained efforts for more than half a century, we could not achieve worthwhile progress in population stabilization. Therefore it can be said that our strategy to control population growth through family planning programmes could not yield expected results. The failure of programmes of population control to achieve substantial results motivates us to decipher various aspects of population growth so that the future strategy to check rapid population growth can be designed in a proper way to get the desired outcomes. On the similar line of thought, in the recent past, especially after the CAIRO summit need to incorporate socio-economic aspects into the programmes of population control has been advocated.

In this study, an attempt has been made to identify relatively more important socio-economic and demographic variables, which have maximum contribution in determining fertility behaviour. The main objective of this dissertation is to see the spatial pattern of fertility behaviour and its determinants. Here firstly we are trying to investigate the important socio-economic and demographic variables for Rajasthan and Tamil Nadu. Further an attempt has been made to compare and contrast the pattern of association among various socio-economic and demographic variables and fertility in these two states.

Evaluation of the plethora of literature clearly brings out the message that social, economic and demographic factors have very strong association with fertility behaviour. On the basis of this, a few important variables have been chosen to evaluate the influence of socio-economic and demographic characteristics of the society on fertility behaviour in this piece of work. Here these aspects are studied spatially and temporally.

The influence of explanatory variables on fertility behaviour has been examined in two different states like Rajasthan and Tamil Nadu. Out of these two states, Rajasthan is one of the northern states, which is experiencing high fertility rates and showing marginal decline in its growth rate of population in the recent past. On the other side, Tamil Nadu is situated in the southern belt of low fertility and has shown a significant decline in fertility in the last few decades. These two states of differing characteristics have been selected to examine the differences regarding the nature and magnitude of influence of different explanatory variables on fertility behaviour. This exercise is carried out for these two states, taking two different reference time periods to examine the temporal change in nature of the relationship between fertility behaviour and its determinants.

To achieve the above stated objectives, district level data have been collected and transformed in the required form for further statistical analysis. Here for the selection of the important explanatory variables among the considered variables and to identify the variability in their explanation, multiple regression techniques of zero order correlation coefficient matrices and stepwise regression are applied. To carry out this analysis TFR, which is taken as a summary measure of fertility behaviour in this study, has been adopted as a dependent variable and the other socio-economic and demographic variables have been considered as independent explanatory variables.

With the help of **stepwise regression analysis**, the most important explanatory variables influencing fertility behaviour have been sorted out among all the considered variables. However, this technique fails to establish causal relationships among the dependent variable and independent variables. To establish causal links or direct and indirect effect of each explanatory variable on dependent variable, **path analysis** has been used in this study. This analysis is based on the preconceived chains of causal links among the considered variables and for this a conceptual framework has been prepared on the basis of existing theoretical base. The variables, which emerged significantly important in multiple regression techniques have been placed in the conceptual framework for path analysis and causal links or direct and indirect effect of these variables on fertility have been established for the states of Rajasthan and Tamil Nadu.

In the results of stepwise regression analysis, social factors have emerged as the most significant factors to influence fertility behaviour in both the states. Further these variables are followed by economic variables in Rajasthan, while for Tamil Nadu, demographic variables have emerged as the second most important determinant aspects of fertility next to the social factors. The above difference can be explained in the following manner. For an economically backward state like Rajasthan, economic aspects have played important role in the determination of fertility behaviour as these are considered to be the key factors in influencing the way of life. However, for places of relatively better economic conditions like Tamil Nadu, other factors like demographic aspects play an important role in determining the family size, next to the social factors.

Among the social variables also, the magnitude to influence the fertility behaviour of different social variables are not found to be identical for different places and for different reference periods for the same region. Among the social variables, female education is found to be an important predictor variable for explaining variation in fertility levels in both the places. Female education has potential to influence fertility behaviour-both directly ad indirectly with considerable magnitude. In Rajasthan, female literacy has emerged as the most potent factor in determining fertility behaviour. On the other hand, in Tamil Nadu, female literacy upto secondary and above is explaining the maximum variation in fertility behaviour. This might be so because in Tamil Nadu, female literacy is widely spread. Hence the level of female education is more significant in explaining fertility behaviour. In Rajasthan, female literacy itself is an important contributing factor in fertility decline because of the poor status of female literacy there. From this work therefore, we can infer that female education which helps in enlightening one's mind and widens life's perspective, is the best contraceptive.

The physical standard of living is found to be the second most important social variable in explaining fertility behaviour in both the places. However, its influence is found to be more pronounced in Rajasthan for when compared to that of Tamil Nadu. The poor social and economic infrastructural facilities in the former might be responsible for this.

In case of economic variables, the level of economic development of society, which is represented by proportion of main workers in the non-primary sector, has emerged as the most powerful indicator in determining reduction in fertility levels in both the places. In case of Rajasthan it is followed by female work participation where the poor status of females is an important contributing factor for high fertility and little improvement in this may bring changes in fertility behaviour. On the contrary, in Tamil Nadu the female work participation is already high. So it is not providing much of explanation for the dynamics in fertility behaviour. Here, land man ratio, which indicates the pressure on land, has emerged as an important variable because in a densely populated state like Tamil Nadu, the pressure on land is high. The high agricultural density in the state curtails the potential of land to absorb further increase in population size and ultimately contributes towards the increasing acceptance of small family norms. In Rajasthan, since the agricultural density is low and land-man ratio is high, it is not contributing significantly for bringing variations in fertility.

