Socioeconomic development and fertility trends among the states of India

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Abstract

Purpose – The purpose of this paper is to investigate the relationship between levels of socioeconomic development and subsequent trends in fertility among the states of India. Based on the Theory of Demographic Transition, this study tests the hypothesis: The higher the level of socioeconomic development in 1993, the greater the subsequent percentage of decrease in fertility rates between 1999 and 2006 among the states of India.

Design/methodology/approach – The study utilizes Pearson's *r* correlation and linear multiple regression analysis on three National Family Health Surveys data to predict two measures of decline in fertility from socioeconomic indicators.

Findings – The findings support the theory of demographic transition in large measure revealing that the overall level of socioeconomic development is directly related to subsequent declines in fertility among the states of India.

Research limitations/implications – Correlations between state-wide indicators are based on sample data of which margins of error and response rates are unknown.

Practical implications – The study suggests that the empowerment of women through education, employment opportunities and exposure to the mass media reduces fertility.

Social implications – Population control in India is extremely important for the future welfare of all of its society members.

Originality/value – Although previous research has shown cross-sectional correlations between fertility and socioeconomic development, this is the first time correlations between socioeconomic development and subsequent trends in fertility have been measured. This is methodologically important because Demographic Transition Theory hypothesizes a lag between modernization and fertility decline. Rather than correlating level of economic development with current fertility, this study correlates level of economic development with the subsequent dynamic changes in fertility.

Keywords India, Birth rate, Economic development, Family, Fertility

Paper type Research paper

Introduction

Two words describe India's current population; large and growing. India's population increased from 238 million in 1901 to 361 million in 1951. The pace of growth accelerated in the 1950s, and the population reached 1,027 million by the time of the 2001 census. Between 1991 and 2001, the population increased by 166 million, or 21 percent (India, Registrar General and Census Commissioner, 2001). The World Bank estimated the population of India in 2008 at 1,140 million (The World Bank, 2009).

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Even though the government of India has provided information about the benefits of small families, the total fertility rate (TFR) of the country is 2.6, and the growth rate is 1.5 percent per year. Modern medical and health practices have been successfully introduced into India, resulting in a sharp decline in the mortality rate and an increase in the average life expectancy from 32 years in 1947 to 64 years in 2010 (Population Reference Bureau, 2010). India's population problem is the result of the absence of a concurrent decline in the fertility rate, though many other developing countries have made great strides in the past 30 years to achieve fertility decline. The inevitable result has been an increasing strain on available resources. This demand seriously threatens the socioeconomic development and political stability of India. While India's population is second in size to China's, its annual population growth leads the world. India's population is projected to reach 1.75 billion by 2050, passing China to become the most highly populated country in the world (Population Reference Bureau, 2010). Although practice of family planning in India has increased over a period of time, only 48 percent of married women use modern methods of contraception as compared to 68 percent in the USA (Population Reference Bureau, 2008). The obvious key to stabilizing India's population is to find ways to reduce its fertility rate to a level near or below its mortality rate. In other words, India must be nurtured through the full cycle of demographic transition.

Among the developing countries, India was a pioneer in the international movement to control population growth and adopted a national population policy of fertility control as an integral part of its national developmental plan. The official recognition of the problem came with the publication of the first five-year plan (India, Planning Commission, 1953), which went into effect in 1951. Since implementing the program, 11 five-year plans have been completed. Unfortunately, the family planning program has not met with the success anticipated.

Societal fertility rates, in general, tend to be inversely related to the level of socioeconomic development, with the most socioeconomically developed countries having the lowest crude birth rate (CBR) and TFR. More developed regions (North America, Europe, Australia, Japan and New Zealand) have the lowest rates (CBR 11 and TFR 1.7. On the other hand, less developed regions (Africa, Latin America and Caribbean, and Asia) have much higher rates – CBR 22 and TFR 2.7 (Population Reference Bureau, 2010).

With a current total population of 1.188 billion and a birth rate of 23 per 1,000 in the population, over 27 million babies are born in India every year. With a death rate of seven per 1,000 in the population, 8.3 million people die each year (Population Reference Bureau, 2010). With the addition of 19 million people to India's population each year, numerous social problems such as hunger, malnutrition, environmental degradation, congestion and overcrowding are becoming increasingly difficult to control. The most intuitive solution to these problems is a decline in the birth rate.

The primary objective of this study is to investigate the relationship between the levels of socioeconomic development and resultant trends in fertility among the states of India. This objective will be addressed through quantitative analysis of survey data collected among the states of India. While previous studies examined static models of this relationship using a one-shot design, correlating current fertility and development measures (Amonker and Brinker, 2000), the release of results from the third iteration of the National Family Health Survey conducted in 2006 has enabled an innovative

time series design never used before, using the subsequent change in fertility after socioeconomic development has occurred, to better capture the dynamic effects of development on subsequent changes in fertility. Since demographic transition theory predicts a temporal delay between modernization and fertility decline, this dynamic model should provide a superior assessment of the validity of the demographic transition model as it applies to modern India.

