DECOMPOSITION ANALYSES OF RECENT DECLINE IN FERTILITY OF INDIA AND ITS MAJOR STATES

Ravendra K Sharma[1], Manju Rani[2], Arvind Pandey[3]

[1]Regional Medical Research Centre for Tribals (ICMR), Jabalpur, India
[2]Government Degree College, Chhaprauli, Baghpat (U.P.), India
[3]National Institute of Medical Statistics (NIMS), New Delhi, India

Abstract

The main objective of this study is to examine the pattern of decline in Indian fertility and also to decompose the total decline in fertility into its important components. The Bongaart's supply-demand framework is used to study the decline in total fertility. The model assumes fertility as a function of three components known as wanted fertility (Fw), natural fertility (Fn) and index of preference implementation (Ip). A technique suggested by Das Gupta (1991) for the decomposition of a rate, where rate is a function of three components, has been used to find out the contribution of each aforesaid component in the fertility decline.

The data for present analyses has been taken from the three rounds of National Family and Health Survey (NFHS). The NFHS survey was conducted in 1992-93 (round-I), 1998-99 (round-II) and recently in 2005-06 (round-III), and it comprises almost whole country. The main objectives of these NFHS surveys were to provide state and national estimates of fertility, practice of family planning, infant and child mortality, and the utilization of health services provided to mothers and children.

The total fertility rate (TFR) of India has declined to 2.68 in 2005-06 from 2.85 in 1998-99 and 3.39 in 1992-93 and similar trend of decline was observed in both rural and urban areas. Thus total fertility rate has declined by 0.71 points during NFHS-1 (1992-93) and NFHS-3 (2005-06), and 82.6% of this downturn was due to decline in wanted fertility (Fw). The Index of preference implementation (Ip) which is proxy of contraceptive use contributed to 31.9% of this recession. While natural fertility has slightly increased during aforesaid period and thus enhanced the TFR by 14.6 percent. The decompositions of decline in Fertility of rural-urban areas, different socio-economic groups are also discussed in the paper.

OBJECTIVE:

- To study the levels and trend of total observed, wanted and natural fertility
- To decompose the overall changes in observed fertility into its components

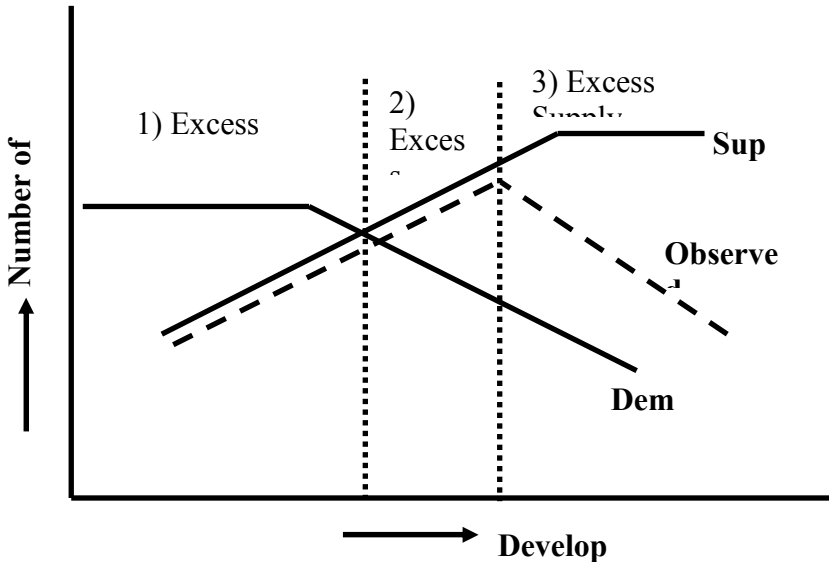
DATA SOURCES:

Data taken from the National Family Health Survey (NFHS)'s National and States Reports of

