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***Fertility, Parental Education
and Development in India:
Evidence from NSS and NFHS in 1992-2006***

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Abstract

This paper empirically investigates the determinants of fertility, drawing upon large nationwide household data sets in India constructed by the National Sample Surveys (NSS) and National Family Health Surveys (NFHS) over the period 1992-2006. First, we find a negative and significant association between the number of children and mother's education even if the latter is instrumented by (the proxy for) the pre-generation access to primary school at village level, or if parental wage equations are incorporated into the fertility equation. Both direct and indirect effects are observed for mother's education which directly reduces not just fertility but also increases mother's potential wages or opportunity costs which would deter her from having a baby. Second, father's education becomes increasingly important in reducing fertility in the last two rounds. Third, the negative effect of expenditure on fertility is found when it is treated as exogenous, but *not* once instrumented. Fourth, pseudo panel models for three rounds of NSS and NFHS are estimated to confirm the negative effects of parental education. Finally, state-wise regression results show that fertility determinants are different in different states. Our results suggest that national and state governments should improve social infrastructure, such as school at various levels, promote both male and female education, and facilitate female labour market participation to slow down population growth. These policies would be particularly important in backward states or for socially disadvantaged groups (e.g., scheduled castes) which still have higher fertility as well as poverty rates.

Keywords: Fertility, Population, Parental education, NSS, NFHS, India

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1 Introduction

The population problem is still one of the important global issues in the 21st century in light of alleviating world poverty and guaranteeing food security. The population increase is also closely related to global warming simply because more people will consume more resources.¹ Based on the UN estimate, the world population is projected to be 6.51 billion in 2005 and 9.19 billion in 2050 (Table 1). More than one-third of the current world population is concentrated in India and China: India's population was 1.13 billion, ranked second in the world after China with 1.31 billion inhabitants in 2005. However, India is likely to be the most populous country in the world by 2050 with 1.66 billion people, or almost 18 percent of the world population, while China's population will be 1.41 billion under certain assumptions on mortality and fertility changes (UN 2007). No doubt, curbing the population growth in Sub-Saharan African (SSA) countries will remain crucial in providing a solution for the global population problem as their population is expected to increase from 0.77 billion in 2005 to 1.76 billion in 2050. India's population problem, however, would be equally important, at least in terms of its size. Besides, India's population growth could be controlled by governmental policy of a single country, compared to many, as in the SSA region.

The population problem is one of the crucial domestic issues for India as well, for example, because the fertility decline will have direct and indirect impacts on national poverty.² If the calculation of the poverty rate is based on per capita expenditure or income, a reduction in fertility will decrease it significantly. If the household has fewer children, then the educational opportunities per child will improve, and spending per child health service will increase, having an indirect impact on reducing poverty. Economic growth is influenced by population growth and fertility changes, while the former would affect the latter in a complex way, for example, through technical changes (e.g., Rosenzweig 1990).

Table 1. Population projection for India, China, Sub-Saharan Africa and world 2005

	India		China		SSA total		World	
1980	689	(15.5%)	989	(22.2%)	388	(8.7%)	4,451	(100%)
2005	1,134	(17.4%)	1,312	(20.1%)	769	(11.8%)	6,514	(100%)
2050	1,658	(18.0%)	1,408	(15.3%)	1,760	(19.1%)	9,191	(100%)

Note: Unit=million. The number in the brackets: share in the world.

Source: United Nations (2007).

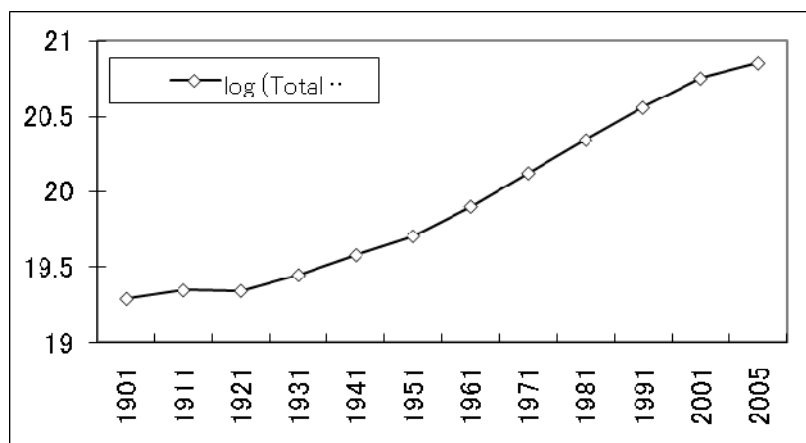
¹ See Vallely (2008) for the recent debate.

² Poverty headcount ratio based on the national poverty line in 2004/5 is 28.7 percent (Himanshu 2007).

Although India was among the first developing countries to implement family planning schemes, authoritarian birth control measures corresponding to China's 'one child policy' have never been included in government programmes except for a very short period during the mid 1970s. While the population trend has been upwards since the last century as shown by Figure 1, it is conjectured that India is now moving towards the third stage of the demographic transition.^{3/4} Indeed, the crude birth rate is 25 per thousand in 1999 compared to 43 in 1960, and the total fertility rate (TFR), the average number of children a woman bears over her lifetime, was three in 1999 compared to six in 1960. Consequently, the annual population growth rate dropped from 2.3 percent in 1960-70 to 1.9 percent in 1990-95 and further to 1.7 percent in 1995-2000 (Mahbub ul Haq Human Development Center 2002: 176).

The main objective of the present study is to examine the determinants of population in India, with a particular focus on fertility, drawing upon two different sources of multi-rounds of large national household survey data spanning from 1992 to 2006, namely the National Sample Survey (NSS) Data conducted in 1993-94, 1999-2000 and 2004-05 and

Figure 1. Long-term trend of India's population



Source: Gol (1999: 4-5).

³ See Lee (2003) for a detailed survey on the demographic transition.

⁴ The well-known theory of demographic transition explains the common pattern of transition in population history. While the first stage of transition before economic modernization sees stable population due to high birth and death rates, the population grows rapidly in the second stage where death rates decline more rapidly than birth rates, for example, through better educational systems, and medical and health care facilities only available in modernized society. The population becomes stable again in the third stage when further modernization and better education cause fertility to go down.

National Family Health Survey (NFHS) Data in 1992-93, 1998-89 and 2005-06. An individual household's fertility decision which underlies macro-level demographic transition can be analysed directly by using the household datasets. Our main focus is on the role of parental education in reducing fertility rates. The impacts of other household socioeconomic characteristics on fertility are also tested.

It is widely known that female education contributes to fertility reduction. For example, according to Subbarao and Raney (1995: 105):

Female education increases the value of women's time in economic activities by raising labour productivity and wages, with a consequential rise in household incomes and a reduction in poverty. Female education also produces social gains by improving health (the women's own health and the health of her children), increasing child schooling, and reducing fertility.

Drèze and Sen (2002: 19) extend this line of argument:

...women's emancipation (through basic education, economic independence, political organization and related means) tends to have quite a strong impact on fertility rates. This linkage has been widely observed in international comparisons, but it is consistent also with recent experiences of remarkably rapid fertility reduction.... Through this connection with demographic change, the role of women's agency extends well beyond the interest of today's women, and even beyond the interests of all living people today, and has a significant impact on the lives of future generation.

The form of the data (e.g., cross-section or panel data) or their level of aggregation (e.g., national, state, district, or household level) varies considerably among different studies in drawing these conclusions. Along the lines of Subbarao and Raney (1995), Drèze and Murthi (2001) – using district-level data, the data which aggregate the census data at district levels in India – empirically find that female education is the most important determinant of fertility. However, few studies have examined the determinants of fertility using household level data despite the fact that fertility decisions are actually made at individual or household levels. Drèze and Murthi (2001: 40) recognize the utility of employing household-level data as follows:

... if fertility decisions are, in fact, driven mainly by individual and household characteristics (with social effects playing little role), then household-level analyses are more appropriate, bearing in mind the potential aggregation problems involved in treating the district as the unit of analysis.

While we examine the direct effect of education on fertility by including variables on education as explanatory variables in the fertility equation, the indirect effect of parental

education through the change in opportunity costs of parents is also tested by including predicted parental wages, also estimated by education. This is an extension of Foster and Rosenzweig (2006) who analyse the fertility decline in India using panel data by incorporating predicted wages into the fertility equation.⁵ One would also claim that education is not entirely exogenous determinants of fertility. Another contribution would be made by estimating the instrumental variable (IV) model where parental education is instrumented by the availability of village-level education in grandparent's age.

The rest of the paper is organized as follows. Section 2 briefly sets out the basic analytical framework of the determinants of fertility at household level as a background to the empirical sections. The data used in this paper with their basic statistical analysis are described in Section 3. After the presentation of econometric models in Section 4, we report and discuss the regression results in Section 5. The final section offers concluding remarks with some policy implications.

2 Analytical framework

This section outlines a basic analytical framework focusing on the factors influencing the number of children a household wishes to bear. The neoclassical approach to understanding a household's fertility decision is based on its utility maximization behaviour, which is subject to budget constraints (e.g., Becker 1960; Bardhan and Udry 1999). We follow a version of the 'collective' model of household behaviour that explicitly models intra-household resource allocation (e.g., Browning and Chiappori 1998). We consider a two-person household with a wife (or a mother, m) and a husband (or a father, f). Let x_i be the i^{th} person's consumption ($i = m, f$), n be the number of children, and q be the (average) quality of children. The i^{th} person's utility is $U_i(x_i, n, q; A_i)$ where A_i is a vector consisting of exogenous factors that determine the preferences of the individual i . In this setting, the household utility function is defined as $\gamma U_m + (1 - \gamma) U_f$ where γ represents the 'bargaining power of a wife in a household ($0 < \gamma < 1$)'. The household's utility maximization problem is specified as follows:

$$\text{Max } U = \gamma U_m(x_m, n, q; A_m) + (1 - \gamma) U_f(x_f, n, q; A_f)$$

subject to

⁵ Drawing upon the household panel datasets in India over the period 1971-99, Foster and Rosenzweig find evidence on the importance of changes in the implicit cost or shadow price of children and women as sources of fertility change. The main departure of our study is that we use individual education in estimating male and female wage equations based on much larger nationwide household datasets, while Foster and Rosenzweig use village-level education, which is not significant.

$$I = p_m x_m + p_f x_f + p_c nq$$

where I is a household's income, p_i is the price of the private goods for i^{th} person (mother or father), and p_c is the shadow price of public goods, that is, children. In general, the optimal n^* will depend on parameters such as γ , p_c , I , p_i , and A_i as follows:

$$n^* = n^*(\gamma, I, p_m, p_f, p_c, A_m, A_f) \quad (1)$$

This model sheds light on several aspects of the household fertility decision which underlies demographic transition at macro level. For example, 'bargaining power' γ may reflect 'women's agency' such as female education and female labour participation, as emphasized in Drèze and Sen (2002, Chapter 7), in improving the quality of life. Given that a female is more likely than a male to value q , the quality of children (e.g., the nutrition and education level of children) over n , the number of children, the stronger bargaining power of a female reflected in higher γ leads to fewer children. Furthermore, the preferences A_i represent each household member's attitude toward the fertility decision, which may be different in various classes, social groups, religious communities, and regions, and they may move toward "small family value" with social and economic changes.