Among the demographic variables, CMR and female age at marriage have emerged most significant explanatory variables influencing fertility behaviour in Rajasthan and Tamil Nadu. CMR is positively related with fertility while female age at marriage has an inverse relation with it. In 1981, for both the states, maximum variation in fertility behaviour is explained by CMR but in 1991, female age at marriage has become the most influential factor in determining the fertility level. It is found to be so because during 1981, CMR was high and it was playing an important role in deciding fertility. During 1991, child mortality rates reduced considerably and the influence of this variable on fertility has also reduced. Along with this, during 1981 low female age at marriage was a usual practice in the society. This scenario changed during 1980s. In the relatively advance section of the society female age at marriage started showing increasing trends. Thus the variation in female age at marriage among different groups has become more important in explaining fertility behaviour in 1991.

In this work we find that the nature and magnitude of the influence of various socio-economic and demographic aspects on fertility behaviour is showing spatial and temporal variations. The socio-economic status of any region plays an important role in shaping the idea regarding family size for the concern population. Thus we can conclude that the level of socio-economic development of any region governs the relationship of the various explanatory variables with fertility behaviour. Further, the nature and magnitude of the effect of various socio-economic and demographic variables on fertility behaviour also changes with changing levels of the socio-economic status of any society with time. It is also concluded that the relationship between fertility and its determinants is highly complex in nature. It presents varying scenario for different regions and also varies for different reference periods even for the same region.

With the above discussion it is evident that the social, economic and demographic aspects of a society are the actual determinants of its fertility behaviour. Thus it can be said that mere family planning programmes have not been sufficient for simulating any significant fertility decline. Its future contribution of lowering fertility levels in the region would be significant only after the socio-economic factors permit smaller family norms (Mehta, 1993).

Since the socio-economic status has laid immense impact on fertility behaviour, therefore various policies and developmental processes for the socio-economic development of all the groups are likely to contribute in the reduction of fertility differentials. The standard of living, which reflects the overall status of a society, influences the need for family planning and adoption of small family norms. It also decides the extent to which the need for family planning is met. So it is very much clear that until and unless the overall socio-economic development takes place, usage of family planning norms will not be achieved upto the expected levels. The over all development on the socio-economic front will not only strengthen the family planning programmes but also contribute to the other sectors as well.

A significant decline in fertility level for the country as a whole in the near future is possible only when the small family norm is widely accepted across all sections of the society.

The population status of India presents a complex picture, expectedly so, given the country's immense cultural and economic diversities. Therefore there cannot be any one miracle formula, which will cover the entire country, (Singh and Choudhary, 1994). We find that among the various socio-economic and demographic factors, considered in this work, some of them have negative impact on fertility behaviour and acting as barriers for population control. The effects of these negative factors have to be mitigated. The present work shows that there is regional variation in the pattern of the nature and extent of the influence of various explanatory variables on fertility behaviour. Therefore, the strategy for the removal for these obstacles should be formulated regionally with the consideration of their priorities in different regions. There are certain specific socio-economic and demographic problems for population control specific to a region. Some times the magnitude and dimension of such problems within a region are also seen to change with time.

This study has considered the various important socio-economic and demographic variables. There are some other variables also which affect the decision regarding family size. The refined economic variables like per capita income and expenditure, the psychological factors like perception of people towards family size, motivation to control fertility and cultural practices and others are some of these variables. The profound effect of these variables on fertility behaviour is envisaged in various studies. The inclusion of these variables could have improved the precession and predictability of the results. However, unfortunately the unavailability of data regarding such factors has imposed certain limitations, thereby restricting the scope of this research to a limited framework.

Thus we conclude that various population policies and programmes for population control should include socio-economic factors as important ingredients. Further, these programmes should be region specific. The formulation of these programmes should be based on extensive fieldwork. The empirical studies of specific regions reveal the grassroot level relationship between fertility and its determinants. On the basis of results of such studies, important explanatory variables should be taken into consideration. After receiving these information strategies for controlling fertility should be adopted. In the processes of formulation of such strategies weightage should be rationalized for the different attributes for population control, in specific regions. At the same time these programmes should be evaluated from time to time, as the influence of various explanatory variables also changes accordingly.