Theoretical framework, literature review and hypothesis

The perspective of this research is taken essentially from the framework of one of the most enduring theories of fertility control. This theory states that through economic development, social changes happen that allow for high fertility and mortality rates to be replaced by a decline first in mortality rates, followed by a subsequent decline in fertility rates, leading to population stability in a given society. This theory has been called the "Theory of Demographic Transition" in demography literature. Works by Thompson (1929), Notestein (1945), Davis (1949), Coale and Hoover (1958), Stolnitz (1964) and Lee (2003a, b) are but a few of the demographers to find empirical support for this theory.

According to the demographic transition theory, in the past two centuries fertility and mortality decline in Europe, and later elsewhere, was largely the result of economic and social development. In the wake of this development came the rapid decline in mortality. With more children surviving, fewer births were needed to achieve a given family size or rate of population increase. The rising cost of nurturing and diminished economic utility of children in urban and industrial environments provided additional motivation for limiting family size. The rising status of women through the extension of educational opportunities and employment of women in occupations formerly reserved for males contributed to the widening practice of family limitation. As industrialization and modernization infiltrated the culture, a more secular, rational attitude favoring the voluntary control of fertility evolved (Caldwell, 1982; Coale, 1969; Teitelbaum, 1975; The World Bank, 1984). Sanderson and Dubrow (2000) found the empowerment of women to be a good predictor of fertility in a large sample of world societies.

The low demand for children in developed societies results in low fertility. However, in developing countries, such as India, children have traditionally played significant roles in their parents' economic and old age security. A number of field studies have reported that children in many developing countries are a principal economic resource. They are economically active, contributing significantly to household labor in rural settings. Many of these children work in the formal labor force. In addition, children are traditionally viewed as a form of insurance for rural parents in old age (Bosserup, 1981; Cain, 1981; Mendelievich, 1979; Rodgers and Standing, 1981). The social status of women in developing countries is often primarily determined by the number of children they have. But as socioeconomic development occurs, the effect of children on the social status of women tends to decline (Bekman and Aksu-Koc, 2009). More recently, Sanderson and Dubrow (2000) found weak support for the economic value of children's labor playing a role in the decision to have children. Ram (2012) found recent trends of decreasing family size, later age of first marriage and earlier completion of child-bearing among families in India, particularly among the young and urban families.

Kaplan (1994) found evidence of regional and cross-cultural variation in norms and practices regarding behaviors that effect fertility and concluded that, "There is room

for historical forces and the processes of cultural transmission to exert an impact on reproduction and parental investment." His discussion suggested a need for "an integrated understanding of the physiological and psychological mechanisms and of the cultural processes underlying fertility outcomes." Supporting the theory of demographic transition, Kaplan concludes that in modern industrialized societies where earnings increase with time spent in school, parents, by supporting their children through extended educational training, increase their earning value as adults:

> These models suggest that if parents elect to have two or three children, their assessment must be that the care and resources diverted to a third or fourth child would worsen outcomes for the first two children sufficiently to motivate succession of reproduction.

His theory suggests that:

> [...] in addition to the availability and cost of contraception, three factors should affect fertility reduction in the developing world: (1) production opportunities that require high levels of accrued human capital; (2) access to education; and (3) the cost of education. With respect to the first factor, growth in production opportunities and women's access to them may be especially critical.

These conditions, Kaplan concludes, should favor lower fertility.

A number of studies have sought to clarify the complex relationship between socioeconomic development and fertility in developed and developing countries. Although Pandy and Pandy (2011) concluded that poverty and religious fertility dictates are largely responsible for India's high fertility rate, some researchers have stressed the effect of education, especially of the mother, as the key factor in the declines in fertility in developing countries (Becker, 1981; Dreze *et al.*, 1996; Schultz, 1973). In India, studies have established a distinct relationship between the education of women and fertility. A negative association between the educational attainment of currently married women and fertility was observed in Greater Bombay (Rele and Kanitkar, 1974). Another study conducted in the State of Kerala revealed the existence of fertility differentials by education, the differentials being more marked with respect to women's education (Mehrotra, 1966). Increased schooling and postponement of marriage affect an individual's choice of marriage partner, son preference, knowledge of contraceptive methods, and ability to control the number of births. According to Caldwell (1980), mass education that tends to emphasize modernization and secular attitudes is the only means to enhance child survival and reduce fertility.

