Fertility Transition and Development Pattern in Districts of India, 2001-16

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Abstract

Using data from multiple sources over last 15 years, this paper examine the fertility and development relationship in 640 districts of India. The total fertility rate (TFR) is the dependent variable and has been estimated for 2001 and 2015-16 using data from census of India, 2001 and National Family Health Survey, 2015-16. A set of nine indicators in the domain of health, knowledge and standard of living has been used to compute a district development index (DDI), similar to human development index. Descriptive statistics, ordinary regression analyses and panel regression are used in the analyses. Result suggest limited converge of fertility level in districts of India. The association of fertility level and development is strong and consistent over time. However, the regional pattern of fertility and development is evident. We did not find any strong evidence on shift in fertility and development relationship in districts of India.

Extended Abstract

Introduction

Fertility transition and socio-economic development are concomitant across and within countries. Globally, more than half of the countries have reached the replacement level of fertility and countries are said to be converging in fertility level. The socio-economic development measured by the composite index of human development (HDI) has been improving over time. A large body of empirical research has been carried out on the fertility and development relationship at varying geographical unit; country, regions, provinces and other smaller micro-regions. Finding from many of these studies are not consistent and context specific (Bongaarts & Watkins, 1996; Bryant, 2007; Potter et al., 2002; Drèze and Murthi, 2001). The common inferences from may of these studies suggests negative association of fertility and development. The cross country finding on the shift in fertility and development relationship over time and can be attributed to diffusion of contraception through social interaction (Bongaarts & Watkins 1996). This cross country findings was contested (Bryant 2007; Potter 2002). Potter et al (2002) found strong and consistent relationship of fertility decline and socio-economic development in micro-regions of Brazil. Global fertility reduction is said to have been guided by four key factors - the pace of social and economic change, the pace of change in economic aspiration and expectation, the pace of provision of birth control services and the pace of reduction of moral and social cost of birth control (Casterline, 2001). Recent evidences suggests J

shaped relationship of fertility and development suggesting positive association of fertility and human development (HDI) in highly developed countries (Myrskyla et al 2016). The literature on fertility and development relationship has mainly guided from cross country analyses. However, these analyses has limitations of capturing heterogeneity within countries and used limited variables. The country specific analyses are useful in deriving and validating these inferences.

Fertility transition in India is of global significance not merely because of its large population size but also because of its regional diversity and variations along the levels of socioeconomic development. The TFR of India has declined from 5.2 in 1971 to 2.3 in 2016. By 2016 (ORGI, 2016), 18 out of the 29 states of India reached the replacement level of fertility, while the states of Uttar Pradesh, Bihar, Jharkhand and Rajasthan continue to have unacceptably high fertility levels. A number of studies have examined the role of proximate and distal determinants in fertility reduction in the states of India (Jain and Nag, 1986; Arokiasamy, 2009; Bhat, 2002; Mohanty, 2011; Dharmalingam, Rajan and Morgan, 2014). Studies have also identified a set of social and cultural determinants of fertility change in India (Dyson and More, 1983; Basu, 1992; Maharatna, 1998). There is a limited but growing number of studies on the association of fertility with distal and proximate determinants in the districts (Drèze and Murthi, 2001; Bhat, 2002; Mohanty et al., 2016; Guilmoto and Rajan, 2001; 2013). The spatial clustering of fertility with distal and proximate determinants are high in districts of India (Singh et al., 2017).

Recent reduction in fertility level in absence of increase in modern contraceptive use in India is puzzling to demographer and social scientist. While the states are converging in fertility levels, they are diverging in the level of socio-economic development. Though a large number of studies examined the association of fertility change with socio-economic development in states of India, there are limited number of studies on fertility and development relationship in districts of India. Using data from multiple sources, this paper examined the association of fertility change and change in socio-economic development during 2001-16 in districts of India. The total fertility rate (TFR) is the dependent variable. The socio-economic development has been assessed using a composite index comprising of 10 variables in the health, knowledge and economic domain.