Economic growth increases a household's income level I with a consequent positive effect on consumption x_i , the number of children n , and the quality of children q . It is most likely that an increase in the income level lowers n and increases q and x_i . The key point is $p_c nq$ in the budget constraints. That a household's marginal utility MU equals its marginal cost is the first-order condition with respect to n and q in the maximization problem mentioned above: $MU_n = \lambda p_c q$ and $MU_q = \lambda p_c n$, where λ is the Lagrange multiplier for the budget constraint. If the rise in income increases the demand for q much more than it increases the demand for n , $\lambda p_c q$, which represents n 's shadow prices, will increase much more. In the next round, an increase in n 's shadow price will first reduce the demand for n . Subsequently, $\lambda p_c n$, which represents q 's shadow prices, will decrease, and this will be followed by an increase in the demand for q . Consequently, a higher income level may make n much less and q much more. In this sense, we can suggest that there is a 'quantity-quality' tradeoff in the fertility behaviours (see Becker and Lewis 1973 for more details).

In addition, as women attend schools and participate in labour markets more than they did previously and as the wages increase, the opportunity cost of bringing up children p_c may relatively increase, since women must allocate a greater amount of their time to raising children. As a consequence of the substitution effect, a household may reduce its n .

3 Data

This study draws upon three rounds of employment schedule of National Sample Survey (NSS) Data in 1993-94, 1999-2000 and 2004-05 (or 50th, 55th and 61st round) and National Family Health Survey (NFHS) Data in 1992-93, 1998-9 and 2005-06 (or NFHS-1, NFHS-2 and NFHS-3). There are two reason for using both the NSS and NFHS. First, detailed data on fertility behaviour are available only in NFHS, while the proxy for fertility, namely the number of children in the household, can be constructed only from NSS. Potentially important determinants of fertility, such as parental wages, are only available from NSS. Second, comparing the results based on the same econometric model applied to these two different survey data or combining the two datasets, for example by the pseudo panel model, would not only make our conclusion more robust but also provide additional insights into fertility behaviour in India.

The NSS, set up by the government of India in 1950, is a multi-subject integrated sample survey conducted all over India in the form of successive rounds relating to various aspects of social, economic, demographic, industrial and agricultural statistics.⁶ We use the data in the 'employment and unemployment' schedule, called 'the scheduled 10', one of the series of quinquennial surveys in 1993-94, 1999-2000 and 2004-05. These form the repeated cross-section datasets, each of which contains a large number of households across India.⁷ The employment and unemployment schedule contains a variety of information related to employment and unemployment situations, together with basic socioeconomic characteristics of the household (e.g., gender, age, religion, caste, and landholding) and mean per capita expenditure (MPCE). The comparison across different years is possible only at the aggregated regional unit, such as state or NSS region.

The NFHS is another major nationwide, large multi-round survey conducted in a representative sample of households in India with a focus on the health and nutrition of household members, especially of women and young children.⁸ The survey also contains the detailed data on fertility and mortality. The years for the three rounds of NFHS roughly correspond to those for NSS, which enables us to compare NSS and NFHS for each round.

⁶ See the website of National Sample Survey Organization http://mospi.nic.in/nssso_test1.htm for more details of NSS.

⁷ After dropping the households with missing observations in one of the explanatory variables, the number of households used for the estimation is 92,399; 59,869, and 91,666, respectively for 50th, 55th and 61st round.

⁸ See <http://www.nfhsindia.org/index.html> for the detailed description of NFHS.

The dependent variable constructed by NSS is the number of children aged under 15 years and deemed children of the head of the household or his or her spouse (to exclude the grandchildren of the head or maid in a large household). Mother, on the other hand, is defined as a female member of the household aged from 13 to 60 years, who is either the household head's spouse or the household head herself (to include the case of single mothers), assuming that a female could give birth between the ages of 13 and 45.⁹ We use these indirect ways of identifying children and mothers, as NSS does not have the data according to which we can track the mother for a particular child. Our proxy for fertility based on NSS thus excludes children who have died.

A more direct proxy for the fertility is available from NFHS, which would overcome the above limitation. NFHS has a question asking mothers aged 15-49 years how many children they have borne, a number which excludes miscarriages but includes the death** of any child. We use the number of children based on this question as a dependent variable. While NFHS has an ideal proxy for fertility, it lacks the data on household expenditure, father or mother's wages, which are potentially important determinants of fertility, but found in only NSS. The joint use of NSS and NFHS is thus necessary to overcome these limitations.

Table 2 summarizes the recent trends in total fertility rate (TFR)¹⁰ by different regions in India. Overall, TFR declined from 1992 to 2005. However, a significant disparity remains between rural and urban areas. Also noted is the disparity among different regions, reflecting considerable variance among different states. TFRs are much lower in the south (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and west (Goa, Gujarat and Maharashtra) than in central regions (Madhya Pradesh and Uttar Pradesh), the east (Bihar, Orissa and West Bengal) or the northeast (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura). The north corresponds roughly to the national average, while TFR in 2005 is varied among different states within the north ranging from 1.94 in Himachal Pradesh and 1.99 in Punjab to 3.21 in Rajasthan in 2005.¹¹

⁹ The problem with this procedure, which is inevitable for NSS, is that a representative mother is not necessarily the true mother, as in case of extended families she could also be the grandmother. The same problem applies to representative fathers. However, based on data from NSS 55th round we have confirmed that the percentage of representative parents who are not necessarily the child's true parents is less than 10%. The use of NFHS will overcome this limitation.

¹⁰ TFR is the average number of children that would be born to a woman over her lifetime if she were to experience the exact current age-specific fertility rates through her lifetime, and she were to survive from birth through the end of her reproductive life.

¹¹ See Appendix 1 for the fertility trends at state level.

Table 2. Total fertility rate for 15-49 year olds in India, based on NFHS-1, 2 and 3 (1992-93, 1998-99 and 2005-06)

	Urban			Rural			Total		
	1992	1998	2005	1992	1998	2005	1992	1998	2005
North	2.69	2.15	1.95	3.60	2.98	2.68	3.32	2.71	2.43
Central	3.43	2.75	2.66	4.65	3.94	3.64	4.36	3.65	3.37
East	2.64	2.21	2.04	3.46	2.86	3.04	3.28	2.75	2.82
Northeast	2.53	2.08	2.09	2.70	3.43	3.17	3.31	3.12	2.87
West	2.33	2.09	1.87	2.76	2.53	2.31	2.58	2.34	2.11
South	2.22	1.90	1.76	2.60	2.22	1.99	2.48	2.13	1.90
All India	2.70	2.27	2.06	3.67	3.07	2.98	3.39	2.85	2.68

Source: Based on National Family Health Survey in 1998-99 and 2005-06 (Table 4.3)

4 Econometric models

The main objective of our econometric model is to identify the key determinants of fertility proxied by the number of children based on the analytical framework of household model of fertility summarized in Section 2. The basic idea of specifying the econometric model of fertility behaviour draws upon Drèze and Sen (2001) and Foster and Rosenzweig (2006).

In Equation (1), we do not have any data for p_i , the price of private goods for the mother or father. While we do not have the direct data for γ on the bargaining power, we include education for the mother or father which is likely to affect γ . In some specifications, wages of the mother or father, which would also determine their relative bargaining power, are used as explanatory variables. In addition, exogenous household-specific variables common to both parents (e.g., religion, social class or caste) can be included together with regionally-specific environment or infrastructure in this framework.

4.1 Tobit model

Using the cross-sectional household data constructed from three rounds of NSS and NFHS, we estimate the following reduced form as a baseline model. In this version we do not insert wages of the father or mother, assuming that the coefficients related to parental education capture both direct and indirect effects.

$$n_i = n_i(E_i^m, E_i^f, L_i, A_i^m, B_i, O_i, M_i, L_i, S_i, R_i, D_i) \quad (2)^{12}$$

¹² There is a high correlation between neonatal mortality and fertility as a mother who has lost her baby is more likely to have another child, shown analytically and empirically by Bhalotra and

i denotes household and the dependent variable is n_i the number of children defined separately for NSS and NFHS as discussed in the previous section. n_i is estimated by the following explanatory variables.

E_i^m : A vector of the mother's education (Case i: whether literate; Case ii: whether literate, but has not completed primary school, whether completed primary school, whether completed middle school, whether completed secondary or higher secondary school, and whether completed higher education). Each dummy variable takes either 1 or 0.

In general, female education may be considered as a proxy for the opportunity cost of raising children. Furthermore, an increase in female education will empower women and increase their bargaining capability in households, which results in a decline in the number of children born, and thus eliminates the physical risks of childbirth for mothers, or improves health and education of children.

E_i^f : A vector of the father's education (defined same as above).

Higher education level of the father might lead him to cooperate with the mother in family planning and using contraceptives. This fact has been relatively neglected in the literature with a few exceptions, for example Bhat (2002).¹³

I_i : A vector of household income (proxied by mean per capita expenditure or MPCE at household level).¹⁴

A_i^m : Mother's age and its square, which take account of the lifecycle effect of the mother.

B_i : Social backwardness of the household in terms of whether (i) a household belongs to scheduled caste and (ii) belongs to scheduled tribe.

O_i : Occupation of parents in terms of (i) whether the household is classified as non-agricultural self-employment and (ii) whether as agricultural self-employment.

van Soest (2008) in the Indian context. In case where we use NSS, we may underestimate fertility, as our proxy of fertility excludes children who have died. They are counted in the case of NFHS.

¹³ According to the bargaining model in the previous section, education can be regarded as a proxy of bargaining power, but it may be also regarded as a proxy of the preference and the opportunity cost of raising children.

¹⁴ One of the fundamental factors underling income growth is technical change. See Rosenzweig (1990) who shows analytically and empirically that changes in returns to exogenous technical change induce human capital investments and reduce fertility.

- M_i : Religion of the household. We use the Muslim dummy only in consideration of the unique fertility behaviour among Muslims.
- L_i : Owned land as a measure of wealth.
- S_i : Son-preference index (defined as [the number of female children]/[the total number of children]) following Arnold, Choe, and Roy (1998) and Drèze and Murthi (2001). In India, the fact that sons are preferred over daughters is well-known and thus the expected sign of this index is positive.
- R : The degree of urbanization proxied by the rural sector dummy (whether in rural areas).
- D : A vector of state dummy variables.