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# APPENDIX

**Table A.1:** Socio-Economic and Demographic indicators, Rajasthan, 1981.

| DISTRICTS | TFR | CBR | PFLIT | PFLITSEC | PSC | PST | LOFURB | HBPLHP | PHHELE | PHHSDW | PUHHTOI | IPSL | PFWINNPS | PMWINNPS | FWPART | LMR | RLPHSK | IMR | CMR | SEXRATIO | SMAMFE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AJMER | 5.2 | 36.4 | 25.11 | 20.51 | 18.38 | 2.23 | 42.8 | 131.08 | 35.39 | 24.26 | 63.72 | 41.12 | 15.44 | 38.88 | 24.34 | 1.61 | 139.16 | 106 | 162 | 922 | 16.4 |
| ALWAR | 6.5 | 41.8 | 13.35 | 12.56 | 17.64 | 8.12 | 11.08 | 39.86 | 14 | 11.78 | 64.14 | 29.97 | 17.64 | 25.94 | 22.85 | 1.96 | 79.77 | 108 | 170 | 892 | 16.7 |
| BANSWARA | 6.3 | 43.6 | 8.88 | 10.82 | 4.72 | 72.63 | 6.22 | 54.48 | 14.21 | 8.8 | 65.26 | 29.42 | 16.56 | 17.41 | 33.22 | 1.48 | 100.36 | 150 | 138 | 984 | 17 |
| BARMER | 6.5 | 43.2 | 4.41 | 7.57 | 15.63 | 5.1 | 8.78 | 19.93 | 7 | 7.91 | 46.98 | 20.63 | 7.19 | 14.33 | 26.58 | 5.3 | 25.74 | 166 | 129 | 904 | 17 |
| BHARATPUR | 7.1 | 44.7 | 11.88 | 13.05 | 21.3 | 3.01 | 17.07 | 41.4 | 14.43 | 10.83 | 47.48 | 24.25 | 29.55 | 23.63 | 13.52 | 1.55 | 68.62 | 160 | 199 | 831 | 16.8 |
| BHILWARA | 5.4 | 38.3 | 10.3 | 13.86 | 17.01 | 9.28 | 14.39 | 31.29 | 50.3 | 12.29 | 47.66 | 36.75 | 5.95 | 18.33 | 31.18 | 1.01 | 39.61 | 160 | 183 | 942 | 14.2 |
| BIKANER | 5.6 | 38.8 | 20.78 | 17.42 | 18.35 | 0.18 | 39.48 | 164.6 | 35.66 | 29.97 | 67.16 | 44.26 | 32.51 | 40.7 | 13.1 | 6.86 | 30.73 | 107 | 74 | 891 | 16.5 |
| BUNDI | 6 | 40.9 | 10.42 | 13.22 | 18.91 | 20.11 | 17.01 | 30.84 | 14 | 13.1 | 46.33 | 24.48 | 13.67 | 22.41 | 19.36 | 2.14 | 86.16 | 151 | 165 | 887 | 14.6 |
| CHITTORGARH | 5.7 | 41.1 | 10.84 | 11.31 | 14.47 | 18.16 | 13.18 | 29.21 | 19.72 | 11.02 | 44.08 | 24.92 | 8.52 | 19.24 | 38.01 | 1.41 | 30.27 | 179 | 176 | 951 | 15 |
| CHURU | 5.7 | 39.1 | 11.5 | 10.16 | 19.55 | 0.48 | 29.22 | 51.89 | 18.01 | 16.06 | 40.22 | 24.76 | 6.53 | 22.24 | 19.8 | 5.72 | 33.31 | 69 | 98 | 954 | 16.1 |
| DUNGARPUR | 5.7 | 42.1 | 9.35 | 8.28 | 4.51 | 64.44 | 6.46 | 38.08 | 13.83 | 7.27 | 56.54 | 25.88 | 9.75 | 15.84 | 38.15 | 1.28 | 107.59 | 171 | 142 | 1045 | 17.7 |
| GANGANAGAR | 5.3 | 36.6 | 16.72 | 13.64 | 29.05 | 0.25 | 20.61 | 31.82 | 25.23 | 23.79 | 63.53 | 37.52 | 25.11 | 26.16 | 10.01 | 4.64 | 47.62 | 141 | 112 | 874 | 17.9 |
| JAIPUR | 5.8 | 39.3 | 20.07 | 23.03 | 16.26 | 11.12 | 36.56 | 93.52 | 35.89 | 79.17 | 68.85 | 61.3 | 20.72 | 44.43 | 15.69 | 1.81 | 141.26 | 175 | 144 | 894 | 17.9 |