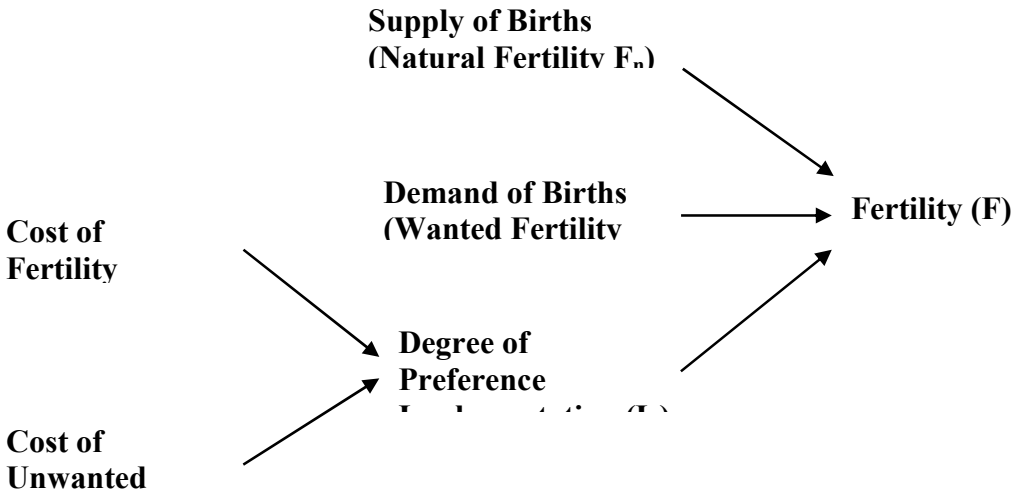
- NFHS-I (1992-93)
- NFHS-II (1998-99)
- NFHS-III (2005-06)

MODELS OF FERTILITY:

- **Demand Models**
  - Liebenstein's Model (1957)
  - Baker's Economic Model (1960)
  - Easterlin's Socio-Economic Model (1975;1983)
  - Caldwell's intergeneration flow Model (1976)
- **Supply Models**
  - Davis & Blake's Model (1956)
  - Bongaarts & Potter's Model (1983)



Easterlin (1983)



Bogaarts (1993)

Table 1: Comparison of Bongaarts and Easterlin's Demand and Supply model of Fertility

Variables	Estimated as	
	Easterlin's Model	**Bongaarts's Model**
Actual Child bearing	Average number of living children among married women at end of the reproductive period (ages 35.-45)	Total Fertility Rate (TFR)
Demand	Average desired family size	Wanted Fertility Rate (TWFR)
Supply	Natural fertility (from proximate determinants regression equation) and child survival probability	Natural Fertility (from proximate determinants of fertility)
Regulation Cost	Number of family planning methods known to respondents	Degree of preference implementation (I_p) - an index with a range of 0 – 1.

Bogaarts (1993) Model is different from Easterlin's model in three ways.

a) It measures reproductive performance as well as supply and demand in terms of births rather than surviving children

b) It is period rather than cohort-based

c) It relies on new variable, the degree of preference implementation, to quantify the roles of the costs of fertility regulation and unwanted childbearing.

EXPLANATION OF THE VARIABLES:

- **Supply of Children (Fn)**: The supply of children is measured as natural total fertility. Natural fertility means the rate of childbearing that would prevail in the absence of deliberate efforts by couple to limits family size. In Practice, a population's fertility may be considered natural if no contraception or induced abortion is used.
- **Demand for Children (Fw)**: It is measured as the wanted total fertility rate (TWFR). Wanted fertility is the rate of childbearing that would be achieve if all women were able to eliminate unwanted births.
- **Degree of Preference Implementation (Ip)**: It is measured by an index which takes values between 0 and 1 depending on the decision-making process in which couple weighs the cost of fertility regulation and cost of the unwanted childbearing, i.e. if Ip =1, the F = Fw; & if Ip = 0, F = Fn.

THE QUANTITATIVE RELATIONSHIP:

Total fertility is expressed as the sum of wanted and unwanted fertility.

$F = F_w + F_u$ ……..(1)

Where F_w is wanted fertility and F_u is unwanted fertility.

Unwanted fertility can be expressed as the difference between supply and demand and degree of preference implementation index (I_p).

$F_u = (F_n - F_w) * (1 - I_p)$ ……(2)

Where F_n is natural fertility.

Substituting eq (2) in eq (1), we will get central equation which summarises the overall relationship between fertility and the three mediating variables.