Some researchers have stressed the education of women and maternal education as the key factors in the decline of fertility in developing countries. As the education level of a society increases, fertility rate goes down. Educational attainment of parents, especially of mothers, has been found to have a significant negative relationship with fertility. Maternal education has been shown to be positively correlated with levels of maternal childcare. Literate mothers usually give birth to healthier babies because they have more information about prenatal care than illiterate mothers. They also have more influence within the family in deciding to take sick children for treatment (Mellington and Cameron, 1999; Pitt, 1995; Rajna *et al.*, 1998; Yadava and Chadney, 1994). Smita and Pandy (2010), however, found that "selection and acceptability of a fertility method is strongly influenced by the predilection and pressures of other people in a woman's life, particularly her spouse," suggesting that "understanding the sexual attitude and behavior of the male partner becomes imperative to any effort

at understanding the fertility behavior of women." Economic development, such as an increase in gross national product, per capita income and urbanization of a society, has a significant inhibiting effect on fertility (Audinarayana and Thenmozhi, 1989; United Nations, 1990, 1995). Economic development allows for an improved standard of living and higher aspirations for children and parents. In a developed society, the economic value and benefits of children decrease, resulting in lower fertility (Freedman, 1979). Some variables indicating economic development, such as availability of water, electricity and toilet facilities, also affect fertility directly or indirectly through their impact on mortality. Regular exposure to the mass media, especially to radio and television, influences family planning attitudes and behavior, which in turn affects fertility (Westoff and Bankole, 1999).

The economic activity of women with some education is also considered an important factor in reducing fertility (Chaudhury, 1996; Ward and Pampel, 1985). An increase in labor force participation rates enhances the status and power of women, which in turn encourages and enables them to limit fertility. The earning capacity of women is expected to bring them economic independence, which ultimately gives them more decision-making power. Furthermore, working women may have higher exposure to mass media and knowledge of family planning methods and services. In early studies, however, the relationship between economic indicators and fertility was found to be very weak in India (Jain, 1985). In developing societies such as mid-twentieth century India, the working status of women in agricultural activity hardly changed their status in family and society and, as a result, had little effect on fertility decisions (Ward, 1984). In developing countries like these, poverty rather than choice often forces women into the labor force (Youssef, 1982). But in the twenty-first century, as post-industrial societies continue to outsource non-agricultural jobs to India, increasing opportunities for women in highly skilled and highly paid occupations may be changing these dynamics. Anju *et al.* (1995) concluded that multi-dimensional gender inequality and manifestations of patriarchy, which limited educational and high-status job opportunities for women, were the constructs most strongly correlated with fertility. Literacy, in particular, was a strong predictor of later marriage, which is logically associated with lower fertility.

Lee (2003a, b) expanded on the idea that transfers of social capital to the young by individuals past their reproductive years contributed to their reproductive fitness and, more so than fertility, explain post-reproductive age survival and why juvenile mortality decreases with age. Consistent with Kaplan's life theory models, certain organisms optimize their chances of survival with high fertility and low investment in post-reproductive transfers, resulting in high post-reproductive mortality, while others opt for low fertility and high investment transfers, resulting in low post-reproductive mortality. Lee concludes that for some organisms, "transfers to offspring are centrally important for survival, growth and eventual reproductive success, and such organisms have evolved lower fertility, and plausibly optimize the quality-quantity tradeoff."

A number of researchers have found that a decrease in infant and child mortality has a significant effect in lowering fertility. As the infant and child mortality rates in a society decrease, the parental motivation to replace dead children also decreases (Knodel, 1974). A study by Taylor and Takulia (1971) in India found that the use of contraception is dependent on the respondent's perception of increased child survival.

Furthermore, a couple's approval of contraception decreases in proportion to the number of child deaths (Rutstein, 1974).

In developing countries such as India and China, family planning programs play a direct role in reducing fertility. The availability of effective contraception gives contemporary developing countries a major advantage over the European societies that underwent fertility decline earlier. Legalized abortion and other forms of birth control, a trained family planning workforce, statements by political leaders, public campaigns and the use of mass media in developing countries have accelerated the diffusion of new ideas about family planning in both rural and urban environments, creating conditions for fertility decline (Mauldin and Berelson, 1978). However, a study by Robey *et al.* (1993) notes that, in contrast to the demographic transition undergone by the now developed world, birth rates in the developing world have fallen even in the absence of improved living conditions. The decrease has also proceeded with remarkable speed. Developing countries appear to have benefited from the growing influence and scope of family planning programs, new contraceptive technologies and from the educational power of mass media.

Recent studies have shown that preference for male children is still quite strong (Ram, 2012). Charmabagwala (2010) found a positive correlation between family size and offspring sex ratios, suggesting that many families are using sex-selection technologies. Their research also suggests that the more educated and wealthy families have increased access to these technologies, while the demographic transition theory would suggest that the poor and less-educated have a higher need for male children. Efforts to expand education to poor women and provide them access to sex-selection technology might have the effect of reducing family size. Saavala (2010) found significant reductions in fertility among the Southern states of India despite slow social and economic development, suggesting that social diffusion can be a strong factor in fertility reduction.