| JAISALMER | 6.1 | 40.4 | 6.23 | 10.28 | 14.52 | 4.39 | 13.55 | 34.56 | 8.07 | 8.46 | 39.71 | 18.75 | 30.6 | 24.93 | 11.76 | 5.55 | 5.15 | 164 | 108 | 811 | 17 |
| JALORE | 6.9 | 44 | 5.29 | 7.07 | 17.01 | 8.01 | 8.06 | 31.01 | 10.11 | 16.11 | 30.37 | 18.86 | 8.74 | 16.36 | 14.76 | 3.71 | 45.85 | 115 | 137 | 942 | 17.4 |
| JHALAWAR | 6.1 | 40.8 | 10.82 | 10.17 | 17.1 | 11.67 | 11.66 | 38.6 | 13.31 | 10.43 | 51.87 | 25.2 | 6.81 | 16.57 | 24.26 | 1.72 | 103.86 | 140 | 160 | 926 | 14.9 |
| JHUNJHUNU | 5.8 | 39.5 | 13.29 | 8.34 | 14.91 | 1.9 | 20.74 | 88.4 | 21.09 | 17.74 | 40.71 | 26.51 | 11.47 | 29.7 | 23.01 | 2.95 | 107.69 | 84 | 113 | 956 | 16.2 |
| JODHPUR | 5.6 | 38.8 | 16.95 | 21.63 | 15.51 | 2.4 | 34.77 | 86.52 | 28.43 | 24.25 | 64.28 | 38.99 | 11.37 | 33.21 | 15.85 | 3.62 | 56.51 | 112 | 107 | 909 | 17 |
| KOTA | 5.9 | 40.6 | 20.38 | 18.99 | 18.81 | 14.83 | 31.93 | 59.24 | 26.01 | 23.98 | 57.8 | 35.93 | 28.75 | 38.74 | 15.25 | 2.6 | 66.86 | 141 | 142 | 888 | 16 |
| NAGAUR | 5.6 | 37.9 | 8.25 | 7.39 | 19.18 | 0.18 | 14.56 | 30.39 | 14.45 | 10.81 | 41.77 | 22.34 | 4.95 | 19.22 | 24.39 | 3.26 | 38.44 | 108 | 118 | 958 | 15.4 |
| PALI | 6.4 | 42.7 | 10.32 | 9.55 | 17.73 | 5.47 | 18.42 | 39.07 | 17.52 | 13.02 | 34.87 | 21.8 | 10.04 | 27.32 | 22.72 | 2.12 | 14.72 | 99 | 168 | 946 | 16.3 |
| SAWAI MADHOPUR | 6.7 | 43.1 | 9.57 | 8.95 | 21.37 | 22.67 | 13.42 | 22.79 | 13.49 | 8.93 | 52.4 | 24.94 | 12.4 | 22.85 | 16.77 | 1.69 | 38.02 | 188 | 189 | 867 | 15.3 |
| SIKAR | 6.1 | 39.9 | 10.61 | 6.71 | 13.75 | 2.65 | 20.25 | 54.89 | 20.72 | 17.65 | 42.36 | 26.91 | 14.91 | 32.03 | 16.12 | 2.8 | 54.95 | 137 | 119 | 963 | 15.8 |
| SIROHI | 6 | 42 | 11.63 | 12.04 | 18.74 | 23.11 | 17.9 | 54.05 | 17.77 | 14.16 | 41.92 | 24.62 | 20.43 | 32.68 | 19.06 | 1.93 | 145.39 | 145 | 157 | 963 | 17.4 |
| TONK | 6.2 | 41.7 | 9.63 | 19.72 | 20.63 | 11.8 | 18.36 | 37.65 | 16.33 | 11.32 | 52 | 26.55 | 12.29 | 23.35 | 28.37 | 2.67 | 44.5 | 174 | 203 | 928 | 14.6 |
| UDAIPUR | 5.8 | 41 | 12.54 | 19.52 | 8.21 | 34.33 | 15.07 | 63.39 | 18.47 | 13.09 | 59.36 | 30.31 | 16.48 | 25.25 | 25.92 | 1.03 | 58.82 | 191 | 156 | 977 | 16.7 |
| **RAJASTHAN** | **6** | **40.5** | **13.36** | **15.59** | **17.04** | **12.21** | **21.05** | **56.71** | **20.48** | **16.53** | **56.48** | **31.16** | **13.34** | **26.43** | **21.06** | **2.58** | **51.14** | **108** | **175** | **977** | **16.3** |