$F = F_w * I_p + F_n * (1 - I_p)$……(3)

COMPUTATION OF VARIABLES:

(a) **Natural Fertility**: There are various methods for computation of natural fertility, Easterlin & Crimmins (1985), Bongaarts (1978), but Bongaarts (1993) suggested an alternative and easier methods to estimate it as follows:

$$F_n = \frac{F}{C} \quad \text{.....} \quad (4)$$

Where C is an index having value between 0 and 1, it represent the proportion of natural fertility attributed to the birth controls.

If we exclude induced abortion (as the proportion of induced abortion is very low, especially in developing counties), the value of C can be estimated as

$$C = 1 - 1.02 * U \quad \text{.....} \quad (5)$$

where U is proportion of currently married women who practices contraception.

(b) **Wanted Fertility**: Wanted fertility rates are taken form NFHS surveys reports, where it has been calculated in similar way as total fertility except that unwanted births are excluded from the numerator, TWFR.

(c) **Degree of Preference Implementation**: The estimation of the index of preference implementation can be obtained from eq (3), In eq (3) Ip is the only unknown variable. Thus

$$Ip = \frac{(F_n - F)}{F_n - F_w} \quad \text{.....} \quad (6)$$

DECOMPOSITION METHODOLOGY:

If a rate is function of three factors (variables) α, β, and γ, the rate F (α, β, γ) is function of these factors. If the factors takes value A, B, C and a, b c in population 1 and 2 respectively. Then the difference between the rates can be expressed as :

F (a, b, c) – F (A, B, C) = α effect + β effect + γ effect

Where

$$\alpha \text{ effect} = \frac{[F(a,b,c)-F(A,b,c)]+[F(a,B,C)-F(A,B,C)]}{3} + \frac{[F(a,b,C)-F(A,b,C)]+[F(a,B,c)-F(A,B,c)]}{6}$$

$$\beta \text{ effect} = \frac{[F(a,b,c)-F(a,B,c)]+[F(A,b,C)-F(A,B,C)]}{3} + \frac{[F(a,b,C)-F(a,B,C)]+[F(A,b,c)-F(A,B,c)]}{6}$$

$$\gamma \text{ effect} = \frac{[F(a,b,c)-F(a,b,C)]+[F(A,B,c)-F(A,B,C)]}{3} + \frac{[F(a,B,c)-F(a,B,C)]+[F(A,b,c)-F(A,b,C)]}{6}$$

Similarly we can compute the values for β, and γ.

RESULTS:

Fig 1: TNFR, TFR, TWFR, Ip, India (Total), NFHS 1-3

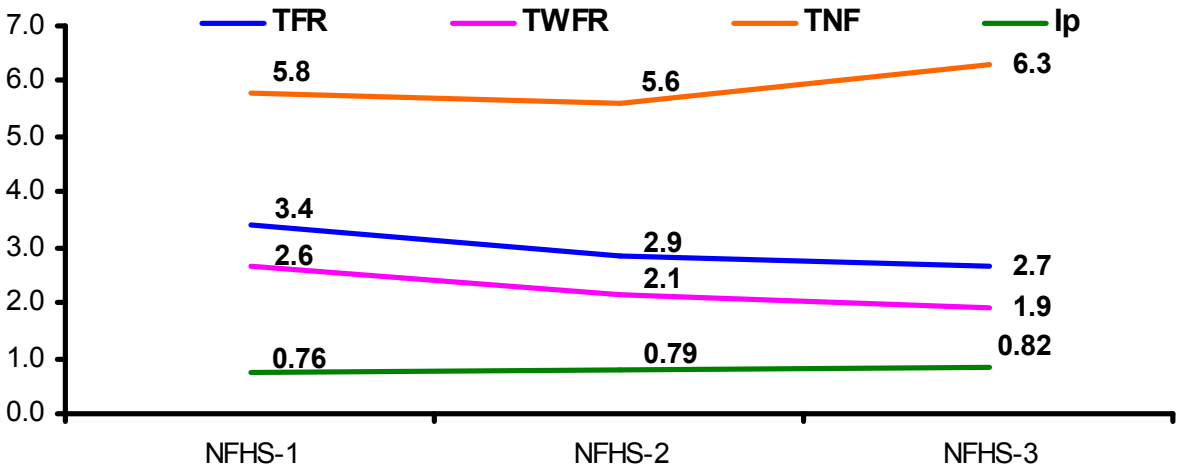


Fig 2: TNFR, TFR, TWFR, Ip, India (Urban), NFHS 1-3

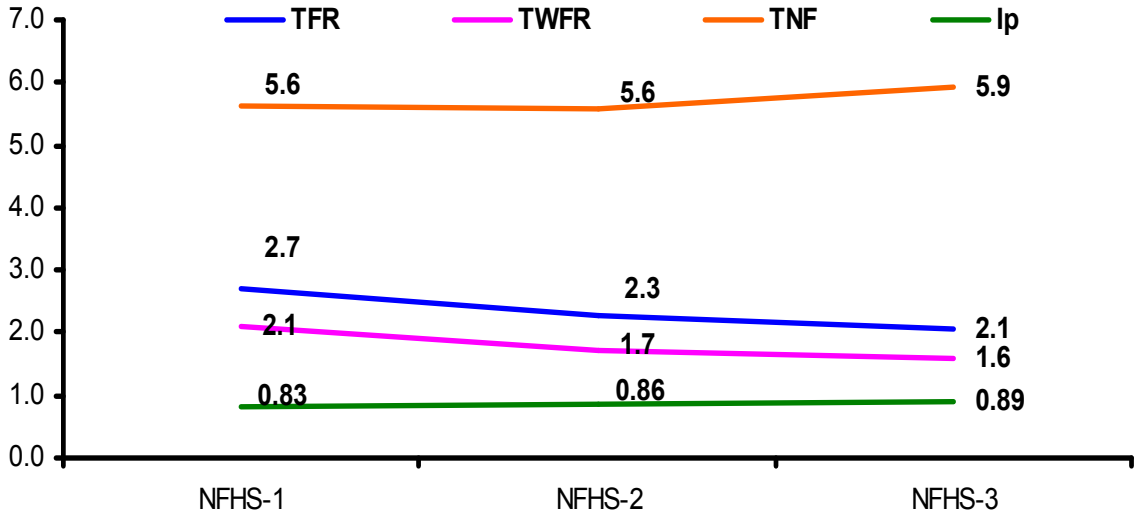


Fig 3: TNFR, TFR, TWFR, Ip, India (Rural), NFHS 1-3

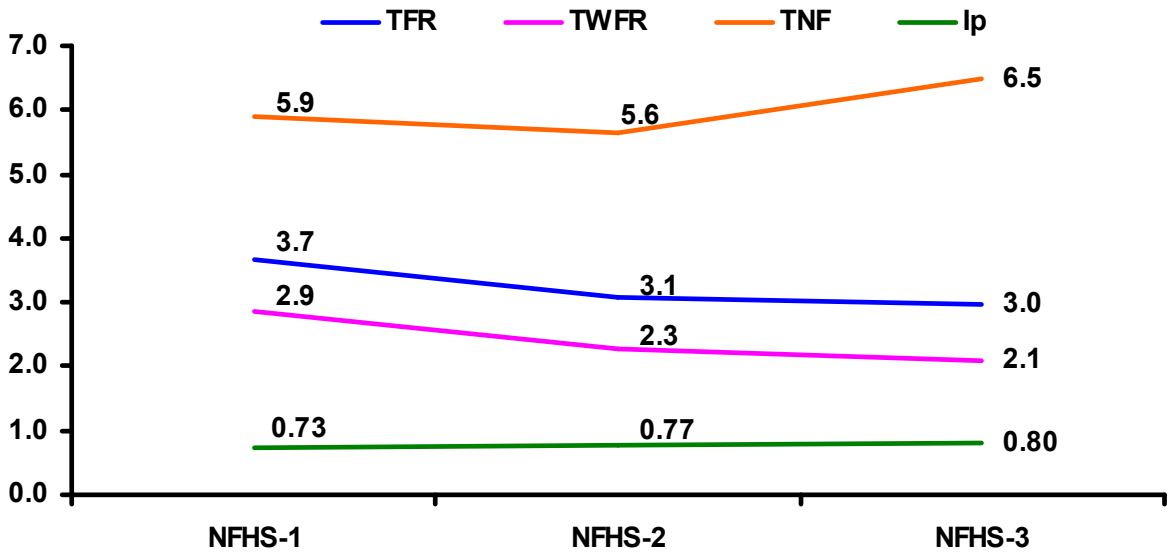


Table 2: Decomposition of total fertility in Rural and Urban areas

	Total			Urban			Rural		
	NFHS-1	**NFHS-2**	**NFHS-3**	**NFHS-1**	**NFHS-2**	**NFHS-3**	**NFHS-1**	**NFHS-2**	**NFHS-3**
TFR	3.39	2.85	2.68	2.70	2.27	2.06	3.67	3.07	2.98
TWFR	2.64	2.13	1.90	2.09	1.73	1.60	2.86	2.28	2.10
Cont.	0.407	0.482	0.563	0.511	0.582	0.640	0.371	0.447	0.530
Fn	5.796	5.606	6.295	5.639	5.586	5.933	5.904	5.643	6.487
Ip	0.762	0.793	0.823	0.828	0.860	0.894	0.734	0.765	0.799
Effect of	**NFHS 1&2**	**NFHS 2&3**	**NFHS 1&3**	**NFHS 1&2**	**NFHS 2&3**	**NFHS 1&3**	**NFHS 1&2**	**NFHS 2&3**	**NFHS 1&3**
α (F_w)	0.40 (73.4)	0.19 (109.3)	0.59 (82.6)	0.30 (70.7)	0.11 (54.3)	0.42 (65.9)	0.43 (72.5)	0.14 (156.5)	0.58 (84.4)
β (F_n)	0.04 (7.8)	-0.13 (-77.9)	-0.10 (-14.6)	0.01 (1.9)	-0.04 (-20.3)	-0.04 (-6.4)	0.07 (10.9)	-0.18 (-204.2)	-0.14 (-19.7)