The preceding discussion forms the central orientation of this study. The underlying assumption behind the demographic transition theory is that as the level of development in country increases, children become less of an economic asset and more a liability in an industrializing economy. Modernization also tends to bring improvements in health care, enhancing the survivability of children to adulthood. These social forces eventually drive rational decisions by couples to have fewer children, which in turn lead to evolving social norms of small families. Thus, this study will test the following major hypothesis:

H1. The higher the level of socioeconomic development in 1993, the higher the subsequent percent of decrease in the fertility rates among the states of India between 1999 and 2006.

Data and measurement

Data for this study have been obtained from the three National Family Health Surveys of ever married women (NFHS1:1992-1993, sample 89,777 of age 13-49, NFHS2:1998-1999, sample 89,119 of age 15-49 and NFHS3:2005-2006, sample 124,385 of age 15-49) initiated by the Ministry of Health and Family Welfare, Government of India, and conducted by the International Institute for Population Sciences, Bombay. The main objective of the NFHS was to collect reliable and up-to-date information on fertility, family planning, mortality and maternal and child health. The three NFHS studies are the most comprehensive surveys of their kind ever conducted in India. Their purpose is to

strengthen the research capabilities of the 18 population research centers located in universities and institutes of national repute throughout India (International Institute for Population Sciences, 1995, 2000, 2007).

Previous studies have shown correlation between measures of economic development and fertility using data from the National Family Health Surveys (Amonker and Brinker, 2000, 2007). These studies, however, used data of fertility and modernization collected at the same point in time. One accepted premise for establishing causation is that the independent variable must occur in time before the dependent variable. It is an established assumption of the demographic transition theory that modernization causes an immediate decline in mortality rates, thus causing an immediate increase in population growth, but that high fertility persists until the cultural liabilities of children in a modernized society become apparent within households and these liabilities become compelling enough to affect a decline in fertility. Although modernization often occurs quite rapidly in less developed countries today, much more rapidly than in nineteenth century Europe, engrained social norms regarding family size and family planning practices may persist for several years after modernization has occurred. So correlation between modernization and fertility in static, cross sectional research designs may not capture the full causal effect of modernization on subsequent declines fertility, only fertility change concurrent with modernization. The recent accumulation of modernization and fertility data among the states of India over three points in time facilitates a dynamic analysis model analyzing the delayed effect of modernization on subsequent changes in fertility rates. This research design will analyze the correlation between early measures of socioeconomic development (1993) and the percent of change between two later measures of fertility (1999 and 2006) to assess the dynamic changes in fertility among the states of India.

The two main concepts used in the research are:

(1) level of socioeconomic development in 1993 (measure of the independent variable); and

(2) changes in fertility between 1999 and 2006 (measure of the dependent variable).

The term "socioeconomic development" implies an ongoing process of change in a society and includes a large number of indicators (such as education, occupation, income, communication, transportation, energy, utilities infrastructures and health) to describe the overall development of a society (Bongaarts, 1978). However, in this study the following 20 variables are selected from the NFHS data of the states of India, which are grouped into four major categories: these are:

(a) Education variables:

(1) Percent literate females.

(2) Percent household population attending school.

(3) Percent of females attending school.

(4) Median school years attained by females.

(5) Percent women completing high school education and above.

(b) Modernization variables:

(6) Percent women employed.

(7) percent women exposed to mass media.
(8) Percent households with improved source of drinking water.
(9) Percent households with toilet facility.
(10) Percent households with electricity.

(c) Health variables:
(11) Infant mortality rate.
(12) Child mortality rate.
(13) Percent children immunized.
(14) Percent mothers receiving antenatal care.
(15) Percent births delivered in health facility.
(16) Percent deliveries assisted by health professionals.
(17) Percent underweight children under 3-4 years.

(d) Family planning variables:
(18) Percent having knowledge of modern contraception.
(19) Percent using contraceptives.
(20) Percent sterilized.

The term "fertility" refers to reproductive performance of a society. The two indicators of fertility are: the CBR (the number of births per 1,000 in the population, and the TFR – the average number of children born during a woman's reproductive span of life per woman, among the states of India. The dependent variables Percent of Change in CBR and Percent of Change in TFR were computed using the standard percent of change equation using the rates in 1999 as Time 1 and the rates in 2006 as Time 2. Table I shows the measures of socioeconomic development from the 1992-1993 NFHS reports. Table II shows the fertility data from the 1998-1999 and 2005-2006 NFHS data, as well as the computed percentages of change in fertility between 1999 and 2006.

Analysis of data and results

The analysis of data and results presented below are based on two commonly used statistical procedures appropriate for the levels of measurement of the variables used:

(1) Pearson's r correlation coefficient measures the association between the interval level independent variables of socioeconomic development and the two interval-level dependent variables of percent of change in fertility.