Data and Methods

Preparing data file for 640 districts of over two period was a gigantic task. The unit of analyses is district and a district data file on TFR and socio-economic variables was prepared. Data was primarily drawn from the census of India 2001 and 2011, the National Family and Health Survey 4 (2015-16), District Level Household Survey (DLHS 2002-04), the National Sample Survey, 2004 and 2011-12 and published paper (IIPS & ICF, 2017). A data file on a set of socio-economic and demographic indicators for 640 districts of India was prepared for 2001 and 2015. Though all the variables are not exactly at the same data point, they are close to the period studies. The estimates of total fertility rate (TFR) was taken from Mohanty & Rajbhar and the estimates of under-five-mortality for

later period was taken from Ram et al (Ram et al., 2014). The TFR for 2015-16 has been estimated from the unit data of NFHS 4. The validity of the estimated TFR has been checked using alternative estimates (Guilmoto & Rajan, 2002; 2013). The set of independent variables used in construction of district development index (DDI) is shown in Table 1.

Descriptive statistics, construction of composite indices, ordinary least square regression and panel regression is used in the analyses. The TFR is the dependent variable. A composite variable based on socio-economic variable was prepared and labeled as District Development Index (DDI). The DDI was constructed based on nine variables and using Alkire and Foster methodology. Accordingly, equal weight is assigned to each of the dimensions and equal weight to variables within the dimension. Each of the variable was standardized to 0 and 1 taking the natural/ observed upper and lower limit of the variable. Besides, the convergence analyses of fertility and development was examined using the beta convergence model, as employed by Dorius (2008). The mathematical form of the model is given as

$\ln(Y_{jn}/Y_{j0})/T=\alpha+\beta(Y_{j0})+e_j$ ----------(1)

where ln is the natural log,

Y is the TFR/ DDI,

T is the number of years between 2001 and 2016,

β is the convergence coefficient,

α is the constant, and

e is the error term.

A negative β means lagging districts are catching up with leading districts (converging), and a positive β means lagging districts are falling farther behind (diverging). β convergence in fertility occurs when the rate of decline among districts with high fertility is greater than the rate of decline among those with low fertility. Besides,

The general form of the regression is as follows

$TFR_{dt} = \alpha d + \beta * DDI_{dt} + e_{dt}$ ------(2)

where TFR is the total fertility rate of the district in time t

DDI is the District Development Index

α and β_is are the regression coefficients.

As a robustness exercise we have estimated the equation by taking each independent variables used in DDA.

Results

Table 1 presents the mean and standard deviation of independent variables used in the analyses. There has been improvement in each of the variable over time. Both underweight and under-five mortality has declined over time. There has been improvement in all four social variables; largest increase is in female literacy rate. The wealth index has increased by about 50% while more than two fold increased monthly per-capita consumption expenditure. However, the percentage of agricultural labourer has increased marginally. While the standard deviation has reduced in some variables, it has increased in others. All these variables suggests that there has been significant improvement in the socio-economic development

Table 1: Methodology in computing wealth index and index of economic development*

Dimension	Variable	Data source of 2001	Mean, 2001	Standard Deviation	Data source of 2016	Mean, 2016	Standard Deviation	Weight
Health	Percentage of children underweight under age five years	DLHS2, 2002-04	45.10	14.62	NFHS 4,	35.97	9.92	1/6
	Under-five mortality rate (per 1000)	Census of India, 2001	99.40	31.75	Ram et al, 2013	57.19	22.92	1/6
Social	Female literacy	Census of India, 2001	52.63	15.42	Census of India, 2011	63.76	12.83	1/12
	Mean Years of Schooling (person aged 7 years and above)	DLHS 2	4.81	1.01	NFHS 4,	6.13	1.24	1/12
	Percent Urban	Census of India, 2001,	23.84	19.87	Census of India, 2011	26.25	21.00	1/12
	Female work participation rate,	2001 and	29.12	9.85		35.12	12.5	1/12
Economic	Wealth index based on five household items; television, bicycle, motorcycle/jeep, car and bank account	Census of India, 2001,	0.23	0.09	Census of India, 2011	0.33	0.10	1/9
	Monthly Per capita Consumption Expenditure in Indian rupees	NSS, 2004	700	263	NSS, 2010-12	1582	584	1/9
	Percentage of agricultural labourer	Census of India, 2001	23.66	14.83	Census of India, 2011	27.03	16.51	1/9
No of districts	640				640			

Fertility Convergence across Districts of India

Table 2 presents the results of absolute β convergence across the districts of India between 1991 and 2001, 2001 and 2011, and 1991 and 2011. The fertility convergence is guided by the fact that districts with high fertility had a larger relative decline in TFR than those districts with lower fertility rates. The regression coefficients are positive and significant suggesting that fertility rates are not converging across the districts of India. The coefficients were smaller in 2001-11 compared to 1991-2001.