γ (I_p)	0.10 (18.7)	0.12 (68.6)	0.23 (31.9)	0.12 (27.4)	0.14 (66.1)	0.26 (40.5)	0.10 (16.6)	0.13 (147.7)	0.24 (35.3)
Total	0.54 (100.0)	0.17 (100.0)	0.71 (100.0)	0.43 (100.0)	0.21 (100.0)	0.64 (100.0)	0.60 (100.0)	0.09 (100.0)	0.69 (100.0)

Similarly analysis is carried out for different other socio-economic background variables. However results are not discussed here in this abstract.

Table 3: Decomposition of total fertility in Major states of India

States	NFHS 1 – NFHS 3			
	α (Fw)	β (Fn)	γ (Ip)	Total
India	82.6	-14.6	32.0	0.71
Haryana	45.6	6.1	48.3	0.71
HP	45.9	-1.6	55.7	1.03
Punjab	60.5	24.0	15.5	2.45
Rajasthan	98.0	-56.5	58.6	0.42
MP	91.7	-10.1	18.3	0.96
UP	80.1	-22.4	42.3	1.27
Bihar	176.2	-63.9	-12.3	0.31
Orissa	73.6	-10.9	37.3	0.55
West Bengal	67.9	-22.6	54.7	0.65
Gujarat	79.6	-38.6	58.9	0.57
Maharashtra	50.0	-5.5	55.5	0.75
AP	64.9	-11.9	47.1	0.80
Karnataka	63.2	-3.5	40.3	0.78
Kerala	27.5	-42.0	114.5	0.07
Tamil Nadu	44.0	5.5	50.4	0.68

Fig. 4: Relationship of TFR, TWFR, TNFR with Per-Capita Income (in INR)