(2) Linear multiple regression analysis models the interval-level percent of change in CBR using the predictor variables of socioeconomic development.

(1) Pearson's correlation coefficients

Table III presents Pearson correlation coefficients between the 1993 socioeconomic development variables and percent of change in fertility rates between 1999 and 2006 (CBR and TFR) in India. An examination of the statistics shows that of the 20 socioeconomic development variables, 19 are related to percent of change in CBR and 18 are related to percent of change in TFR in the directions predicted by the research hypothesis. Since data are analyzed on the entire population of states of India, there is no

	Independent variables																			
	Education					Modernization					Health							Family planning		
State	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Andhra Pradesh	38.5	63.3	54.8	0.0	10.4	53.4	75.2	63.4	24.4	62.2	70.4	22.4	45.0	86.3	32.8	49.3	49.1	96.6	47.0	44.8
Arunachal Pradesh	42.1	71.0	65.3	1.2	7.3	44.9	46.6	75.8	73.6	63.1	40.0	33.3	22.5	48.9	19.9	21.3	39.7	77.7	23.6	10.7
Assam	50.7	70.1	66.0	2.6	7.1	18.4	39.1	43.2	49.6	20.4	88.7	58.7	19.4	49.3	11.1	17.9	50.4	96.9	42.8	4.4
Bihar	28.6	51.3	38.3	0.0	8.1	24.9	29.5	63.6	16.5	16.6	89.2	42.0	10.7	36.8	12.1	9.0	62.6	94.9	23.1	18.6
Delhi	70.8	86.9	86.3	7.3	36.9	19.3	86.7	99.5	84.1	95.5	65.4	19.0	57.8	82.4	44.3	53.0	41.6	98.9	60.3	23.3
Goa	73.1	93.5	92.5	6.5	27.2	29.7	85.2	92.5	43.5	91.7	31.9	7.2	74.9	95.4	86.8	88.4	35.0	98.8	47.8	30.5
Gujarat	51.3	75.7	68.4	4.1	16.1	43.2	55.4	75.1	35.8	76.6	68.7	37.9	49.8	75.7	35.6	42.5	50.1	96.4	49.3	41.0
Haryana	45.9	81.3	74.7	3.4	14.4	28.9	60.1	73.0	26.9	85.0	73.3	27.4	53.5	72.7	16.7	30.3	37.9	99.4	49.7	34.8
Himachal Pradesh	57.4	90.8	87.6	4.6	13.4	47.7	66.8	57.6	12.6	90.2	55.8	14.1	62.9	76.0	16.0	25.6	47.0	98.9	58.4	45.8
Jammu & Kashmir	51.8	85.7	79.6	4.5	18.8	27.5	72.2	57.3	19.1	86.7	45.4	14.3	65.7	79.5	21.9	31.2	44.5	99.6	49.4	29.7
Karnataka	46.5	70.5	64.4	2.9	13.6	47.0	70.1	75.6	31.2	64.0	65.4	23.5	57.2	83.5	37.5	50.9	54.3	98.8	49.1	42.5
Kerala	82.4	94.8	94.8	6.7	21.3	24.7	79.2	21.0	70.9	60.3	23.8	8.4	54.4	97.3	87.8	89.7	28.5	99.7	63.3	48.3
Madhya Pradesh	34.3	62.3	54.8	0.0	7.3	32.4	41.0	55.8	21.3	62.4	85.2	49.3	29.2	52.1	15.9	30.0	57.4	87.8	36.5	31.5
Maharashtra	55.9	81.5	76.6	4.5	14.8	49.0	62.8	78.5	40.8	73.6	50.5	20.9	64.1	82.7	43.9	53.2	54.2	97.8	53.7	46.2
Manipur	63.0	90.2	86.8	5.1	22.6	53.5	67.8	47.0	83.1	62.1	42.4	20.2	29.1	63.4	23.0	40.4	30.1	93.0	34.9	13.8
Meghalaya	60.2	75.0	75.7	2.5	10.4	41.8	46.4	47.6	54.3	42.6	64.2	24.3	9.7	51.8	29.6	36.9	45.5	76.9	20.7	10.0
Mizoram	88.9	90.7	88.5	5.9	14.6	33.2	61.3	40.1	98.3	76.0	14.6	14.9	56.4	88.9	48.9	61.5	28.1	98.1	53.8	44.6
Nagaland	71.8	89.6	89.0	5.1	15.8	43.7	44.6	72.1	79.3	76.9	17.2	3.6	3.8	39.3	6.0	22.2	28.7	44.3	13.0	6.4
Orrissa	41.4	69.6	62.0	1.8	6.0	25.9	39.5	50.9	12.2	27.8	112.1	21.3	36.1	61.6	14.1	20.5	53.3	92.5	36.3	31.6
Punjab	52.0	80.8	77.8	4.1	18.3	7.7	65.5	98.6	36.7	92.0	53.7	15.0	61.9	87.9	24.8	48.3	45.9	99.8	58.7	34.0
Rajasthan	25.4	58.8	40.6	0.0	4.9	31.4	30.1	57.3	19.8	51.9	72.6	32.3	21.1	31.2	11.6	21.8	41.6	87.2	31.8	27.7
Tamil Nadu	56.1	82.4	78.7	5.0	15.2	46.7	78.0	74.6	29.4	63.8	67.7	20.1	64.9	94.2	63.4	71.2	48.2	99.1	49.8	39.5
Uttar Pradesh	31.5	61.3	48.2	0.0	8.8	13.4	35.5	74.3	22.9	31.9	99.9	46.0	19.8	44.7	11.2	17.2	59.0	95.2	19.8	13.1
West Bengal	52.2	67.7	62.9	3.3	9.6	33.0	61.3	84.9	40.4	32.9	75.3	26.0	34.2	75.3	31.5	33.0	56.8	98.8	57.4	30.6