Table 2: Fertility convergence across the districts of India, 1991-2011

Time period	Constant	β coefficient	t-statistics	95% Confidence Interval	R squared	N
1991-2016	-0.028	0.0020	6.93	0.0014–0.0026	0.0723	618
1991–2001	-0.029	0.0030	6.92	0.0022–0.0039	0.0722	618
2001–2016	-0.025	0.0009	2.20	0.0001–0.017	0.0075	640

Fertility Transition in Districts of India

Figures 1.1(a) and 1.1(b) present the TFR in the districts of India in 2001 and 2016 respectively. The districts are marked but not labeled due to a large count of the same. The names of the states are labeled for easy identification. The TFR has been classified in five broad categories TFR of 4 and more , TFR in the range of 3-4(yellow), TFR in the range of 2.1-3 (orange) , TFR in the range of 1.8-2.1 (blue) and TFR of less than 1.8 (green). Reduction in fertility across districts has been reasonably fast during 2011-16. The number of districts with TFR of 4+ was 43, while those with TFR of less than 2.1 was 207 by 2016. The high fertility districts are now largely concentrated in the states of Bihar, Uttar Pradesh, Rajasthan and Meghalaya.

Fig. 1.1 (a) Total Fertility Rate (TFR) in the districts of India, 2001

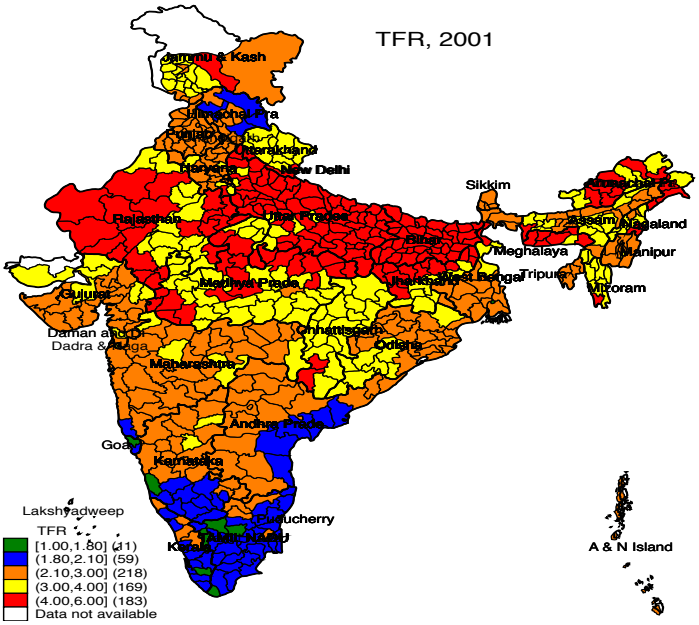
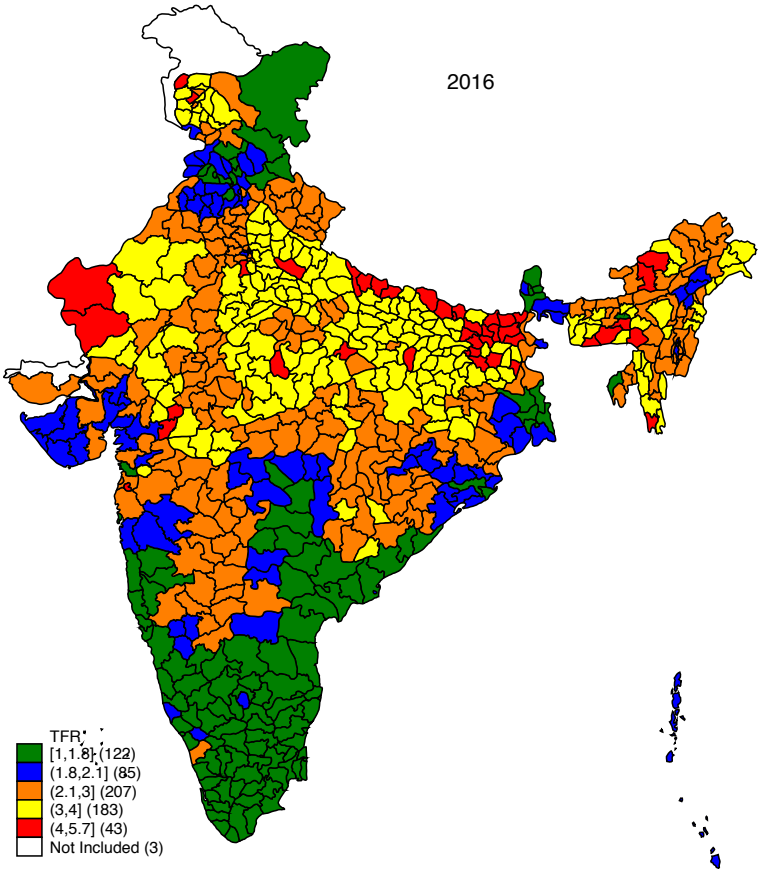