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6. Indian Agricultural Statistics, Vol. I and II, (1981-82), All India, State wise and District wise.
7. Human Development Report-Rajasthan, (1999), Society for International Development, Rajasthan Charter.

**Table A.2:** Socio-Economic and Demographic indicators, Rajasthan, 1991.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AJMER | 4.6 | 34.1 | 34.5 | 25.1 | 18.5 | 2.3 | 40.69 | 170 | 56.57 | 72.02 | 30.9 | 53.16 | 15.34 | 40.75 | 27.88 | 1.48 | 324.15 | 113 | 130 | 918 | 17.9 |
| ALWAR | 6.1 | 40.5 | 22.54 | 16.6 | 17.78 | 8.06 | 13.95 | 44 | 29.42 | 48.62 | 13.11 | 30.38 | 8.14 | 26.96 | 31.97 | 1.58 | 238.89 | 101 | 124 | 880 | 17.6 |
| BANSWARA | 5.2 | 39.1 | 13.42 | 16.6 | 5 | 73.47 | 7.72 | 73 | 21.58 | 59.54 | 8.64 | 29.92 | 7.71 | 13.72 | 40.73 | 1.08 | 244.33 | 92 | 148 | 969 | 18.4 |
| BARMER | 4.9 | 36.4 | 7.68 | 11.1 | 15.7 | 5.87 | 10.04 | 35 | 14 | 37.01 | 7.28 | 19.43 | 4.83 | 15.69 | 36.39 | 4 | 46.7 | 99 | 143 | 891 | 18.2 |
| BHARATPUR | 6.5 | 42.1 | 19.6 | 18.7 | 21.64 | 2.31 | 19.42 | 49 | 29.47 | 25.96 | 12.75 | 22.73 | 17.7 | 27.51 | 21.56 | 1.67 | 267.92 | 78 | 126 | 832 | 17.8 |
| BHILWARA | 4.6 | 35.1 | 16.5 | 20.1 | 17.12 | 9.02 | 19.53 | 66 | 32.49 | 60.3 | 12.58 | 35.12 | 6.15 | 21.65 | 36.78 | 1.14 | 90.66 | 120 | 143 | 945 | 16.5 |
| BIKANER | 4.7 | 35.1 | 27.03 | 21 | 18.64 | 0.26 | 39.73 | 136 | 47.03 | 58.97 | 34.62 | 46.87 | 20.1 | 38.08 | 20.87 | 3.8 | 54.94 | 60 | 82 | 885 | 17.6 |
| BUNDI | 5.3 | 37.9 | 16.13 | 15.9 | 18.79 | 20.25 | 17.36 | 51 | 33.63 | 71.63 | 12.2 | 39.15 | 9.25 | 20.49 | 27.17 | 1.78 | 157.59 | 82 | 120 | 889 | 16.5 |
| CHITTORGARH | 4.2 | 34.1 | 17.15 | 16.1 | 14.63 | 20.28 | 15.61 | 51 | 33.4 | 72.25 | 11.1 | 38.92 | 4.98 | 17.58 | 41.73 | 1.26 | 96.05 | 99 | 149 | 950 | 16.8 |
| CHURU | 5.3 | 37.6 | 17.32 | 12.3 | 20.13 | 0.51 | 28.9 | 55 | 32 | 51.6 | 19.04 | 34.21 | 5.23 | 22.93 | 29.35 | 4.25 | 11.3 | 64 | 83 | 937 | 16.7 |
| DHOLPUR | 6.7 | 43.8 | 15.25 | 14.8 | 20.17 | 4.59 | 17.19 | 41 | 19.32 | 38.34 | 10.77 | 22.81 | 22.07 | 19.74 | 6.6 | 1.25 | 195.72 | 107 | 150 | 795 | 17.2 |
| DUNGARPUR | 4.4 | 36.4 | 15.4 | 12 | 4.61 | 65.84 | 7.3 | 54 | 23.28 | 65.63 | 6.87 | 31.93 | 9.68 | 17.87 | 37.97 | 0.82 | 261.64 | 98 | 140 | 995 | 18.3 |
| GANGANAGAR | 4.3 | 32.1 | 26.39 | 15.8 | 29.58 | 0.34 | 21.05 | 35 | 42.16 | 60.42 | 53.12 | 51.9 | 16.66 | 27.67 | 19.91 | 3.43 | 177.01 | 54 | 73 | 877 | 18.2 |