Notes: Independent variables – (a) education variables: (1) Percent literate females, (2) Percent household population attending school, (3) Percent of females attending school, (4) Median school years attained by female, and (5) Percent women completing high school education and above; (b) modernization variables: (6) Percent women employed, (7) Percent women exposed to mass media, (8) Percent households with improved source of drinking water, (9) Percent households with toilet facility, and (10) Percent households with electricity; (c) health variables: (11) Infant mortality rate, (12) Child mortality rate, (13) Percent children immunized, (14) Percent mothers receiving antenatal care, (15) Percent births delivered in health facility, (16) Percent deliveries assisted by health professionals, and (17) Percent underweight children under 3-4 years; (d) family planning variables: (18) Percent having knowledge of modern contraception, (19) Percent using contraceptives, and (20) Percent sterilized

Source: 1992/1993 National Family Health Survey (NFHS)

Table I.
Socioeconomic development variables of the states of India

State	Dependent variables: CBR 1999	CBR 2006	CBR % change	TFR 1999	TFR 2006	TFR % change
Andhra Pradesh	21.4	17.1	−20.1	2.3	1.8	−21.7
Arunachal Pradesh	22.6	24.1	6.6	2.5	3.0	20.0
Assam	21.8	22.1	1.4	2.3	2.4	4.3
Bihar	28.1	32.4	15.3	3.5	4.0	14.3
Delhi	21.3	18.1	−15.0	2.4	2.1	−12.5
Goa	16.6	16.7	0.6	1.8	1.8	0.0
Gujarat	24.3	21.7	−10.7	2.7	2.4	−11.1
Haryana	23.1	22.1	−4.3	2.9	2.7	−6.9
Himachal Pradesh	19.9	18.3	−8.0	2.1	2.1	0.0
Jammu & Kashmir	23.1	20.9	−9.5	2.7	2.4	−11.1
Karnataka	20.4	19.6	−3.9	2.1	2.1	0.0
Kerala	18.8	16.4	−12.8	2.0	1.9	−5.0
Madhya Pradesh	26.7	24.9	−6.7	3.3	3.1	−6.1
Maharashtra	23.0	18.8	−18.3	2.5	2.1	−16.0
Manipur	25.8	22.1	−14.3	3.0	2.8	−6.7
Meghalaya	35.7	28.7	−19.6	4.6	3.8	−17.4
Mizoram	25.7	24.8	−3.5	2.9	2.9	0.0
Nagaland	30.4	28.5	−6.3	3.8	3.7	−2.6
Orrissa	22.1	22.1	0.0	2.5	2.4	−4.0
Punjab	19.1	18.6	−2.6	2.2	2.0	−9.1
Rajasthan	29.9	25.7	−14.0	3.8	3.2	−15.8
Tamil Nadu	21.4	16.4	−23.4	2.2	1.8	−18.2
Uttar Pradesh	31.1	29.1	−6.4	4.0	3.8	−5.0
West Bengal	20.8	21.2	1.9	2.3	2.3	0.0

Table II.
Fertility (CBR and TFR) variables of the states of India

Source: National Family Health Survey (NFHS) 1998-1999 and 2005-2006, and computed percent of change by authors

sampling error or need to test for statistical significance. These results confirm the major hypothesis that the higher the level of socioeconomic development, the greater the subsequent reduction in fertility rates among the states of India. The results of the four major categories of socioeconomic development and fertility rates are as follows.

(a) Education. Among the five education variables, all are correlated in the predicted direction with both percent of change in CBR and percent of change in TFR. The correlations were all stronger for CBR, which is a more accurate measure of current fertility. The independent variables that most strongly correlate with percent of change in CBR are percent of household population attending school (−0.304), percent of females attending school (−0.286) and percent of females completing high school or above (−0.279). States with the higher levels of education, particularly among females, tended to have the greatest reductions in CBR and TFR.