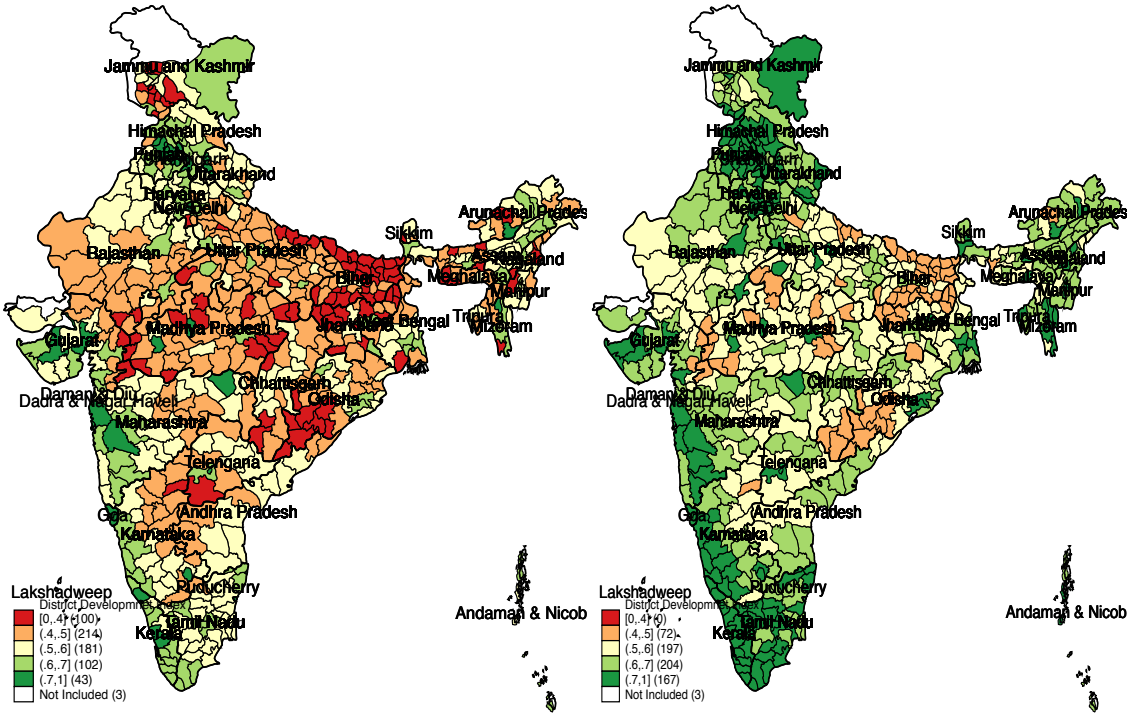
Fig. 1.1 (b) Total Fertility Rate (TFR) in the districts of India, 2016



Development pattern in Districts of India

Fig 2 presents the district development index in districts of India for 2001 and 2016. The mean DDI has increased from 0.51 in 2001 to 0.64 by 2016. The standard deviation was similar over two period indicating similar variability. The DDI varies to a larger extent among the districts of India and among the districts within the states of India. A higher proportion of districts from the states of Bihar, Uttar Pradesh, Madhya Pradesh and Chhattisgarh had lower value of DDI in both the period.

Fig 2: District Development Index in India, 2001 and 2016



Fertility and Development in Districts of India, 2001-16

Fig 3 (a) presents the scatter plot of TFR and DDI for 640 districts of India. The square represents for 2001 and the triangle presents for 2016. The TFR varies in a wide range at the same level of development The points has moved right and downward suggesting that higher level of development and lower level of fertility in 2016 compared to 2001. However, the fitted curve almost overlaps in both time period.