| JAIPUR | 5.3 | 37.5 | 28.69 | 27.3 | 16.23 | 11.26 | 39.53 | 106 | 50.23 | 66.43 | 34.02 | 50.23 | 18.85 | 46.46 | 20.01 | 1.61 | 379.93 | 67 | 94 | 891 | 17.8 |
| JAISALMER | 5.2 | 36.6 | 11.28 | 15.3 | 14.55 | 4.85 | 15.56 | 61 | 16.74 | 63.51 | 12.18 | 30.81 | 25.17 | 35.59 | 20.45 | 4.1 | 6 | 75 | 124 | 807 | 18.1 |
| JALORE | 5.3 | 37.8 | 7.75 | 9.4 | 17.79 | 8.43 | 7.28 | 53 | 20.56 | 55.46 | 6.01 | 27.34 | 4.99 | 15.24 | 31.56 | 2.89 | 99.09 | 91 | 129 | 942 | 18.4 |
| JHALAWAR | 4.9 | 35.9 | 16.18 | 15.3 | 17.23 | 11.9 | 15.78 | 53 | 28.07 | 51.89 | 11.71 | 30.56 | 5 | 15.81 | 32.31 | 1.49 | 186.61 | 100 | 124 | 918 | 16.6 |
| JHUNJHUNU | 5.2 | 36.8 | 25.54 | 11.7 | 15.37 | 1.93 | 20.54 | 85 | 36.16 | 60.07 | 15.45 | 37.23 | 10.99 | 32.36 | 23.41 | 2.29 | 290.47 | 56 | 80 | 931 | 17.3 |
| JODHPUR | 4.6 | 34.6 | 22.58 | 24.9 | 15.27 | 2.82 | 35.5 | 103 | 42.2 | 68.19 | 27.16 | 45.85 | 12.84 | 36.94 | 23.63 | 3.22 | 133.61 | 72 | 86 | 893 | 18.2 |
| KOTA | 5.1 | 37.2 | 29.5 | 21.9 | 19.72 | 14.2 | 36.43 | 58 | 49.24 | 75.8 | 26.12 | 50.39 | 19.77 | 37.49 | 21.39 | 2.03 | 159.73 | 84 | 140 | 887 | 17.3 |
| NAGAUR | 5.4 | 36.9 | 13.29 | 10.3 | 19.73 | 0.22 | 15.98 | 45 | 30.66 | 49.01 | 13.86 | 31.18 | 4.07 | 21.49 | 30.74 | 2.65 | 57.43 | 82 | 102 | 942 | 16.7 |
| PALI | 4.8 | 36.1 | 16.97 | 11.2 | 18.15 | 5.4 | 21.75 | 63 | 34.88 | 59.68 | 12.53 | 35.7 | 8.37 | 28.51 | 27.55 | 2.41 | 93.91 | 111 | 156 | 956 | 17.9 |
| SAWAI MADHOPUR | 6.1 | 40.7 | 14.64 | 14.2 | 21.87 | 22.59 | 14.48 | 36 | 23.72 | 37.89 | 11.1 | 24.24 | 7.59 | 22.52 | 28.17 | 1.53 | 122.73 | 79 | 122 | 854 | 16.8 |
| SIKAR | 6 | 39.9 | 19.88 | 9.5 | 14.01 | 2.65 | 21.03 | 65 | 43.59 | 62.37 | 16.85 | 40.94 | 10.98 | 34.37 | 19.74 | 2.3 | 164.46 | 57 | 78 | 946 | 16.8 |
| SIROHI | 4.7 | 36.2 | 16.99 | 17.5 | 19.24 | 23.39 | 19.51 | 81 | 35.87 | 74 | 12.82 | 40.9 | 13.59 | 32.92 | 25.8 | 1.71 | 285.26 | 118 | 139 | 949 | 18.5 |
| TONK | 5.4 | 38.4 | 15.24 | 17.6 | 20.2 | 11.89 | 19.53 | 60 | 27.13 | 58.46 | 12.7 | 32.76 | 9.9 | 23.78 | 32.12 | 2.27 | 110.55 | 123 | 149 | 923 | 16.6 |
| UDAIPUR | 4.3 | 34.4 | 19 | 22.1 | 8.32 | 36.79 | 17.1 | 65 | 32.16 | 64.24 | 14 | 36.8 | 12.84 | 26.96 | 33.1 | 0.83 | 111.48 | 92 | 129 | 965 | 17.8 |
| **RAJASTHAN** | **5.2** | **37** | **20.44** | **18.9** | **17.29** | **12.44** | **22.88** | **69** | **35.03** | **58.96** | **19.57** | **37.85** | **10.53** | **28.34** | **27.4** | **2.1** | **122.52** | **87** | **110** | **910** | **17.5** |