Tobit model is used to take account of the censoring at 0 as some households have no children.¹⁵

$$\begin{aligned}
 n_i^* &= \alpha + \sum_{i=1}^q \beta^i x_i^i + \epsilon_i & (3) \\
 n_i &= n_i^* , \text{ if } n_i^* > 0 \\
 n_i &= 0 , \text{ if } n_i^* \leq 0
 \end{aligned}$$

where n_i^* is the latent variable, whose actual value we cannot directly observe from the dataset. x_i^i is a vector of a set of explanatory variables, such as the mother's education, E_i^m or land, L , while β^i is a corresponding vector of coefficient. ϵ_i is an error term.

Tobit has the advantage of providing an unbiased and consistent estimator when the variance of the error term is homoscedastic, while the OLS estimator given in the first model is still biased and inconsistent. However, the Tobit estimator is neither unbiased nor consistent and the estimator is unreliable when the variance of the error term is heteroscedastic, while heteroscedasticity plays no role in the determination of the unbiasedness in the case of OLS. We have thus employed Tobit model based on the White-Huber robust variance-covariance estimator.¹⁶

¹⁵ We have tried both OLS and Tobit for all the cases and obtained broadly similar results. Due to the space limitation, we report the results based on the 'robust' Tobit.

¹⁶ Two other interpretations can be made of this index. First, it reflects higher expected wages of sons and higher expected expenses related to daughters (e.g., dowry), leading to higher expected household net income in the future by having more sons. Second, the index may be correlated to the opportunity cost of raising children, since young girls, whose opportunity costs are negligible, are usually involved in bringing up younger brothers and sisters.

4.2 Instrumental variable (IV) estimation

IV for Education

There are two issues regarding the endogeneity of explanatory variables. First, education is deemed not exogenous due to the simultaneity in determining the number of children, the dependent variable, and the general level of education at the household level. This will cause the correlation of education and the error term, which may bias the coefficient estimate. We use two-stage least squares (2SLS) to address this issue in estimating the fertility equation.

For example, if a household has fewer or no children, then young parents or couples could have time to go to school. A household with fewer children could spend more in the education per child and they will have fewer children in the next generation when they are grown up. Instrumental variable (IV) estimation would at least partly take account of this problem, but it is generally not easy to find the variable that affects parental education but not the dependent variable, the number of the children. We use the ratio of those who attended primary school in the total age group of 50 or above for men and women separately at the village level (or the FSU (first sampling unit) village level). This is a proxy for general education levels or the availability of primary education for grandparents, which would affect parental education, but not fertility. We use the two-stage least squares (2SLS) to address this issue.

IV for mean per capita expenditure (MPCE)

Another key variable, MPCE, our proxy for household income, is not entirely exogenous. For instance, having more children would cause a mother to spend more time on childcare, which may reduce her current and expected future earnings, for example, due to the increased difficulty in finding a new job. Because we use MPCE based on the question covering household expenditure over the last 30 days, we instrument it by the seasonal unemployment rate at village level, assuming that a seasonal shock reduces MPCE, but not fertility which is more likely to be influenced by long-term conditions.

4.3 Incorporation of wage equation into the fertility model

While the higher level of parental education is likely to reduce fertility, it is not clear whether it is due to the increase in bargaining power or in opportunity costs for the mother. Educated women are more likely to earn higher wages and have less incentive to have children. As NSS provides us with individual data of earnings during the previous week of the survey date, these could be used as proxies for wages of the parents. So in the first step, we estimate the parental wage equation by Tobit model.

$$w_j^{Female} = w_j^{Female}(E_p, A_p, B_v, O_v, M_t, L_{tv}, S_v, D) \quad (4)$$

$$w_j^{Male} = w_j^{Male}(E_p, A_p, B_v, O_v, M_t, L_{tv}, D) \quad (4)'$$

Here, wage for female workers (or for male workers) is estimated by a set of variables at individual levels for the individual j , such as a set of education dummies, E_j , age or its square, denoted as a vector, A_j . These variables serve as identifying wage equations. Reflecting the difference in the labour market structure for rural and urban areas, the wage equation is estimated separately for rural and urban areas, and separately for w_j^{Female} and w_j^{Male} . This will give us predicted wages for female and male workers (including fathers and mothers), \hat{w}_j^{Female} and \hat{w}_j^{Male} , which will be directly used as predicted wages for the mother and father for each household i , \hat{w}_i^M and \hat{w}_i^F . These predicted wages will be used as explanatory variables for the estimation of fertility together with the variables at household level, such as O_i, M_i and L_i in the second step.

$$\bar{n}_i = \bar{n}_i(\hat{w}_i^M(E_j, A_j, B_i, O_i, M_i, L_i, S_i, D), \hat{w}_i^F(E_j, A_j, B_i, O_i, M_i, L_i, S_i, D), E_i^m, E_i^f, I_i, A_i^m, B_i, O_i, M_i, L_i, S_i, R, D) \quad (5)$$

Equation (5) will enable us to identify the direct and indirect effects of education of parents on fertility, the latter of which will be related to the effects of education on wages. This is an extension of Foster and Rosenzweig (2006) by taking account of the effects of individual education on wages.

4.4 Pseudo panel model

One of the limitations in the above models is that each round of NSS or NFHS is used separately for the cross-sectional estimations. To overcome this, we apply the pseudo panel model which aggregates micro-level household data by any meaningful unit or cohort (e.g., geographical areas or categorization by household characteristics) that is common across cross-sectional datasets in different years. We apply the pseudo panel model for the cohort k based on the combination of states and rural-urban classifications, which is common for both NSS and NFHS. The cohort is denoted as k in the equation (6) below.

$$\bar{n}_{i_{kt}} = \bar{n}_{i_{kt}}(E_{i_{kt}}^m, I_{i_{kt}}, A_{i_{kt}}^m, E_{i_{kt}}, O_{i_{kt}}, M_{i_{kt}}, L_{i_{kt}}, S_{i_{kt}}) \quad (6)$$

where k denotes cohort (i.e., state \times rural-urban classification) and t stands for survey years for three rounds of NSS and NFHS, 1992 or 1993, 1998 or 1999 and 2004 or 2005. The upper bar means that the average of each variable is taken for each cohort, k for each round t . As the mother's education is highly correlated with the father's at the aggregate level, we insert either $E_{i_{kt}}^m$ or $E_{i_{kt}}^f$ at one time.

Equation (6) can be estimated by the standard static panel mode, such as fixed effects or random effects model.

$$\bar{n}_{i_{kt}} = \alpha + \sum_{i=1}^q \beta^i \bar{x}_{i_{kt}}^i + \gamma D_t + \bar{\mu}_{kt} + \bar{\varepsilon}_{kt} \quad (7)$$

where $\bar{x}_{i,kt}^i$ is a dependent variable, $\bar{x}_{i,kt}^i$ is an explanatory variable such as $\bar{E}_{i,kt}^m$, D_t is the vector of year dummies, $\bar{\mu}_{kt}$ is the unobservable individual effect specific to the cohort k (e.g., the infrastructure, the cultural effects not captured by explanatory variables), and $\bar{\epsilon}_{kt}$ is an error term. The issue is whether Equation (7) is a good approximation of the underlying household panel models for household i in Equation (7) below. It is not straightforward to check this, as we do not have 'real' panel data.

$$n_{it} = \alpha^i + \sum_{i=1}^q \beta^{ii} x_{it}^i + \gamma^i D_t + \mu_i + \epsilon_{it} \quad (7)'$$

However, as shown by Verbeek and Nijman (1992) and Verbeek (1996), if the number of observations in cohort k tends to infinity, $\bar{\mu}_{kt} \rightarrow \mu_k^*$ and the estimator is consistent. In our case, k is very large and thus the estimator is likely to be almost consistent. Once we take account of the cohort population, Equation (7) will become the model developed by Deaton (1985) whereby $\bar{n}_{i,kt}$ and $\bar{x}_{i,kt}$ are considered to be error-ridden measurements of unobservable cohort means, which leads to the so-called 'error-in-variables estimator' (see Fuller 1987 for more details).

5 Main results

In this section we report and discuss the econometric results for the models described in the previous section. The results of cross-sectional estimations for the first, second and third rounds of NSS and NFHS are compared in Tables 3, 4, and 5. The results for wage equations are shown in Appendix 2. Table 6 reports the results of the pseudo panel models. Selected state-wise regression results are given in Appendix 3. Only key results are summarize below for each case.

5.2 Cross-sectional regression results for households across all India

For each round of NSS and NFHS, we show only seven representative cases, four for NSS and three for NFHS in Tables 3, 4, and 5. In Case (1) for NSS and in Case (5) for NFHS, we estimate Equation (2) by Tobit model using the literacy dummies for mother and father. Note, however, that MPCE is available only for NSS, not for NFHS. In Case (2) for NSS and in Case (6) for NFHS, 2SLS is applied to take account of the endogeneity of education variables for the mother and father (or their literacy) which are instrumented by the pre-generation access to primary school at the village level. Case (3) for NSS is the case where MPCE is instrumented by seasonal unemployment rate at the village level. In Case (4) for NSS, predicted wages of mother and father are used in the Tobit model where dummy variables of the mother and father's educational levels are used. The corresponding case for NFHS is Case (7) which uses similar education dummies without wages because wage data are not available from NFHS.

Table 3. Determinants of fertility (based on NSS 50th round and NFHS-1)

Dependent variable: number of children

Explanatory variables	Based on NSS 50 th round (1993-94)				Based on NFHS-1 (1992-93)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit	IV for education	IV for expenditure	With education dummies & wages	Tobit	IV for education	Tobin with education dummies
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Mother's age	0.494 (89.38)**	0.216 (62.86)**	0.207 (13.42)**	0.589 (91.99)**	0.307 (20.20)**	0.15 (10.77)**	0.316 (20.76)**
(Mother's age) ²	-0.008 (96.13)**	-0.003 (63.28)**	-0.004 (35.15)**	-0.009 (95.72)**	-0.002 (7.06)**	0.00 (0.17)	-0.002 (7.77)**
Scheduled tribe dummy (ST) (ST=1, otherwise=0)	-0.077 (3.35)**	-0.137 (5.80)**	(0.341) (1.12)	0.007 (0.29)	-0.084 (1.30)	-0.089 (0.64)	-0.091 (1.40)
Scheduled caste dummy (SC) (SC=1, otherwise=0)	0.038 (2.15)*	-0.054 (3.05)**	0.456 (1.35)	0.035 (1.83)	0.263 (4.17)**	0.164 (2.10)*	0.235 (3.72)**
Non-agricultural self-employ. dummy (non-agri. self- employ.=1, otherwise 0)	0.186 (12.39)**	0.156 (13.21)**	0.229 (3.14)**	0.352 (13.41)**	0.147 (2.75)**	0.055 (0.70)	-0.008 (0.15)
Agricultural self-employ. dummy (agri.self- employ.=1, otherwise=0)	0.214 (8.61)**	0.124 (6.57)**	-0.004 (0.03)	0.287 (9.43)**	0.199 (3.65)**	0.077 (0.55)	0.029 (0.50)
Monthly p.c. expenditure (MPCE) (Rs) (/10⁶)	-13.20 (21.58)**	-2.80 (2.86)**	54.20 (1.01)	– –	– –	– –	– –
Land owned	-0.001 (1.49)	-0.001 (1.64)	-0.002 (1.22)	-0.001 (1.33)	-0.001 (2.44)*	0.00 (0.95)	-0.001 (2.24)*
Muslim dummy (Muslim=1, otherwise=0)	0.585 (27.51)**	0.391 (20.49)**	0.814 (2.82)**	0.606 (26.75)**	0.32 (3.88)**	0.309 (2.78)**	0.281 (3.39)**
Mother's literacy (whether mother literate)	-0.052 (3.08)**	-0.497 (4.23)**	-1.091 (1.31)	– –	-0.354 (8.11)**	-2.389 (2.46)*	– –
Father's literacy (whether father literate)	0.033 (2.12)*	-0.164 (1.27)	– –	– –	-0.053 (1.18)	1.658 (1.33)	– –
Mother's wages	– –	– –	– –	-9.16 (2.76)**	– –	– –	– –
Father's wages	– –	– –	– –	-11.9 (6.66)**	– –	– –	– –
Mother's education							
Literate, but not completed primary school	– –	– –	– –	-0.086 (3.46)**	– –	– –	-0.147 (2.92)**
Completed primary school	– –	– –	– –	-0.08 (3.21)**	– –	– –	-0.484 (8.83)**
Completed middle school	– –	– –	– –	-0.116 (2.48)*	– –	– –	-1.146 (10.28)**
Completed secondary/ higher secondary school	– –	– –	– –	-0.132 (1.06)	– –	– –	– –
Completed higher education	– –	– –	– –	-0.29 (1.54)	– –	– –	– –