Fig 3(a): Fertility and Development in districts of India, 2001-16

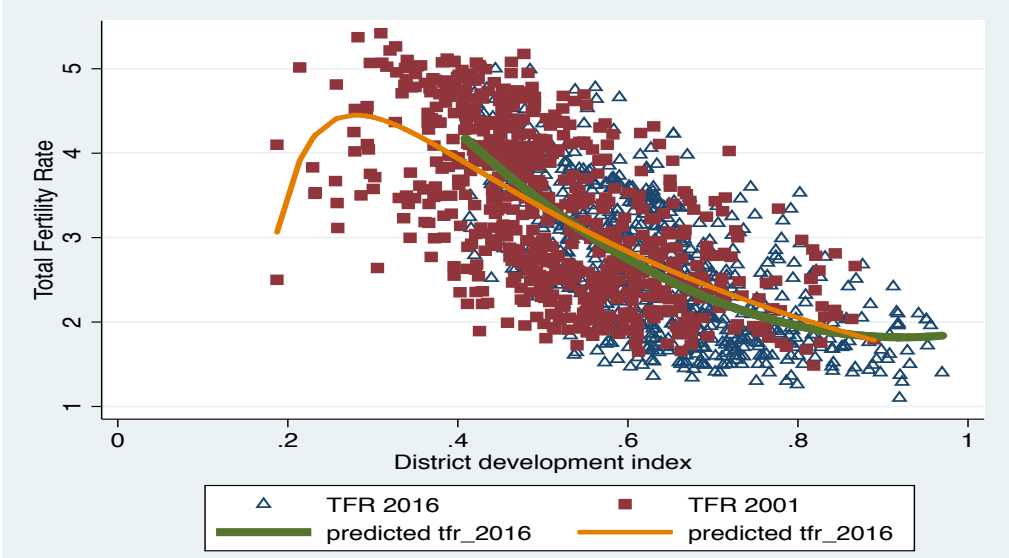


Fig 3 (b): Fertility and Development in districts of Southern India, 2001-16

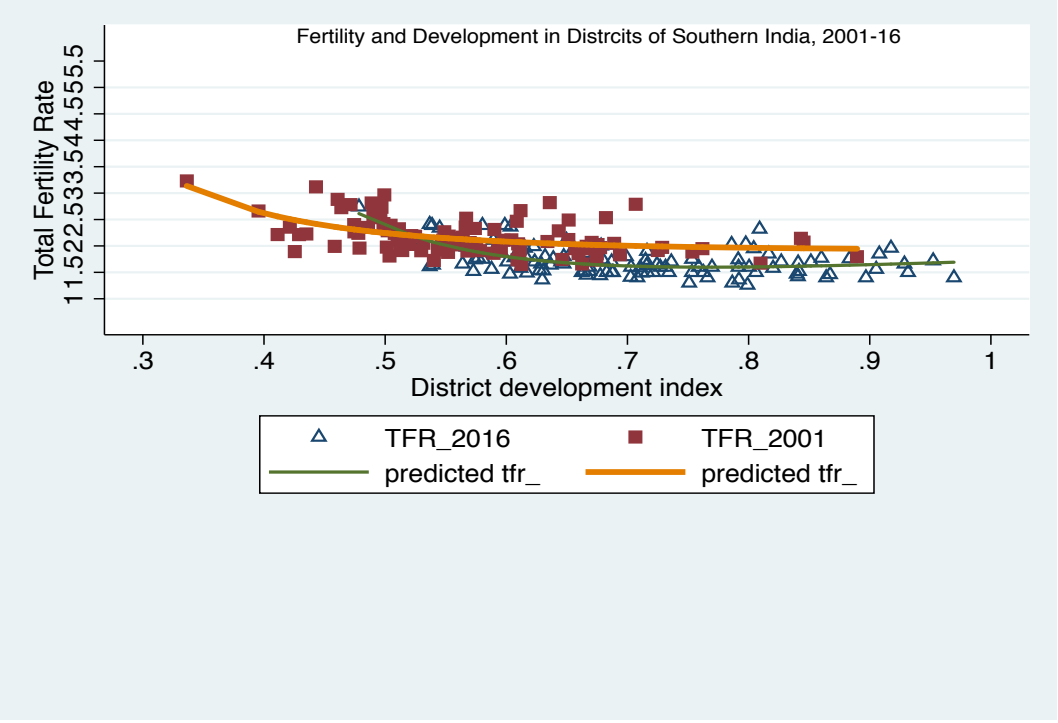


Fig 3 (c): Fertility and Development in districts of Southern India, 2001-16

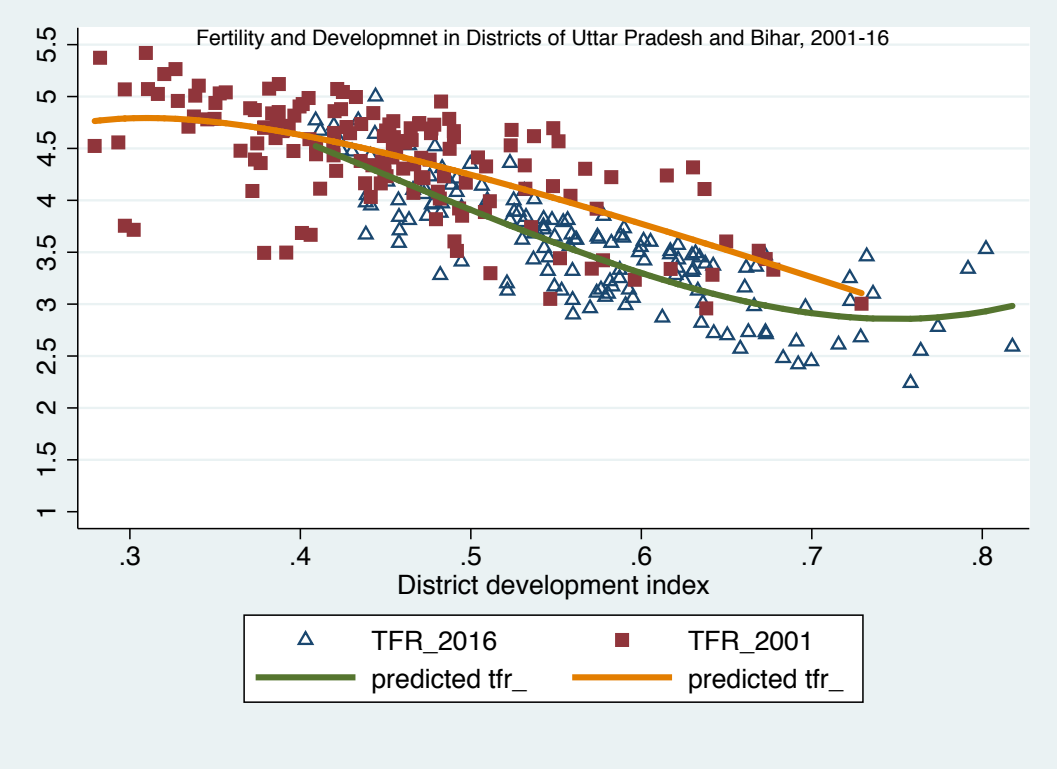


Fig 3 (d): Fertility and Development in districts of Northern India, 2001-16

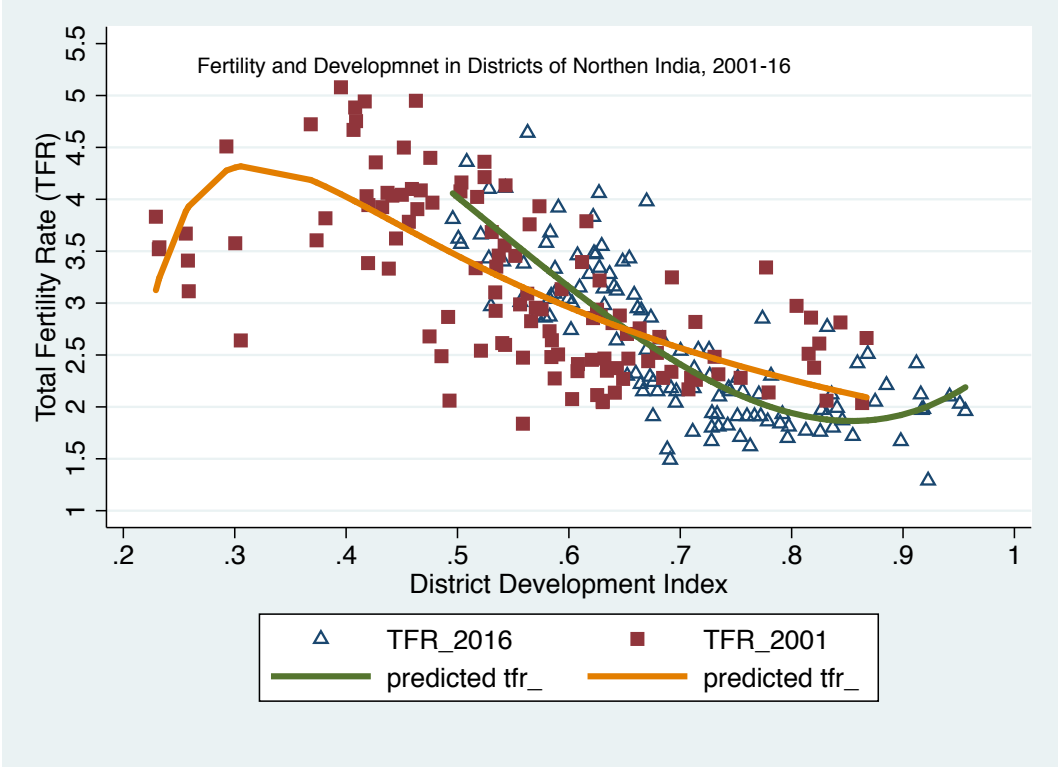


Fig 3 (e): Fertility and Development in districts of Western India, 2001-16

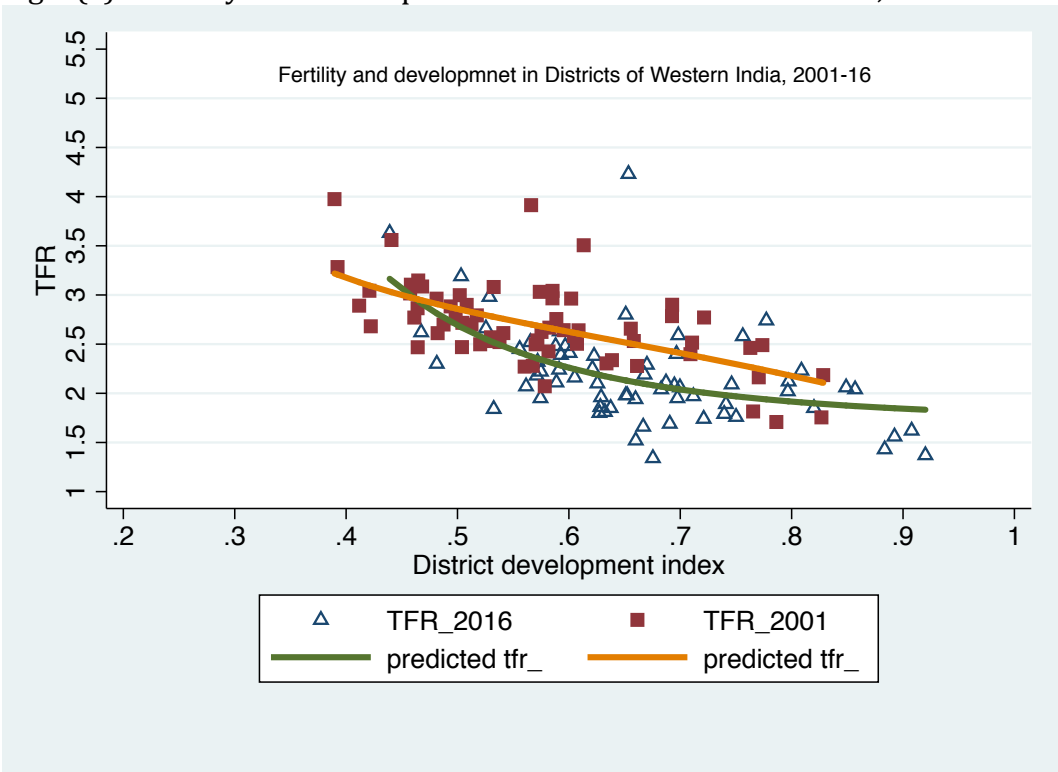


Fig 3(b) and Fig 3(c) presents the TFR at varying level of development in districts of southern India and the state of Uttar Pradesh and Bihar. It may be mentioned that the districts of southern region (N=107) has low level of fertility while districts of Uttar Pradesh and Bihar (N=147) has higher level of fertility. With the same level of development, districts of Uttar Pradesh and Bihar had at least one more birth per woman compared to districts of Southern regions. Both the districts had moved to lower level of fertility with improvement in level of development. Similarly, Fig 3 (d) and Fig 3 (e) presents the TFR and DDI in districts of Northern and Western India. From all these graphs it is clear that fertility and development relationship varies greatly across regions of India.

Table 4 presents the result regression analyses with TFR as the dependent variable and ddi as the independent variable. The model is controlled for region. Results suggests that the coefficient of DDI remains similar over time. The variable is significant and explain 74% of variation in TFR in 2001 and 72% of variation in TFR in 2016. The polled result also explains 75% variation in DDI and the coefficient is similar.