(b) Modernization. Among the five modernization variables, four are correlated in the predicted direction with both CBR and TFR. The modernization variables most strongly correlated with percent of change in CBR were percent women exposed to mass media (−0.413), percent females employed (−0.406) and percent households with electricity (−0.326). Percent of change in TFR correlates most highly with percent of women exposed to mass media (−0.324) and percent of households with electricity (−0.276).

Socioeconomic development 1993	% change in TFR 1999-2006	% change in crude birth rate 1999-2006
Education indicators		
Percent females literate	−0.049[a]	−0.215[a]
Percent household population attending school	−0.133[a]	−0.304[a]
Percent females attending school	−0.109[a]	−0.286[a]
Median school years attained by females	−0.126[a]	−0.249[a]
Percent females completing HS education or above	−0.218[a]	−0.279[a]
Modernization indicators		
Percent women employed	−0.164[a]	−0.406[a]
Percent women exposed to mass media	−0.324[a]	−0.413[a]
Percent HH with improved source of drinking water	−0.036[a]	0.107
Percent HH with toilet facility	0.163	−0.077[a]
Percent HH with electricity	−0.276[a]	−0.326[a]
Health indicators		
Infant mortality rate	−0.062	0.149[a]
Child mortality rate	0.235[a]	0.289[a]
Percent children immunized	−0.288[a]	−0.262[a]
Percent mothers receiving antenatal care	−0.313[a]	−0.325[a]
Percent births delivered in health facility	−0.186[a]	−0.286[a]
Percent deliveries assisted by health professional	−0.323[a]	−0.407[a]
Percent underweight children	0.022[a]	0.201[a]
Family planning variables		
Percent having knowledge of modern contraception	−0.130[a]	−0.028[a]
Percent using contraceptives	−0.254[a]	−0.206[a]
Percent sterilized	−0.345[a]	−0.300[a]

Note: [a]Correlation in the direction predicted by research hypothesis

Table III.
Pearson's r correlation coefficients

(c) Health. Among the seven health variables, all are correlated in the predicted direction with percent of change in CBR and all but one are correlated in the predicted direction with percent of change in TFR. The independent variables most highly correlated with percent of change in CBR are percent of deliveries by a health professional (−0.407), percent of mothers receiving antenatal care (−0.325), child mortality rate (+0.289), percent of births delivered in a health facility (−0.286) and percent of children immunized (−0.262). Percent of change in TFR correlates most highly with percent of deliveries assisted by a health professional (−0.323), percent of mothers receiving antenatal care (−0.313), percent of children immunized (−0.288) and child mortality rate (+0.235).

(d) Family planning. Among the three family planning variables, all are correlated in the predicted direction with both percent of change in CBR and percent of change in TFR. Percent of change in CBR and percent of change in TFR correlate most strongly with percent sterilized (−0.300 and −0.345, respectively) and percent using contraception (−0.206 and −0.245, respectively).

(2) Multiple regression analysis

Finally, in an effort to identify the socioeconomic factors that best predict declines in fertility, a multiple regression analysis was carried out. The results presented in Table IV include:

- standardized regression coefficients (β);
- the values of *t*-statistics corresponding to each coefficient estimate;
- the values of *t* significance;
- the value of the R^2 and Adjusted R^2, the overall fitness of the model; and
- the value of the *F*-statistic.

The regression model presented in Table IV uses two measures of socioeconomic development, percent females exposed to mass media and percent females employed, to explain 28.1 percent (adjusted = 21.2 percent) of the variance in the percent of change in CBR. The *F* ratio is 4.103. The β-coefficients indicate that percent of females exposed to mass media (−0.348) explains the most variation in change in CBR, followed by percent of females employed (−0.339).

Conclusion

Although the states of India differ widely in socioeconomic characteristics and fertility rates, the findings of this study support the demographic transition theory in large measure, revealing a correlation in the hypothesized direction between 19 of the 20 socioeconomic development variables and subsequent change in CBR in the direction predicted. 18 of the 20 development variables were correlated with subsequent change in TFR in the predicted direction. The socioeconomic development variables explained over one-fourth of the variation in subsequent percent of change in CBR. The study supports the theory that the overall level of health care, education, and modernization accompanied by ready access to family planning information and services, play a significant role in lowering fertility. More specifically, the emancipation of women as reflected in greater educational and job opportunities, as well as health services targeted to increase the

Model summary

Model	*R*	R^2	*Adjusted* R^2	*Std. error of the estimate*
1	0.530[a]	0.281	0.212	8.13921

ANNOVA[b]

Model	*Sum of squares*	*df*	*Mean square*	*F*	*Sig.*
1. Regression	543.633	2	271.816	4.103	0.031[a]
Residual	1,391.180	21	66.247		
Total	1,934.813	23			