Table 3 cont.

Table 3 (based on NSS 50th round and NFHS-1) (cont.)

Dependent variable: number of children

	Based on NSS 50 th round (1993-94)				Based on NFHS-1 (1992-93)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit	IV for education	IV for expenditure	With education dummies & wages	Tobit	IV for education	Tobin with education dummies
Explanatory variables	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Father's education							
Literate, but not completed primary school	-	-	-	0.076 (3.38)**	-	-	-
Completed primary school	-	-	-	0.122 (4.90)**	-	-	-0.01 (0.20)
Completed middle school	-	-	-	0.21 (6.34)**	-	-	-0.123 (2.30)*
Completed secondary or higher secondary school	-	-	-	0.349 (5.50)**	-	-	-0.306 (3.66)**
Completed higher education	-	-	-	0.619 (5.37)**	-	-	-
Rural sector dummy (rural=1, urban=0)	0.016 (0.94)	-0.062 (3.71)**	0.852 (1.28)	-0.162 (6.06)**	0.163 (2.99)**	-0.07 (0.77)	0.053 (0.96)
Son's preference index	0.28 (48.91)**	0.226 (41.34)**	0.298 (4.38)**	0.273 (47.27)**	1.971 (48.45)**	1.255 (35.32)**	1.963 (48.36)**
Number of adults	-0.153 (32.67)**	-0.089 (27.66)**	0.009 (0.10)	-0.163 (30.47)**	0.051 (5.41)**	0.062 (4.29)**	0.056 (5.90)**
Constant	-5.897 (60.05)	-1.366 (12.94)	-3.876 (2.24)	-7.355 (69.33)	-7.58 (29.29)	-3.53 (8.04)	-7.43 (28.78)
Observations	92,399	83,789	92,399	79,112	11,726	11,585	11,663
R-squared	-	0.31	-	-	-	0.38	-
Joint significant test	Wald Chi ² (45) =26569**	F(45,83743) =1068.8**	F(45,92353) =309.54**	Wald Chi ² (54) =22362**	Wald Chi ² (37) =11670**	F(37,11547) =227.47**	Wald Chi ² (41) =11768**

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%
State dummies are included in the regressions, but are omitted to save space.

Table 4. Determinants of fertility (based on NSS 55th round and NFHS-2)

Dependent variable: number of children

Explanatory variables	Based on NSS 55 th round (1999-2000)				Based on NFHS-2 (1998-99)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit	IV for education	IV for expenditure	With education dummies & wages	Tobit	IV for education	Tobit with education dummies
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Mother's age	0.522 (69.14)**	0.202 (56.95)**	0.211 (34.81)**	0.231 (56.07)**	0.263 (28.27)**	0.089 (4.45)**	0.273 (29.78)**
(Mother's age) ²	-0.008 (76.07)**	-0.003 (74.02)**	-0.003 (66.67)**	-0.004 (68.82)**	-0.001 (8.87)**	0.001 (2.07)*	-0.001 (10.29)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	-0.006 (0.18)	-0.074 (2.92)**	0.005 (0.11)	0.137 (5.47)**	0.067 (1.57)	0.218 (1.00)	0.028 (0.66)
Scheduled caste (SC) dummy (SC=1, otherwise=0)	0.051 (2.21)*	-0.039 (1.92)	0.021 (0.32)	0.143 (7.69)**	0.289 (9.52)**	0.288 (1.70)	0.207 (6.85)**
Non-agricultural self-employ. dummy (non-agri. self-employ.=1, otherwise 0)	0.177 (9.59)**	0.133 (9.72)**	0.133 (4.85)**	0.076 (1.93)	0.018 (0.63)	-0.047 (0.58)	0.003 (0.12)
Agricultural self-employ. dummy (agri.self-employ.=1, otherwise=0)	0.18 (6.01)**	0.069 (3.50)**	0.089 (4.96)**	0.015 (0.48)	0.093 (3.47)**	0.309 (1.67)	0.024 (0.88)
Monthly p.c. expenditure (MPCE) (Rs) (/10 ⁶)	-1,263.80 (24.18)**	-466.85 (10.63)**	-732.91 (1.48)	-	-	-	-
Land owned	-0.002 (3.23)**	-0.001 (5.15)**	-0.001 (1.83)	-0.002 (7.01)**	-0.005 (2.05)*	-0.004 (1.14)	-0.004 (1.91)
Muslim dummy (Muslim=1, otherwise=0)	0.699 (26.55)**	0.452 (20.83)**	0.501 (8.35)**	0.495 (20.98)**	0.482 (11.48)**	0.638 (2.85)**	0.355 (8.47)**
Mother's literacy (whether mother literate)	-0.247 (11.46)**	-0.384 (2.65)**	-0.189 (2.03)*	-	-0.452 (17.18)**	-4.746 (3.15)**	-
Father's literacy	-0.007 (0.31)	-0.317 (2.07)*	0.002 (0.06)	-	-0.077 (2.50)*	5.952 (2.24)*	-
Mother's wages	-	-	-	-6.63 (7.77)**	-	-	-
Father's wages	-	-	-	4.28 (3.83)**	-	-	-
Mother's education							
Literate, but not completed primary school	-	-	-	-0.162 (7.19)**	-	-	-0.121 (3.82)**
Completed primary school	-	-	-	-0.246 (10.30)**	-	-	-0.428 (13.75)**
Completed middle school	-	-	-	-0.351 (14.05)**	-	-	-1.088 (26.72)**
Completed secondary/higher secondary school	-	-	-	-0.283 (11.54)**	-	-	-
Completed higher education	-	-	-	-0.229 (4.63)**	-	-	-

Table 4 cont.

Table 4 (based on NSS 55th round and NFHS-2) (cont.)

Dependent variable: number of children

Explanatory variables	Based on NSS 55 th round (1999-2000)				Based on NFHS-2 (1998-99)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit	IV for education	IV for expenditure	With education dummies & wages	Tobit	IV for education	Tobit with education dummies
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Father's education							
Literate, but not completed primary school	-	-	-	0.016 (0.73)	-	-	0.043 (1.21)
Completed primary school	-	-	-	-0.036 (1.70)	-	-	-0.094 (2.83)**
Completed middle school	-	-	-	-0.074 (3.51)**	-	-	-0.252 (6.24)**
Completed secondary or higher secondary school	-	-	-	-0.16 (6.82)**	-	-	-
Completed higher education	-	-	-	-0.253 (7.42)**	-	-	-
Rural sector dummy (rural=1, urban=0)	-0.043 (2.01)*	-0.053 (2.97)**	-0.023 (0.18)	0.477 (9.28)**	0.31 (11.94)**	-0.001 0.00	0.154 (5.85)**
Son's preference index	0.314 (36.07)**	0.248 (31.66)**	0.241 (19.26)**	0.248 (31.36)**	1.669 (68.12)**	1.013 (23.71)**	1.671 (68.91)**
Number of adults	-0.158 (27.06)**	-0.111 (31.21)**	-0.118 (8.19)**	-0.111 (32.38)**	0.086 (13.91)**	0.049 (1.43)	0.089 (14.56)**
Constant	-5.87 (43.50)	-0.747 (9.28)	-1.118 (4.24)	-2.409 (21.15)	-6.44 (40.70)	-3.80 (4.29)	-6.41 (41.27)
Observations	59,869	56,927	59,869	52,971	26,955	26,955	26,872
R-squared		0.36	0.36	0.34	-	-	-s
Joint significant test	Wald Chi ² (45)	F(45,56881)	F(45,59823)	Wald Chi ² (54)	Wald Chi ² (38)	F(38,26916)	Wald Chi ² (42)
	=20576**	=789.01**	=818.51**	=17354**	=22646**	=182.40**	=23806**

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%
State dummies are included in the regressions, but are omitted to save space.