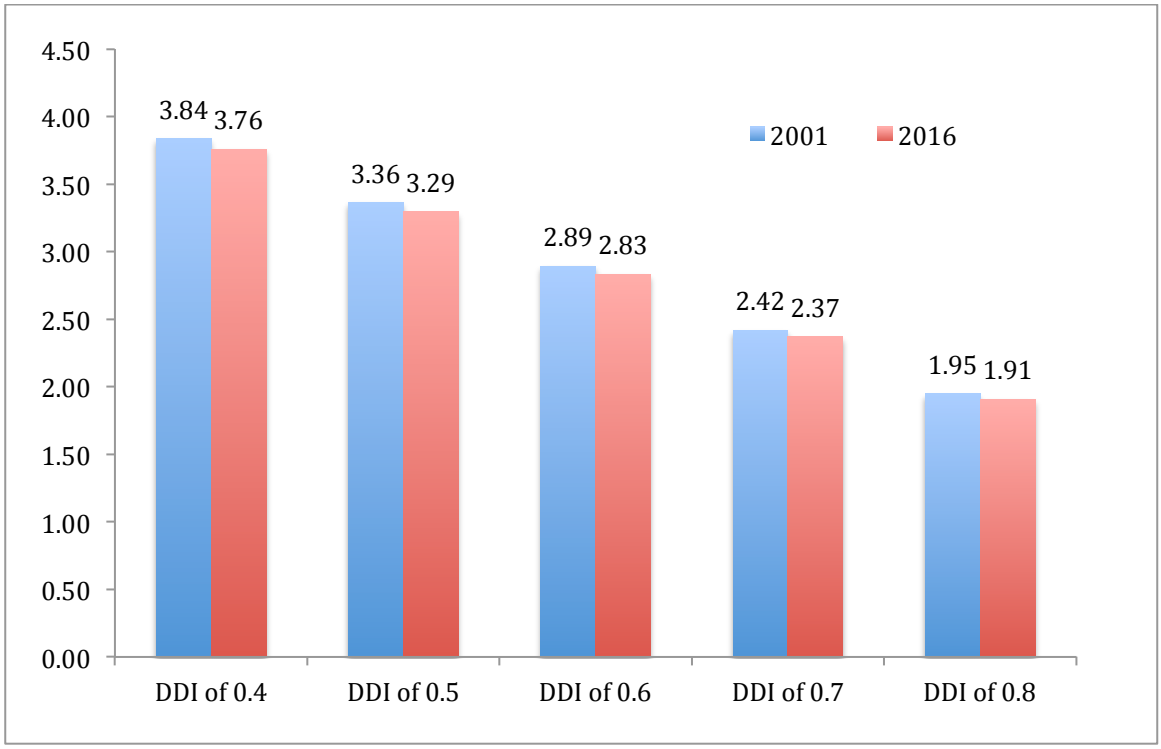
Table 4: Regression coefficient of TFR and district development index in India, 2001-16

					Confidence Interval	
Model 1-2001		Coefficient	T-statistics	Significance	Lower limit	Upper Limit
	District Development Index, 2001	-4.72	-18.83	0	-5.21	-4.23
	Constant	5.72	43.23	0	5.46	5.98
Model 2-2016						
	District Development Index, 2016	-4.62	-20.93	0	-5.05	-4.19
	Constant	5.6	39.26	0	5.32	5.89
Model 3 Polled, 2001-16	District Development Index, 2016	-3.15	-24.86	0.00	-3.40	-2.90
	Time	0.25	8.08	0.00	0.19	0.31
	Constant	3.83	40.08	0.00	3.64	4.02

Fig 4 presents the predicted TFR at varying level of development for 2001 and 2016. The basic idea is to understand whether the fertility and development relationship has shifted over time. We did not find much evidence of changing fertility and development relationship in districts of India. With the same level of development

say DDI of 0.4, the TFR was estimated at 3.84 in 2001 and 3.76 in 2016. Similarly, with a DDI value of 0.8, the TFR was estimated at 1.95 in 2001 and 1.91 in 2016. The above estimates suggests that the fertility development has not changed over time.

Fig 4: Estimated TFR at varying level of TFR in districts of India, 2001 and 2016



Conclusion

From the above analyses it is concluded that the fertility and development relationship is strong and consistent in districts of India. However, the regional variation are striking. The study did not find any significant shift in the fertility and development relationship as observed in cross country analyses.

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