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4. Census of India, (1991), Rajasthan, Census Atlas, Registrar General, India.
5. Statistical Abstract, Rajasthan, (various issues), Directorate of Economics and Statistics, Rajasthan, Jaipur.
6. Indian Agricultural Statistics, Vol. I and II, (1991-92), All India, State wise and District wise.
7. Human Development Report-Rajasthan, (1999), Society for International Development, Rajasthan Charter.

**Table A.3:** Socio-Economic and Demographic indicators, Tamil Nadu, 1981.

| DISTRICTS | TFR | CBR | PFLIT | PFLITSEC | PSC | PST | LOFURB | HBPLHP | PHHELE | PHHSDW | PUHHTOI | IPSL | PFWINNPS | PMWINNPS | FWPART | LMR | RLPHSK | IMR | CMR | SEXRATIO | SMAMFE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHENGALPATTU | 3.8 | 31 | 40.7 | 18.59 | 26 | 1.3 | 38.93 | 67 | 37.47 | 26.6 | 47.46 | 37.18 | 22.31 | 42.47 | 20.68 | 0.62 | 202 | 100 | 132 | 957 | 19.8 |
| COIMBATORE | 2.7 | 23 | 45.8 | 20.34 | 16 | 0.7 | 50.46 | 101 | 52.2 | 28.77 | 51.21 | 44.06 | 25.43 | 48.46 | 28.19 | 0.76 | 221 | 100 | 113 | 950 | 21.1 |
| DHARMAPURI | 4.2 | 32 | 21.3 | 12.12 | 14 | 2.3 | 9.37 | 28 | 31.37 | 16.28 | 52.77 | 33.47 | 8.38 | 16.19 | 29.2 | 0.77 | 110 | 89 | 122 | 959 | 18.4 |
| KANNIYAKUMARI | 3.4 | 27 | 66.7 | 19.94 | 4.2 | 0.5 | 17.25 | 132 | 33.68 | 20.22 | 51.13 | 35.01 | 68.7 | 41.96 | 9.34 | 0.64 | 322 | 87 | 87 | 985 | 23.3 |
| MADRAS | 2.7 | 25 | 67.6 | 30.86 | 13 | 0.2 | 100 | 352 | 67.83 | 65.47 | 76.14 | 69.81 | 99.46 | 98.67 | 6.8 | 0 | 1906 | 53 | 79 | 934 | 21.1 |
| MADURAI | 3.5 | 28 | 39.3 | 16.17 | 15 | 0.3 | 36.24 | 114 | 37.25 | 19.21 | 47.96 | 34.81 | 15.68 | 32.33 | 30.78 | 0.58 | 127 | 105 | 137 | 975 | 20.4 |
| N. ARCOT | 4.3 | 33 | 32.2 | 12.83 | 20 | 2.1 | 23.01 | 92 | 33.5 | 21.48 | 52.86 | 35.95 | 14.68 | 30.7 | 27.22 | 0.52 | 141 | 121 | 158 | 979 | 19.1 |
| PERIYAR | 2.6 | 22 | 30 | 14.07 | 16 | 0.7 | 22.01 | 59 | 36.66 | 21.46 | 43.73 | 33.95 | 19.84 | 33 | 36.51 | 0.65 | 185 | 104 | 110 | 956 | 20.2 |
| PUDUKKOTTAI | 3.9 | 30 | 27.2 | 11.36 | 17 | 0.1 | 13.28 | 59 | 23.01 | 12.72 | 39.46 | 25.06 | 10.01 | 22.46 | 26.49 | 0.71 | 180 | 73 | 111 | 1007 | 20.4 |
| RAMANATHAPURAM | 4 | 31 | 36.3 | 12.63 | 17 | 0.2 | 28.1 | 68 | 32.71 | 11.15 | 26.65 | 23.5 | 26.29 | 34.34 | 32.8 | 0.83 | 126 | 124 | 149 | 1023 | 20.7 |
| SALEM | 2.8 | 24 | 31 | 16.56 | 16 | 3.6 | 28.93 | 47 | 33.75 | 20.64 | 41.31 | 31.9 | 22.38 | 37.31 | 33.34 | 0.6 | 177 | 80 | 112 | 949 | 19.4 |
| S. ARCOT | 4.1 | 33 | 27.2 | 12.46 | 26 | 1.3 | 15.7 | 46 | 23.66 | 19.77 | 45.76 | 29.73 | 8.43 | 19.94 | 26.75 | 0.63 | 146 | 132 | 167 | 972 | 19.2 |
| THANJAVUR | 3.3 | 27 | 42.5 | 11.82 | 23 | 0.2 | 23.06 | 106 | 28.87 | 28.41 | 46.2 | 34.49 | 13.15 | 27.11 | 21.63 | 0.91 | 212 | 102 | 122 | 988 | 20.2 |
| THE NILGIRIS | 3 | 27 | 49.9 | 18.29 | 23 | 3.3 | 48.85 | 138 | 47.49 | 25.23 | 47.74 | 40.15 | 13.23 | 32.04 | 26.81 | 2.87 | 197 | 100 | 133 | 957 | 21.3 |
| TIRUCHIRAPALLI | 3.2 | 26 | 36.4 | 16.04 | 19 | 1.3 | 26.13 | 64 | 31.74 | 17.08 | 46.67 | 31.83 | 13.29 | 29.2 | 29.41 | 0.68 | 148 | 104 | 134 | 985 | 20.3 |
| TIRUNELVELI | 3.9 | 30 | 46.6 | 11.76 | 16 | 0.3 | 34.64 | 79 | 47.97 | 16.61 | 40.52 | 35.03 | 37.96 | 42.43 | 31.69 | 0.69 | 138 | 120 | 166 | 1044 | 21.4 |
| **TAMIL NADU** | **3.5** | **28** | **39.4** | **16.86** | **18** | **1.1** | **32.95** | **97** | **37.21** | **23.44** | **51.27** | **37.31** | **21.24** | **36.11** | **26.52** | **0.68** | **160** | **104** | **132** | **977** | **20.4** |