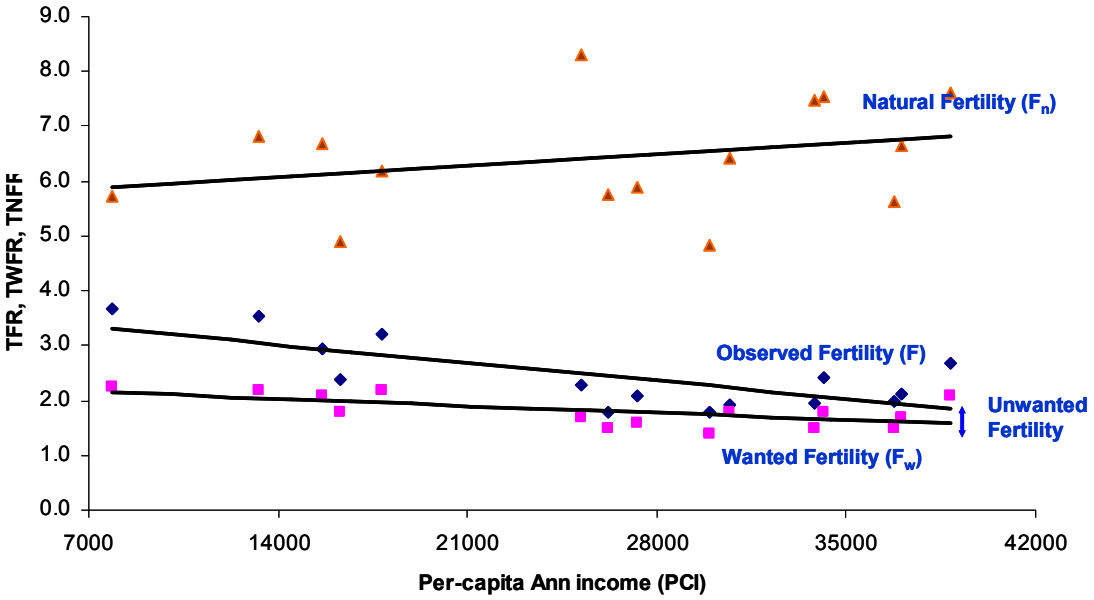
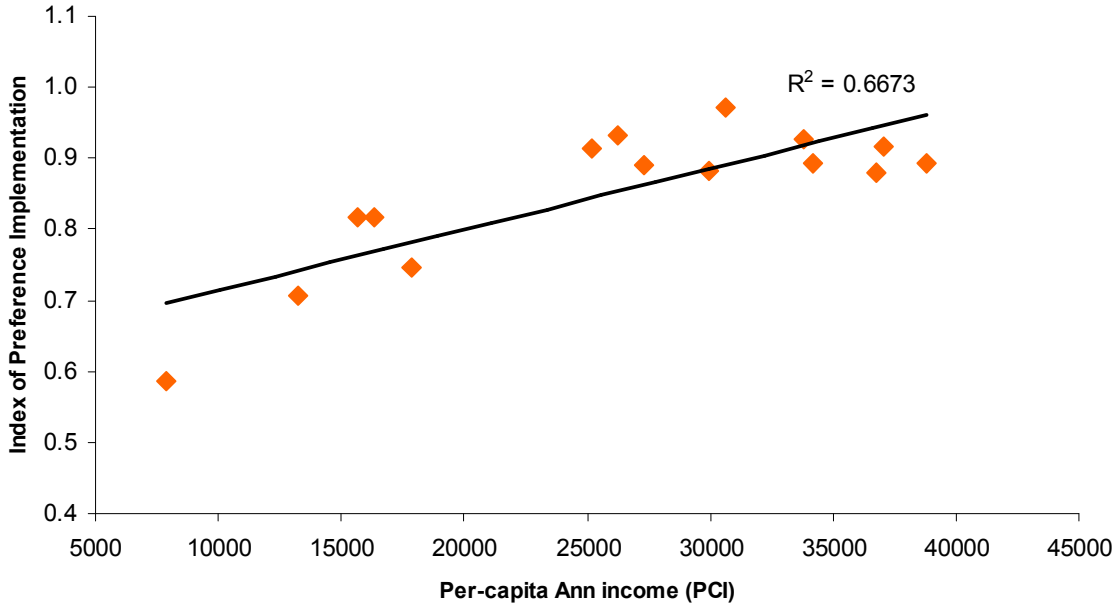


Fig. 5: Relationship of Ip with Per-Capita Income (in INR)



CONCLUSION:

- The decomposition of recent decline in TFR shows those main components attributed to it are wanted fertility (Fw) and Index of Preference Implementation (Ip).
- The increase in Ip shows the use of family planning methods is increasing in India.
- The decline in wanted fertility and observed fertility are highly associated with the increase in per-capita income;
- Similarly the increase in Ip is also highly & positively associated with per-capita income.
- The overall analysis reveals that main reason for recent decline in fertility is the changing value of children in society (desired fertility).
- Family planning method do have contributed in bring down fertility, but not as per our expectation, so there is need to strengthen the family planning programme in India, especially in EAG states.