Table 5. Determinants of fertility (based on NSS 61st round and NFHS-3)

Dependent variable: number of children

Explanatory variables	Based on NSS 61 st round (2004-05)				Based on NFHS-3 (2005-06)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit Coeff. (t-value)	IV for education Coeff. (t-value)	IV for expenditure Coeff. (t-value)	With education dummies & wages Coeff. (t-value)	Tobit Coeff. (t-value)	IV for education Coeff. (t-value)	Tobit with education dummies Coeff. (t-value)
Mother's age	-0.006 (1.23)	0.121 (47.16)**	0.189 (11.74)**	0.15 (50.13)**	0.55 (78.52)**	0.068 (4.81)**	0.362 (50.72)**
(Mother's age) ²	0.00 (4.75)**	-0.002 (66.34)**	-0.003 (16.52)**	-0.002 (64.63)**	-0.006 (56.50)**	0.001 (3.00)**	-0.003 (31.42)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	0.023 (1.00)	0.00 (0.02)	0.998 (5.70)**	0.106 (7.07)**	0.114 (2.93)**	0.09 (1.74)	0.22 (5.72)**
Scheduled caste (SC) dummy (SC=1, otherwise=0)	0.111 (4.28)**	0.054 (3.31)**	-0.689 (4.68)**	0.051 (2.99)**	0.241 (8.70)**	0.077 (1.95)	0.204 (7.49)**
Non-agricultural self-employ. dummy (non-agri. self- employ.=1, otherwise 0)	0.185 (12.91)**	0.087 (9.44)**	0.29 (6.95)**	0.037 (1.64)	0.193 (9.74)**	0.173 (4.71)**	-0.027 (1.45)
Agricultural self-employ. dummy (agri. self-employ.=1, otherwise=0)	0.145 (8.51)**	0.026 (2.49)*	0.107 (5.49)**	-0.044 (2.00)*	— —	— —	— —
Monthly p.c. expenditure (MPCE) (Rs) (/10 ⁶)	-0.033 (2.63)**	-0.011 (4.80)**	59.158 (1.04)	— —	— —	— —	— —
Land owned	0.00 (0.90)	0.00 (0.83)	0.00 (0.86)	0.00 (14.07)**	0.019 (10.11)**	0 (0.02)	0.024 (9.03)**
Muslim dummy (Muslim=1, otherwise=0)	0.595 (27.73)**	0.378 (24.08)**	0.57 (18.87)**	0.336 (20.50)**	0.479 (13.63)**	0.159 (3.45)**	0.476 (13.54)**
Mother's literacy (whether mother literate)	-0.383 (24.65)**	-0.344 (3.90)**	-0.159 (3.25)**	— —	-0.902 (46.14)**	-5.31 (7.91)**	— —
Father's literacy (whether mother literate)	-0.133 (7.60)**	-0.296 (2.85)**	-0.067 (2.23)*	— —	-0.288 (9.16)**	5.764 (5.44)**	— —
Mother's wages	— —	— —	— —	-2.36 (16.28)**	— —	— —	— —
Father's wages	— —	— —	— —	0.74 (8.13)**	— —	— —	— —
Mother's education							
Literate, but not completed primary school	— —	— —	— —	-0.094 (6.74)**	— —	— —	-0.217 (7.37)**
Completed primary school	— —	— —	— —	-0.079 (5.91)**	— —	— —	-0.656 (29.12)**
Completed middle school	— —	— —	— —	-0.145 (8.83)**	— —	— —	-1.171 (42.26)**
Completed secondary/higher secondary school	— —	— —	— —	-0.037 (2.50)*	— —	— —	— —
Completed higher education	— —	— —	— —	-0.233 (11.02)**	— —	— —	— —

Table 5 cont.

Table 5 (based on NSS 61st round and NFHS-3) (cont.)

Dependent variable: number of children

Explanatory variables	Based on NSS 61 st round (2004-05)				Based on NFHS-3 (2005-06)		
	Case (1)	Case (2)	Case (3)	Case (4)	Case (1)	Case (2)	Case (3)
	Tobit Coeff. (t-value)	IV for education Coeff. (t-value)	IV for expenditure Coeff. (t-value)	With education dummies & wages Coeff. (t-value)	Tobit Coeff. (t-value)	IV- education Coeff. (t-value)	Tobin with education dummies Coeff. (t-value)
Father's education							
Literate, but not completed primary school	-	-	-	-0.253 (16.79)**	-	-	-0.013 (0.40)
Completed primary school	-	-	-	-0.188 (13.82)**	-	-	-0.056 (1.86)
Completed middle school	-	-	-	-0.202 (11.97)**	-	-	-0.355 (9.24)**
Completed secondary or higher secondary school	-	-	-	-0.163 (10.98)**	-	-	-
Completed higher education	-	-	-	-0.003 (0.10)	-	-	-
Rural sector dummy (rural=1, urban=0)	0.172 (11.49)**	0.004 (0.32)	0.267 (4.11)**	0.496 (16.42)**	0.301 (14.17)**	-0.035 (0.98)	0.11 (5.24)**
Son's preference index	1.961 (114.54)**	1.397 (116.29)**	1.647 (29.98)**	1.385 (111.21)**	1.222 (73.40)**	0.687 (24.37)**	1.096 (64.02)**
Number of adults	0.07 (14.78)**	-0.114 (37.25)**	-0.134 (4.07)**	-0.124 (44.79)**	0.08 (13.70)**	0.137 (15.45)**	0.153 (24.08)**
Constant	0.701 (7.65)	-0.149 (2.43)	-2.504 (6.00)	-1.585 (20.04)	-11.05 (-79.21)	-3.08 (-8.07)	-7.73 (-57.07)
Observations	91,666	91,666	91,666	82,390	47,441	47,341	35,376
R-squared	-	0.45	-	0.45	-	-	-
Joint significant test	Wald Chi ² (45) =25961**	F(45,91626) =303.21**	F(45,91620) =1375.30**	Wald Chi ² (54) =23413**	Wald Chi ² (32) =39504**	F(32,47308) =433.08**	Wald Chi ² (36) =26222**

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%
State dummies are included in the regressions, but are omitted to save space.

Although NSS and NFHS are carried out for different purposes and the dependent variables are defined differently as we discussed in the previous section, we find very similar patterns in the results for the two surveys. This is important in two ways. First, this will justify our use of the proxy for fertility constructed by NSS, or child number.¹⁷

¹⁷ Appendix 4 shows the graphs of the dependent variable for NSS (the number of children under 15 of the household head and spouse) and that for NFHS (the number of children a mother

Second, the robustness of our general conclusions is strengthened as the set of results based on one survey serves as sensitivity tests for the other.

All cases for the three rounds show that the coefficient estimate of age is positive and significant and its square is negative and significant except in a few incidents (e.g., Case 1 in Table 5, where age is not significant; Case 2 in Tables 4 and 5, where both age and its square are positive). This reflects the non-linearity in the age-fertility relationship, i.e., the fertility rate first increases and then falls as the mother's age increases, which is consistent with the lifecycle of a typical household.

The non-agricultural self-employment dummies have a significant and positive sign in most of the cases. These results suggest that children work for household enterprises as family labourers, more so than in other types of households. The coefficients of the agricultural self-employment household dummy are also positive and significant in most of the cases. The results suggest that children, as agricultural labour input, are more valuable in agricultural households than in other types of households.

The coefficients of scheduled caste dummies are positive and significant in most of the cases for NSS and NFHS, while the results on scheduled tribe dummies are more mixed. It appears that the negative coefficients in the first round (significant in Cases (1) and (2)) turned into positive in the last round (significant in Cases (3), (4), (5) and (7)). Drèze and Sen (2002) and Murthi, Guio, and Drèze (1995) find a negative coefficient on the scheduled tribes variable, while Drèze and Murthi (2001) observe relation between the scheduled tribes variable and fertility after controlling for the son-preference index. Maharatna (2000) finds a relatively low fertility rate in tribal communities in his investigation of historical material in British colonial India. Our results suggest that after controlling for the son-preference index, the fertility level of tribal communities was relatively lower than the rest in the early 1990s, but became relatively higher in 2004-06. The positive effect of scheduled caste and Muslim dummies on fertility found in all the cases is consistent with the earlier literature, for example, Moulasha and Rama Rao (1999) and Bhat and Zavier (2005).^{18/19}

bears) aggregated at state level for rural and urban areas. They are positively correlated with high correlation coefficients, 0.74, 0.80, and 0.75 for each round.

¹⁸ Note that we excluded Muslim households with more than one female spouse of a male household head.

¹⁹ However, it should be noted that fertility declined among Hindus as well as Muslims in India as suggested, for example, by James and Nair (2005) and Kulkarni and Alagrajan (2005). We do not investigate this issue directly, but the results of state-wise fertility regressions show that the Muslim dummy ceased to be significant in 2004-05 in a few states, such as Tamil Nadu, West

The coefficient estimates of MPCE, our proxy for household income, which is available only for NSS, are negative and significant in Cases (1) and (2) in Tables 3, 4, and 5 when it is not instrumented. This is consistent with the analytical framework of bargaining model which implies that higher income reduces fertility. However, once it is instrumented by the village-level seasonal unemployment in Case (3) (which is significant in the first stage), MPCE becomes non-significant with its sign negative only for 1999. Given that MPCE is likely to be an endogenous variable, it is not clear whether the income or MPCE reduces fertility. Regarding the estimates of owned land, they are mostly negative and significant for NSS which defines it as all the land possessed by the household. The signs are as expected. However, due to data limitation, NFHS has the variable of the agricultural land area (which may be larger for rural households – which tend to have more children in a household in general – although some rich agricultural households may have fewer children) and thus we get mixed results. In 1992 and 1998, the effects of agricultural lands on fertility were by and large negative and significant as expected by the theory, but became positive in 2005. While economic growth contributes to a lower fertility rate as implied by the theory of demographic transition, this is not clearly supported by the micro-level household data.

The son preference index is significantly positive in all equations irrespective of the model specification. This result confirms that the son preference increases fertility, as Drèze and Murthi observe (2001).

Let us turn to the effects of education on fertility. Tables 3, 4 and 5 confirm that the mother's education is negative and significant irrespective of the specifications (e.g., whether education is instrumented or not; literacy dummy or dummies on educational levels are used) over the period of 1992-2006 for both NSS and NFHS. The role of father's education appears to have changed over time from positive and significant (or non-significant) effects in 1992-94 to negative and significant effects in 1998-2000 to 2004-06 for NSS and NFHS with a few exceptions. This implies that the role of father's education in reducing fertility became increasingly important over the years.

For example, in Case (1) for NSS and Case (4) for NFHS in Tables 3, 4 and 5, we used the dummy variables on mother's and father's literacy in the baseline specification without instrumenting them. In all the cases, mother's literacy dummy is negative and significant, while father's literacy dummy is negative and significant in Case (4) for NFHS-2 and 3 and Case (1) for the NSS 61st round. Negative and significant results for mother's literacy dummy are unchanged in Case (2) for NSS and Case (5) for NFHS where the dummy variables for the mother's and father's education are instrumented by pre-generation access to primary school for males and females using 2SLS. On the

Bengal, and Bihar, which suggests some recent changes in the reproductive behaviour among Indian Muslims.

estimate of father's literacy dummy, it is negative and non-significant in 1993-94, becoming negative and significant in 1999-2000 and in 2004-05 for NSS. However, it was positive throughout three rounds of NFHS.

In Case (4) for NSS and in Case (7) for NFHS, the predicted wages for the father and mother as well as the dummy variables on their educational attainment are used to estimate fertility. Wages are predicted by the wage equations for males and females at individual levels for rural and urban areas separately as shown in Appendix 3. Appendix 3 shows that education level dummies (for which the baseline case is 'illiterate') are all positive and significant and the significance level is higher with higher levels of education in Tobit estimations. Predicted wages of mothers, defined for both the actual labour market participants and non-participants (for the latter, implied wages are derived by individual characteristics) are negative and significant for all three rounds of NSS, which implies that higher wages would decrease fertility through higher opportunity costs (Case (4) in Tables 3, 4, and 5). The negative and significant results are unchanged for all three rounds if actual wages are used only for households with small samples of labour market participants.²⁰ Predicted wages of the father are negative and significant in 1993-4, positive and significant in 1999-2000 and 2004-05. It is important to note in these cases that the coefficient estimates of education-level dummies in fertility equations are negative and significant for the mother for all three rounds. Those of the father are positive in the first round and negative and significant in the second and the third rounds. It can be concluded that mother's education has direct and indirect negative effects on fertility. Father's education has either direct (in 1999-2000 or 2004-05) or indirect (in 1993-94) negative effects on fertility.