Coefficients[b]

	Unstandardized coefficients		*Standardized coefficients*		
Model	*B*	*Std. error*	β	*t*	*Sig.*
1. (Constant)	11.833	6.914		1.711	0.102
PctfemmassmedA	−0.184	0.100	−0.348	−1.843	0.079
pcefemempA	−0.243	0.135	−0.339	−1.795	0.087

Notes: [a]Predictors: (constant), pcefemempA, pctfemmassmedA; [b]dependent variable: CBR to C

Table IV.
Multiple linear regression using 1993 measures of modernization to predict percent of change in CBR between 1999 and 2006

survivability of children to adulthood, play a crucial role in altering pervasive norms of patriarchy and large families among the lesser developed states of India.

Kaplan (2002) concluded that:

> This commitment to intensive investment in embodied capital (both for self and offspring) also appears to be related to responses to modernization. Changing technologies of production and improved public health may have interacted to increase payoffs to investments in skill and education, investments in health and longevity, and investments in child quality.

He goes on to speculate that the demographic transition may have resulted from the parental investment in embodied capital that occurs with the shift to extra-somatic wealth as societies modernize.

The results of this study strongly support Kaplan's evolutionary theory model. By enhancing the opportunity structure of the environment where skills will be utilized, especially for women, the quality of children, and not the quantity, becomes the salient motivation for desired fertility. By reducing the risk of child loss due to external risk beyond parents' control through a modernized health system and increased education in prenatal and post-natal care, perceived quality of children will increase and quantity of children will become less important. The states of India with higher levels of health care, natal education, employment and educational opportunities for women tended to have the greater decreases in fertility rates.

Governmental policies around the world have historically been directed at influencing variables having positive impacts on mortality, such as improving healthcare, sanitation, and prenatal care. The governments of early developing societies of seventeenth century Western Europe reduced levels of mortality without much thought about the residual population explosions that would occur shortly thereafter. Relatively low population levels, as well as outlets associated with migration opportunities, precluded a need for concerted efforts to reduce fertility, and these societies were able to absorb this growth as the natural forces of demographic transition tended to reduce fertility. However, the situation is very different for societies undergoing industrialization today. Not only do they already have relatively high population densities, but also outlets for migration to less densely populated regions are not as readily available. As world population levels, and specifically population levels in selective areas of high density and growth such as India, reach levels that are increasingly being defined as unsustainable, government policies directed at reducing fertility are becoming more and more necessary. Evolving environmental problems such as changing plant and animal habitats and rising sea levels associated with global warming will only exacerbate problems of overpopulation due to high fertility. These dynamics are further complicated by the fact that industrial pollutants, which have typically increased hand-in-hand with socioeconomic development and modernization, are the major forces driving environmental change. So a critical question for social and environmental researchers is:

> Will per capita increases in consumption and pollution that have historically occurred with modernization offset the associated decreases in overall population, resulting in sustained shortages in commodities and environmental degradation?

These results have several important policy implications for reducing the rate of population growth in India. The earliest population control efforts in India, the first of their kind, amounted to informing the public of India's population problems and appeals to voluntarily limit families to two children. These, and subsequent programs

in countries like China in 1962, had very limited success, where even legal mandates to limit family size were routinely violated. Traditional norms of large families and economic need compelled parents to dismiss or ignore these appeals. The current study provides evidence that government policies aimed at improving the educational levels of women, reducing child and infant mortality, creating basic awareness about population problems through mass media and providing effective family planning services do have a significant impact on reducing population in India.

Other implications of rapid decline in population growth are the concurrent changes in economic and health policy. Nare (2010) studied one state of India, Kerala, where successful population policies led to below-replacement levels of population growth, and concluded that the resultant aging of the population will require extensive diversion of health resources and found "the financial and morbidity burdens of the elderly are already quite high".

The study reinforces the theme "Population and Development," adopted by the third once-in-a-decade International World Population Conference held in Cairo, Egypt in 1994 (United Nations, 1994). The Cairo conference represents a significant change in thinking about population shifting in emphasis from family planning to development. In addition, the Program of Action covers a wide range of topics that reach into every aspect of human existence, such as infant and maternal mortality, education, status of women, family relationships, poverty, urban development, reproductive health care and family planning. While population policies and programs have long been equated with family planning and fertility control, the Cairo Program of Action addresses the social dynamics involved in formulating these policies by emphasizing population control within the context of socioeconomic development, particularly the socioeconomic empowerment of women. The Program of Action asserts that population growth can be stabilized and development efforts enhanced by the emancipation of women, i.e. by providing women with education, expanding the value of female children, legislating gender equality and promoting equal access to economic and political power. In addition, the Plan of Action emphasized the promotion and expansion not only of family planning programs, but also reproductive health programs to bring about a decline in fertility.

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