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| Table A.4: Socio-Economic and Demographic indicators, Tamil Nadu, 1991. | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DISTRICTS | TFR | CBR | PFLIT | PFLITSEC | PSC | PST | LOFURB | HBPLHP | PHHELE | PHHSDW | PHHTOI | IPSL | PFW INNPS | PMW INNPS | FWPART | LMR | RLPHSK | IMR | CMR | SEX RATIO | SMAM FE |
| CHENGALPATTU | 2.5 | 24 | 55.2 | 24.2 | 26 | 1.2 | 44.87 | 52.7 | 61.54 | 53.4 | 31.17 | 48.7 | 27.46 | 48.6 | 21.77 | 0.52 | 137.41 | 52 | 63 | 960 | 20.7 |
| CHIDAMBARANAR | 2.4 | 22 | 64.6 | 16.6 | 17 | 0.2 | 41.19 | 35.23 | 58.49 | 69.66 | 22.31 | 50.15 | 34.68 | 44.5 | 30.05 | 0.79 | 84.78 | 41 | 67 | 1051 | 22.2 |
| COIMBATORE | 1.7 | 18 | 55.7 | 25.7 | 16 | 0.8 | 52.59 | 72.24 | 65.65 | 77.01 | 31.44 | 58.03 | 33.31 | 55.4 | 26.91 | 0.58 | 100.01 | 40 | 52 | 952 | 21.4 |
| DHARMAPURI | 3 | 26 | 34.2 | 15.8 | 14 | 2 | 9.5 | 29.81 | 45.23 | 60.6 | 11.18 | 39 | 9.6 | 18.8 | 37.39 | 0.69 | 51.69 | 54 | 86 | 942 | 19 |
| DINDIGUL ANNA | 2.1 | 20 | 43.9 | 17.7 | 19 | 0.6 | 21.41 | 42.51 | 44.04 | 75.82 | 14.41 | 44.76 | 14.09 | 26.8 | 38.32 | 0.48 | 85.53 | 67 | 96 | 976 | 20.7 |
| KANNIYAKUMARI | 2.1 | 20 | 78.4 | 25.4 | 4.8 | 0.3 | 16.88 | 56.71 | 53.95 | 40.4 | 34.37 | 42.91 | 66.42 | 41 | 11.03 | 0.48 | 178.53 | 29 | 44 | 991 | 23.8 |
| KAMARAJAR | 2.4 | 23 | 50.2 | 18 | 18 | 0.2 | 37.42 | 32.54 | 56.99 | 76.69 | 12.46 | 48.71 | 37.88 | 47.1 | 42.18 | 0.5 | 92.42 | 54 | 82 | 994 | 20.9 |
| MADRAS | 1.8 | 19 | 74.9 | 36.5 | 14 | 0.2 | 100 | 273.22 | 83.46 | 71.14 | 82.33 | 78.98 | 99.9 | 89.9 | 8.44 | 0 | 1001.3 | 31 | 41 | 934 | 21.8 |
| MADURAI | 2.2 | 22 | 54.7 | 21.5 | 15 | 0.4 | 44.7 | 53.17 | 55.66 | 83.83 | 27.18 | 55.56 | 19.3 | 37.9 | 31.77 | 0.39 | 90.3 | 52 | 79 | 964 | 21.1 |
| N. ARCOT | 2.6 | 25 | 48.6 | 18.5 | 21 | 1.7 | 31.71 | 13.55 | 58.17 | 65.51 | 21.72 | 48.47 | 25.45 | 33.5 | 26.09 | 0.47 | 108.42 | 44 | 69 | 978 | 20.3 |
| PASUMPON M. THEVAR | 2.3 | 21 | 49.7 | 16.1 | 16 | 0.1 | 26.91 | 17.32 | 44.65 | 55.68 | 15.26 | 38.53 | 13.71 | 26.5 | 37.66 | 0.69 | 112.8 | 49 | 75 | 1032 | 21.6 |
| PERIYAR | 1.6 | 17 | 41.6 | 18.6 | 17 | 0.8 | 24.71 | 41.55 | 53.51 | 62.75 | 18.09 | 44.78 | 22.16 | 36.4 | 38.66 | 0.56 | 97.78 | 52 | 87 | 957 | 20.5 |
| PUDUKKOTTAI | 2.3 | 22 | 43.6 | 13.8 | 17 | 0.1 | 14.35 | 58.82 | 39.12 | 48.46 | 11.8 | 33.13 | 12.86 | 24.2 | 33 | 0.45 | 108.96 | 54 | 74 | 1005 | 21.3 |
| RAMANATHAPURAM | 2.6 | 25 | 48.7 | 11.2 | 18 | 0.1 | 21.83 | 17.84 | 41.23 | 32.09 | 11.16 | 28.16 | 14.51 | 25.8 | 35.87 | 0.69 | 84.72 | 51 | 70 | 1012 | 21.1 |
| SALEM | 2 | 20 | 41.5 | 21.1 | 17 | 3.5 | 29.16 | 39.78 | 55.3 | 58.65 | 14.32 | 42.76 | 22.63 | 38.4 | 36.69 | 0.59 | 119.15 | 56 | 75 | 937 | 19.8 |
| S. ARCOT | 2.8 | 26 | 39.7 | 16.5 | 27 | 1.2 | 15.76 | 26.67 | 47.08 | 73.45 | 10.79 | 43.77 | 8.8 | 18.5 | 31.81 | 0.53 | 93.31 | 70 | 94 | 968 | 20 |
| THANJAVUR | 2.3 | 21 | 54.8 | 15.9 | 24 | 0.2 | 22.94 | 66.46 | 43.16 | 81.66 | 17.65 | 47.49 | 14.25 | 27.6 | 24.87 | 0.66 | 127.76 | 41 | 52 | 993 | 21.2 |
| THE NILGIRIS | 1.6 | 19 | 61.5 | 24 | 30 | 3.5 | 49.76 | 98.47 | 55.12 | 64.11 | 26.17 | 48.47 | 17.34 | 42.8 | 29.75 | 2.05 | 140.76 | 43 | 56 | 983 | 22 |
| TIRUCHIRAPALLI | 2.2 | 21 | 48.9 | 20.6 | 19 | 0.7 | 26.6 | 35.89 | 48.14 | 72.24 | 17.09 | 45.82 | 14.6 | 30.2 | 34.81 | 0.52 | 128.42 | 57 | 70 | 984 | 20.9 |
| TIRUNELVELI | 2.4 | 23 | 54.2 | 15.2 | 18 | 0.4 | 31.7 | 33.92 | 62.28 | 70.62 | 18.76 | 50.55 | 46.23 | 43.9 | 40.22 | 0.36 | 101.57 | 71 | 97 | 1034 | 21.9 |
| TIRUVANNAMALAI S. | 2.8 | 26 | 39.3 | 12.8 | 21 | 3 | 11.89 | 15.24 | 51.5 | 62.99 | 8.61 | 41.03 | 9.19 | 19.6 | 35.82 | 0.51 | 88.44 | 51 | 72 | 984 | 19.7 |
| **TAMIL NADU)** | **2.3** | **22** | **51.3** | **21** | **19** | **1** | **34.16** | **53.04** | **54.74** | **67.42** | **23.13** | **48.43** | **23.42** | **38.2** | **29.89** | **0.55** | **104.68** | **51** | **70** | **974** | **20.9** |


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