Our result, therefore, justifies the greater role of female education in fertility reduction as emphasized in earlier studies, for example, by Brookins and Brookins (2002); Drèze and Sen (2002: Chapter 7); Drèze and Murthi (2001); Subbarao and Raney (1995); Jain and Nag (1986).²¹ While Drèze and Murthi (2001) and Drèze and Sen (2002: Chapter 7) claim that male literacy makes no contribution to reduction in fertility when controlled by female education, our study confirms that both male literacy and education attainments are closely associated with fertility reduction, particularly in more recent years.

²⁰ The results will be furnished on request.

²¹ We are not excluding the possibility that fertility among illiterate parents has recently declined in India as Bhat argues (2002). It must be noted, however, that fertility declined among illiterate parents, but more so among educated parents, implying the importance of parental education. For example, if we estimate the pseudo panel for the first difference of the number of children, education dummies are negative and significant in some cases. The results will be furnished on request.

These differences from earlier studies are related to our contributions, that is, the consideration of heterogeneity within districts and the extensive use of survey data covering more recent periods. The robustness of our results is further strengthened by using IV to take account of the endogeneity of education. Overall, our results provide a picture broadly consistent with the analytical framework of the relationship between the fertility decision and household-specific socioeconomic factors.

Pseudo panel model results

Table 6 presents the results based on pseudo panel model for state levels classified rural and urban areas for NSS and NFHS. A few points are noted on the selection of explanatory variables. First, we include education variables (literacy or a set of educational levels) separately for the father and mother as they are correlated at the aggregate level. Second, in case where NFHS is used, MPCE is added by the cohort data constructed from the aggregation of NSS. Third, the results based on both fixed-effects and random-effects models are presented. Eight cases are shown according to whether NSS or NFHS is used, whether education is for the mother or father, and how education is defined, i.e., the literacy rate or the educational attainments.

The results are broadly consistent with those in Tables 3, 4 and 5 with a few notable changes. The following explanation is based on either fixed or random-effects model chosen by the Hausman test for each case (shown in bold in the table). We obtain the coefficient estimates with the same signs and significance as obtained by household data for the mother's age (positive) and its square (negative), non-agricultural self-employed dummies (positive), agricultural self-employed dummies (positive for NSS) and the son preference index (positive, significant only for NSS). The variables on schedule castes and Muslim have become non-significant in most cases. MPCE are also non-significant, contrary to the household-level results which show negative and significant coefficient estimates for MPCE when it is not instrumented.

Mother's literacy is negative and significant in Case (1) and so is the father's literacy in Case (2) for NSS. They are not significant in Case (5) for NFHS in fixed-effects models chosen by Hausman tests, but negative and significant in random-effects models. In Case (3) (or Case (4)) for NSS with the mother's (or father's) educational attainment variables, 'under primary school', reflecting the low level of educational attainment, is positive and significant at 1 percent level (or at 10 percent level). In the corresponding cases for NFHS (Cases (7) and (8)), they are negative, although not significant. These results should be interpreted with caution because of the possible aggregation bias, but they confirm the importance of parental education in reducing fertility.

Table 6. Determinants of fertility based on pseudo panel data model for NSS and NFHS, 1992-2006, Dependent variable: number of children

	NSS (dependent variable: no. of children)							
	LITERACY				EDUCATION LEVELS			
	Case 1: Mother		Case 2: Father		Case 3: Mother		Case 4: Father	
	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)
Mother's age	0.28 (2.93)**	0.295 (3.69)**	0.3 (3.10)**	0.312 (3.66)**	0.282 (3.11)**	0.328 (3.68)**	0.219 (2.15)*	0.198 (2.14)*
(Mother's age) ²	-0.004 (3.37)**	-0.004 (4.38)**	-0.004 (3.49)**	-0.005 (4.35)**	-0.004 (3.60)**	-0.005 (4.32)**	-0.003 (2.41)*	-0.003 (2.70)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	0.209 (1.32)	0.37 (5.33)**	0.147 (0.91)	0.299 (4.03)**	0.075 (0.51)	0.26 (3.31)**	0.25 (1.49)	0.262 (3.35)**
Scheduled caste (SC) dummy (SC=1, otherwise=0)	-0.243 (0.59)	-0.231 (1.17)	0.044 (0.11)	-0.101 (0.47)	0.686 (1.98)*	0.156 (0.70)	0.109 (0.29)	0.134 (0.60)
Non-agricultural self-employ. dummy (non-agri. self-employ.=1, otherwise 0)	0.772 (2.71)**	1.028 (5.52)**	0.653 (2.29)*	0.991 (4.95)**	0.677 (2.37)*	1.058 (5.13)**	0.69 (2.30)*	1.098 (5.11)**
Agricultural self-employ. dummy (agri. self-employ.=1, otherwise=0)	0.518 (1.96)	0.605 (4.52)**	0.66 (2.48)*	0.7 (4.55)**	0.614 (2.74)**	0.851 (5.51)**	0.679 (2.66)**	1.05 (6.95)**
Monthly p.c. expenditure (MPCE) (Rs) (/10 ⁶)	0.191 (0.17)	0.265 (0.25)	-0.151 (0.13)	-0.549 (0.51)	- -	- -	- -	- -
Land owned	0 (1.23)	0 (0.89)	0 (1.26)	0 (0.61)	0 (1.46)	0 (0.93)	0 (1.12)	0 (0.44)
Share of Muslim	-0.218 (0.89)	-0.073 (0.75)	-0.036 (0.15)	-0.082 (0.77)	0.152 (0.74)	-0.121 (1.06)	-0.04 (0.18)	-0.049 (0.43)
Mother's literacy (whether literate)	-0.522 (2.04)*	-0.719 (5.66)**	- -	- -	- -	- -	- -	- -
Father's literacy (whether literate)	- -	- -	-0.005 (0.02)	-0.556 (2.95)**	- -	- -	- -	- -
Son's preference index	0.635 (1.66)	0.793 (2.64)**	0.655 (1.67)	0.945 (3.00)**	0.831 (2.46)*	0.983 (3.20)**	0.703 (1.86)	0.969 (3.02)**
Number of adults	0.038 (0.61)	0.062 (1.34)	0.063 (1.00)	0.106 (2.18)*	0.031 (0.57)	0.061 (1.24)	0.043 (0.67)	0.102 (2.00)*
Whether mother (or father) Is literate, but has not completed primary school	- -	- -	- -	- -	2.601 (6.58)**	1.241 (3.55)**	1.365 (2.95)**	0.756 (1.89)
Whether completed primary school	- -	- -	- -	- -	-0.034 (0.09)	-0.824 (2.40)*	0.463 (1.31)	-0.059 (0.19)
Whether completed middle school	- -	- -	- -	- -	0.662 (1.31)	0.017 (0.05)	0.721 (1.29)	0.189 (0.50)
Whether completed secondary or higher secondary school	- -	- -	- -	- -	-0.246 (0.62)	-0.435 (1.26)	0.129 (0.41)	0.305 (1.19)
Whether mother completed higher education	- -	- -	- -	- -	0.316 (1.09)	0.056 (0.23)	0.271 (0.94)	0.278 (1.11)
Whether in 1993	-0.461 (1.31)	-0.599 (2.18)*	-0.413 (1.15)	-0.64 (2.21)*	-0.481 (1.51)	-0.672 (2.38)*	-0.364 (1.02)	-0.645 (2.18)*
Whether in 1998	-0.476 (1.37)	-0.581 (2.15)*	-0.507 (1.43)	-0.743 (2.63)**	-0.558 (1.79)	-0.74 (2.64)**	-0.482 (1.37)	-0.729 (2.47)*
Constant	-3.495 (1.91)	-3.596 (2.44)*	-4.415 (2.43)*	-4.07 (2.61)**	-4.332 (2.65)**	-4.804 (2.99)**	-3.491 (1.90)	-2.835 (1.72)
Observations	185	185	185	185	185	185	185	185
Number of ST Region	64	64	64	64	64	64	64	64
R-squared	0.51	-	0.49	-	0.64	-	0.54	-
Hausman test for Fixed or random effects	Chi ² (12) = 11.30		Chi ² (12) = 17.95		Chi ² (16) = 80.36**		Chi ² (16) = 23.42	
	Random-effects		Random-effects		Fixed-effects		Random-effects	

Table 6 cont.

	NFHS (dependent variable: no. of children born)							
	LITERACY				EDUCATION LEVELS			
	Case 5: Mother		Case 6: Father		Case 7: Mother		Case 8: Father	
	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)	F-effects Coeff. (t-value)	R-effects Coeff. (t-value)
Mother's age	0.532 (1.81)	0.166 (0.68)	0.576 (1.92)	-0.065 (0.23)	0.488 (1.86)	0.277 (1.19)	0.545 (1.93)	-0.138 (0.46)
(Mother's age) ²	-0.007 (1.48)	-0.002 (0.42)	-0.007 (1.58)	0.001 (0.33)	-0.006 (1.56)	-0.003 (0.93)	-0.007 (1.62)	0.002 (0.53)
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	0.401 (0.75)	0.743 (5.56)**	0.403 (0.74)	0.533 (3.22)**	0.202 (0.42)	0.568 (4.21)**	0.194 (0.37)	0.447 (2.63)**
Scheduled caste (SC) dummy (SC=1, otherwise=0)	-0.891 (1.80)	-0.191 (0.50)	-0.869 (1.72)	-0.228 (0.49)	-1.373 (3.06)**	-0.504 (1.38)	-1.422 (2.71)**	-0.272 (0.57)
Non-agricultural self-employ. dummy (non-agri. self-employ.=1, otherwise 0)	1.253 (3.00)**	1.086 (3.02)**	1.292 (3.07)**	0.926 (2.19)*	0.812 (2.14)*	1.179 (3.50)**	0.831 (1.93)	0.876 (1.99)*
Agricultural self-employ. dummy (agri. self-employ.=1, otherwise=0)	0.095 (0.44)	-0.105 (0.54)	0.235 (1.05)	-0.162 (0.72)	0.007 (0.04)	-0.152 (0.84)	-0.028 (0.13)	-0.144 (0.59)
Monthly p.c. expenditure (MPCE) (Rs) (/10 ⁶)	-2.004 (1.00)	-1.866 (0.99)	-2.072 (1.02)	-1.885 (0.87)	-3.2 (1.72)	-2.253 (1.24)	-1.916 (0.97)	-2.396 (1.05)
Land owned	-0.003 (0.43)	-0.003 (0.49)	-0.005 (0.70)	0.001 (0.17)	0 (0.05)	0 (0.06)	-0.004 (0.54)	0.002 (0.28)
Share of Muslim	0.06 (0.14)	0.041 (0.18)	0.401 (0.97)	-0.037 (0.13)	-0.868 (2.09)*	-0.052 (0.24)	-0.155 (0.32)	-0.097 (0.35)
Mother's literacy (whether literate)	-0.73 (1.42)	-1.851 (9.36)**	-	-	-	-	-	-
Father's literacy (whether literate)	-	-	0.316 (0.44)	-1.93 (4.86)**	-	-	-	-
Son's preference index	0.69 (0.87)	0.535 (0.82)	0.819 (1.03)	0.674 (0.87)	-0.244 (0.34)	-0.008 (0.01)	0.102 (0.13)	0.638 (0.78)
Number of adults	-0.008 (0.06)	0.142 (1.89)	0.032 (0.25)	0.217 (2.35)*	0.005 (0.04)	0.132 (1.83)	0.078 (0.61)	0.194 (2.06)*
Whether mother (or father) Is literate, but has not completed primary school	-	-	-	-	-	-2.234 (0.67)	-1.801 (0.28)	-0.894 (0.13)
Whether completed primary school	-	-	-	-	-0.26 (0.50)	-3.005 (0.89)	-0.96 (0.15)	-2.561 (0.36)
Whether completed middle school	-	-	-	-	-1.872 (3.11)**	-4.268 (1.24)	-1.542 (0.24)	-2.289 (0.32)
Whether completed secondary or higher secondary school	-	-	-	-	-3.707 (4.40)**	-4.701 (1.39)	-3.616 (0.55)	-3.087 (0.44)
Whether mother completed higher education	-	-	-	-	-	-	-	-
Whether in 1993	-0.481 (0.68)	-0.231 (0.38)	-0.492 (0.68)	-0.07 (0.10)	0.156 (0.24)	0.039 (0.07)	0.234 (0.32)	0.174 (0.23)
Whether in 1998	-0.304 (0.43)	-0.018 (0.03)	-0.403 (0.57)	0.104 (0.15)	0.453 (0.71)	0.355 (0.63)	0.487 (0.65)	0.356 (0.48)
Constant	-7.058 (1.56)	-0.9 (0.25)	-8.796 (1.87)	3.06 (0.75)	-4.81 (1.19)	0 (.)	-5.75 (0.77)	4.876 (0.58)
Observations	143	143	143	143	143	143	143	143
Number of ST Region	52	52	52	52	52	52	52	52
R-squared	0.91	-	0.9	-	0.93	-	0.92	-
Hausman test for Fixed or random effects *	Chi ² (13) = 29.94**		Chi ² (14) = 359.83**		Chi ² (15) = 7.69		Chi ² (16) = 31.59*	
	Fixed-effects		Fixed-effects		Random-effects		Fixed-effects	

Notes: F-effects = fixed effects; R-effects = random effects;
Robust t statistics in parentheses. * significant at 5%; ** significant at 1%;
* The choice of fixed or random effects model is based on 10 % significance of Hausman Test results. The econometric results for chosen model are shown in bold. Those not chosen by Hausman model are shown as references as a few cases are at the borderline.

State-wise results

Appendix 3 provides cross-sectional regressions applied to household-level data constructed from NSS for selected states. From 1992-93 to 2005-06, Andhra Pradesh and Tamil Nadu experienced remarkable reduction of TFR, 2.59 to 1.79 and 2.48 to 1.80, respectively (Appendix 1). Kerala, the state where the fertility rate was already low (2.00) in 1992-93, experienced a slight reduction, to 1.93 in 2005-06. West Bengal and Orissa experienced a similar decline in TFR from 2.92 to 2.27 or 2.37 in the same period. Bihar remained one of the states with the highest TFR in India (from 4.00 to 3.83). The same specification as Case (4) in Tables 3, 4, and 5 is used.

Four observations to summarize the results on key variables, land, wage and parental education. First, land is negative and significant in all the states. Second, in the states experiencing a remarkable decline in TFR (e.g., Andhra Pradesh, Tamil Nadu, West Bengal and Orissa), also of importance are (a) the mother's education in general and the negative and significant effects of her educational attainment, particularly at middle or secondary school and higher education becomes increasingly pronounced in 1999-2000 and 2004-05, and (b) the father's education in the last two or in the last survey, reflected in the negative and significant coefficient estimates, and (c) the mother's wage is negative and significant, while the father's wage is positive in the last round. Third, in Kerala education attainments at higher levels are not significant and the mother's wage is not significant either, which is in contrast with the results for Andhra Pradesh or Tamil Nadu. This may be because Kerala has already reached the stage where the relative importance of higher levels of education or of the mother's higher wage is low. Finally, even in Bihar with high TFR, the mother's wage is negative and significant and mother's educational attainments as well as higher education of father are associated with lower fertility in 2004-05.

6 Concluding observations

This paper examines the determinants of population in India, with a particular focus on fertility, drawing upon three rounds of NSS and NFHS data over the period 1992-2006. The fact that fertility declined dramatically in many parts of India during the period is consistent with the view that India is seen to be moving from the second stage of demographic transition towards the third. The investigation of fertility in India is important not only for providing an insight into the population problem of the second populous country in the world, but also for serving as background for the debate on poverty in India which would be influenced by the geographical pattern of population growth.

This paper sheds empirical light on the determinants of fertility by applying several econometric models (namely Tobit, IV for parental education**, and the two-step estimation where parental wages are estimated in the first stage and fertility is estimated by Tobit) to the large household datasets constructed by NSS and NFHS. Then, we estimate pseudo panel data models using the cohort defined by state and rural-urban

classifications. Finally, state-wise regressions are estimated for selected states. We find broadly similar and consistent results between the two different surveys, across years and for different models. Our main findings are summarized below.

First, consistent with the literature, mother's education is related to reduction in fertility. With a Tobit model, we have confirmed a negative and significant association of the number of children (for NSS, the number of children under 15 in a household who are deemed children of household heads or spouse and, for NFHS, the number of children a mother bears) and mother's education. This negative and significant relationship is unchanged over the different years when (i) the mother's literacy is instrumented by pre-generation access to primary education of mother; (ii) parental wages estimated by individual education are inserted, and (iii) the pseudo panel model is applied.

Second, we find significant and negative estimates for the father's education, particularly relatively higher levels of education in the second round in 1998-2000 and the third round in 2004-06 of NSS and NFHS.²²

Third, while the significant negative relation between fertility and mean per capita expenditure at household level is observed when the former is exogenous, it is no longer significant once it is instrumented by the village-level seasonal unemployment rate. Owned land is negative and significant in the cases where NSS is used.

Finally, some variance is observed on the determinants of fertility in different states.

Our results suggest that policies by national and state governments to support social infrastructure, such as schooling at various levels for promoting both male and female education, together with facilitating female labour market participation, would be very important in reducing fertility and slowing down the population growth. These policies would play particularly important roles in backward states or for the socially disadvantaged groups (e.g., scheduled castes) who have higher fertility as well as poverty rates.

²² For example, paragraph 27 in India's National Population Policy 2000 correctly states:

'In the past, population programmes have tended to exclude menfolk ...The special needs of men include re-popularizing vasectomies, in particular no-scalpel vasectomy as a safe and simple procedure, and focusing on men in the information and education campaigns to promote the small family norm'. Our results empirically support this statement.

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Appendix 1. Estimates of total fertility rate for women aged 15-49 by state and regions in India in 1992, 1998 and 2005

		URBAN			RURAL			TOTAL		
		NFHS-1 (1992)	NFHS-2 (1998)	NFHS-3 (2005)	NFHS-1 (1992)	NFHS-2 (1998)	NFHS-3 (2005)	NFHS-1 (1992)	NFHS-2 (1998)	NFHS-3 (2005)
	India	2.70	2.27	2.06	3.67	3.07	2.98	3.39	2.85	2.68
North	Delhi	3.00	2.37	2.10	NA	NA	2.50	3.02	2.40	2.13
	Haryana	3.14	2.24	2.17	4.32	3.13	2.92	3.99	2.88	2.69
	Himachal Pradesh	2.03	1.74	1.57	3.07	2.18	1.98	2.97	2.14	1.94
	Jammu & Kashmir	NA	1.66	1.63	NA	3.00	2.69	NA	2.71	2.38
	Punjab	2.48	1.79	1.88	3.09	2.42	2.06	2.92	2.21	1.99
	Rajasthan	2.77	2.98	2.21	3.87	4.06	3.62	3.63	3.78	3.21
Central	Madhya Pradesh	3.27	2.61	2.41	4.11	3.56	3.21	3.90	3.31	2.99
	Uttar Pradesh	3.58	2.88	2.91	5.19	4.31	4.06	4.82	3.99	3.76
East	Bihar	3.25	2.75	2.65	4.14	3.59	4.10	4.00	3.49	3.83
	Orissa	2.53	2.19	1.89	3.00	2.50	2.48	2.92	2.46	2.37
	West Bengal	2.14	1.69	1.59	3.25	2.49	2.54	2.92	2.29	2.27
Northeast	Arunachal Pradesh	NA	NA	2.51	4.38	2.68	3.21	4.25	2.52	3.03
	Assam	2.53	1.50	1.43	3.68	2.39	2.65	3.53	2.31	2.42
	Manipur	NA	2.36	2.35	3.03	3.41	3.07	2.76	3.04	2.83
	Meghalaya	NA	NA	2.28	3.80	5.16	4.38	3.73	4.57	3.80
	Mizoram	NA	2.37	2.50		3.47	3.33	2.30	2.89	2.86
	Nagaland	NA	NA	2.68	3.60	4.06	4.15	3.26	3.77	3.74
	Sikkim	NA	NA	1.29	NA	2.87	2.22	NA	2.75	2.02
	Tripura	NA	NA	1.66	NA	NA	2.34	NA	NA	2.22
West	Goa	1.80	1.69	1.77	1.99	1.83	1.81	1.90	1.77	1.79
	Gujarat	2.65	2.33	1.92	3.17	3.03	2.80	2.99	2.72	2.42
	Maharashtra	2.54	2.24	1.91	3.12	2.74	2.31	2.86	2.52	2.11
South	Andhra Pradesh	2.35	2.07	1.73	2.67	2.32	1.82	2.59	2.25	1.79
	Karnataka	2.38	1.89	1.89	3.08	2.25	2.19	2.85	2.13	2.07
	Kerala	1.78	1.51	1.73	2.09	2.07	2.03	2.00	1.96	1.93
	Tamil Nadu	2.36	2.11	1.70	2.54	2.23	1.90	2.48	2.19	1.80

Source: National Family Health Survey 2005-06, table 4.3, National Family Health Survey 1998-99, table 4.3.

Notes: Population figures for rural and areas are used to calculate TFR for old Bihar, Madhya Pradesh, and Uttar Pradesh. NA indicates that the data are not available.

Appendix 2. Wage equations for male and female workers based on NSS data in 1993, 1998, and 2004

	1993		1998		2004	
	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)
RURAL AREAS						
Land owned	0.349 (0.98)	-0.324 (4.86)**	-0.452 (5.89)**	-0.386 (2.75)**	0.00 (2.39)*	-0.082 (8.35)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	-322.569 (0.87)	1,018.14 (4.08)**	27.535 (2.32)*	148.539 (13.75)**	121.41 (9.13)**	108.96 (7.53)**
Scheduled caste (SC) dummy (SC=1, otherwise=0)	-2,177.57 (7.95)**	-381.166 (1.89)	18.872 (2.03)*	77.975 (8.45)**	–	–
Non-agricultural self-employment dummy (non-agricultural self-employment=1, otherwise=0)	7,216.57 (10.27)**	2,324.92 (5.49)**	-1,306.23 (52.30)**	-460.104 (25.18)**	-1,859.26 (68.44)**	-566.23 (21.97)**
Agricultural self-employment dummy (agricultural self-employment=1, otherwise=0)	7,899.48 (15.13)**	5,204.41 (14.37)**	-1,181.15 (53.85)**	-579.812 (23.35)**	-2,196.08 (69.07)**	-880.79 (22.83)**
Muslim dummy (Muslim=1, otherwise=0)	746.744 (1.61)	185.894 (0.46)	29.163 (2.18)*	-210.77 (12.87)**	113.494 (5.59)**	-330.9 (10.79)**
Age	662.822 (8.65)**	204.695 (3.65)**	69.715 (30.66)**	28.053 (10.97)**	139.625 (37.08)**	49.933 (10.15)**
Age ²	-4.072 (4.17)**	-1.257 (1.69)	-0.86 (32.63)**	-0.359 (11.03)**	-1.638 (39.07)**	-0.637 (10.24)**
Whether mother (or father) is literate, but has not completed primary school	3,542.99 (12.71)**	2,126.39 (7.36)**	20.675 (1.89)	-98.23 (7.56)**	92.081 (5.10)**	-205.98 (8.72)**
Whether mother (or father) completed primary school	7,518.66 (23.01)**	3,208.70 (7.49)**	70.519 (5.94)**	-234.546 (13.56)**	175.043 (9.45)**	-227.04 (9.53)**
Whether mother (or father) completed middle school	14,163.75 (29.57)**	10,200.92 (8.09)**	155.273 (12.13)**	-197.743 (10.15)**	360.514 (19.49)**	-192.21 (7.37)**
Whether mother (or father) completed secondary or higher secondary school	35,055.00 (56.87)**	38,201.86 (26.88)**	532.061 (36.19)**	284.545 (12.11)**	810.913 (33.86)**	201.04 (5.63)**
Whether mother (or father) completed higher education	57,151.06 (47.65)**	53,253.26 (17.32)**	1,091.99 (38.63)**	736.177 (14.63)**	1,473.09 (64.15)**	1,004.51 (20.43)**
Constant	-2,171.00 (1.50)	4,216.78 (4.18)**	-1,366.54 (27.84)**	-954.455 (17.48)**	-2,940.20 (34.97)**	-1,749.97 (16.65)**
Observations	33,720	15,849	64,631	62,488	67,168	59,221

Appendix 2. Wage equations (cont.)

	1993		1998		2004	
	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)	Male wage Coeff. (t-value)	Female wage Coeff. (t-value)
URBAN AREAS						
Land owned	-3.614 (1.21)	15.997 (1.94)	0.075 (0.48)	-0.653 (2.90)**	0.001 (1.32)	-0.077 (2.36)*
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	-2,611.33 (2.53)*	4,112.63 (3.59)**	78.439 (3.09)**	703.703 (14.20)**	55.486 (2.08)*	634.305 (11.26)**
Scheduled caste (SC) dummy (SC=1, otherwise=0)	-4,698.31 (8.11)**	-561.604 (0.83)	17.674 (1.02)	439.395 (11.33)**		
Agricultural self-employment dummy (agricultural self-employment=1, otherwise=0)	21,496.64 (9.98)**	6,469.18 (5.82)**	-2,584.54 (62.16)**	-1,122.31 (23.35)**	-3,658.11 (44.47)**	-1,401.75 (22.58)**
Muslim dummy (Muslim=1, otherwise=0)	-4,223.52 (6.55)**	149.138 (0.14)	-85.447 (4.56)**	-420.463 (8.31)**	-37.205 (0.99)	-523.604 (5.76)**
Age	1,324.95 (6.99)**	1,030.76 (4.52)**	189.38 (49.12)**	113.16 (10.95)**	315.387 (28.86)**	212.348 (10.41)**
Age ²	-4.568 (1.80)	-6.226 (2.10)*	-2.267 (49.03)**	-1.262 (10.03)**	-3.74 (29.58)**	-2.49 (10.00)**
Whether mother (or father) is literate, but has not completed primary school	4,798.27 (7.49)**	5,090.88 (3.58)**	110.174 (4.77)**	-218.989 (4.49)**	173.623 (3.81)**	-430.541 (4.71)**
Whether mother (or father) completed primary school	6,855.26 (10.65)**	6,064.43 (7.23)**	115.636 (5.36)**	-530.84 (9.73)**	243.726 (5.86)**	-595.215 (7.01)**
Whether mother (or father) completed middle school	12,945.26 (20.70)**	15,461.91 (10.05)**	267.889 (13.16)**	-574.963 (10.59)**	429.975 (11.35)**	-854.305 (9.67)**
Whether mother (or father) completed secondary or higher secondary school	29,461.08 (46.56)**	37,408.31 (35.46)**	497.771 (25.91)**	295.871 (8.10)**	737.639 (18.08)**	-231.205 (2.51)*
Whether mother (or father) completed higher education	61,317.93 (63.86)**	56,576.27 (39.31)**	1,091.78 (45.37)**	1,300.66 (21.14)**	1,644.48 (41.56)**	1,539.72 (21.16)**
Constant	-14,176.68 (4.21)**	-13,738.35 (3.25)**	-3,524.42 (43.42)**	-4,121.62 (16.21)**	-6,186.53 (26.69)**	-6,791.28 (15.95)**
Observations	23,968	5,934	4,4205	39,700	28,367	24,174

Note: Robust z-statistics in parentheses; * significant at 5% level; ** significant at 1% level

Appendix 3. State-wise estimates of determinants of fertility (based on NSS in 1993-94, 1999-2000, and 2004-05)
Dependent variable: proxied fertility (no. of unmarried children under 15 yrs old of household head) (based on robust standard errors)

	Andhra Pradesh			Tamil Nadu			Kerala		
	1993	1998	2004	1993	1998	2004	1993	1999	2004
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Mother's age	0.539 (22.43)**	0.542 (14.90)**	-0.08 (3.99)**	0.588 (21.91)**	0.447 (8.99)**	-0.047 (2.19)*	0.451 (10.82)**	0.3 (4.36)**	-0.31 (9.81)**
(Mother's age) ²	-0.009 (24.07)**	-0.009 (16.33)**	0.001 (2.26)*	-0.009 (23.14)**	-0.008 (10.33)**	0 (0.02)	-0.007 (12.38)**	-0.005 (5.89)**	0.003 (8.38)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	0.097 (0.94)	0.342 (2.17)*	0.191 (2.01)*	-0.06 (0.31)	-0.645 (1.64)	0.21 (0.58)	-0.361 (0.95)	0.11 (0.39)	-0.416 (1.38)
Scheduled caste (SC) dummy (SC=1, otherwise=0)	-0.03 (0.49)	0.186 (1.97)*	0.053 (0.51)	0.03 (0.50)	0.217 (1.77)	-0.042 (0.12)	-0.012 (0.12)	0.694 (3.03)**	0.482 (1.55)
Non-agricultural self-employment dummy (Non-agricultural self.employ. =1, otherwise 0)	0.193 (2.09)*	0.008 (0.03)	0.5 (3.37)**	0.188 (2.15)*	0.228 (0.90)	-0.091 (0.62)	0.037 (0.34)	0.616 (1.90)	-0.372 (2.22)*
Agricultural self-employment dummy (Agricultural self-employment=1, otherwise=0)	0.141 (1.57)	0.2 (1.11)	0.575 (3.76)**	0.343 (3.61)**	0.267 (1.25)	0.035 (0.24)	-0.067 (0.53)	0.615 (2.25)*	-0.236 (1.31)
Mother's wage	0.00001 (1.12)	-0.00025 (1.33)	-0.001 (4.38)**	0.000025 (3.07)**	-0.0001 (0.53)	-0.0003 (2.90)**	0.0002 (1.39)	-0.0004 (1.35)	0.0001 (0.87)
Father's wage	-0.00001 (1.30)	0.00001 (0.58)	0.0003 (3.61)**	0.00001 (2.88)**	0.00008 (0.53)	0.00003 (0.47)	-0.00001 (1.23)	0.003 (2.56)*	-0.0002 (2.44)*
Land owned	-0.004 (4.38)**	-0.008 (7.10)**	-0.001 (9.83)**	-0.006 (5.62)**	-0.006 (3.86)**	-0.001 (5.37)**	-0.006 (2.45)*	-0.006 (1.90)	-0.002 (3.88)**
Muslim dummy (Muslim=1, otherwise=0)	0.391 (4.85)**	0.811 (7.07)**	0.329 (3.18)**	0.514 (5.44)**	0.573 (3.76)**	0.098 (0.71)	0.745 (8.80)**	0.677 (4.37)**	0.837 (8.74)**
Whether mother is literate, but has not completed primary school	-0.326 (3.76)**	-0.501 (4.42)**	-0.338 (3.57)**	-0.123 (1.57)	-0.066 (0.46)	-0.138 (1.55)	-0.136 (0.89)	-0.159 (0.55)	-0.129 (0.76)
Whether mother completed primary school	-0.261 (2.88)**	-0.337 (2.71)**	-0.424 (4.73)**	-0.118 (1.59)	-0.04 (0.28)	-0.126 (1.60)	-0.313 (2.11)*	-0.724 (2.63)**	-0.314 (2.08)*

Appendix 3. (cont.)

Dependent variable: proxied fertility (no. of unmarried children under 15 yrs old of household head) (based on robust standard errors)

	Andhra Pradesh			Tamil Nadu			Kerala		
	1993	1998	2004	1993	1998	2004	1993	1999	2004
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Whether mother completed middle school	-0.338 (1.95)	-0.405 (3.02)**	-0.459 (4.42)**	-0.404 (3.10)**	-0.097 (0.64)	-0.359 (3.89)**	-0.322 (1.40)	-0.427 (1.61)	0.274 (1.80)
Whether mother completed secondary or higher secondary school	-0.695 (1.59)	-0.124 (0.96)	-0.226 (2.18)*	-1.216 (3.92)**	-0.075 (0.50)	-0.212 (2.04)*	-0.842 (1.37)	0.082 (0.30)	-0.144 (0.88)
Whether mother completed higher education	-1.205 (1.85)	0.143 (0.49)	0.411 (1.97)*	-1.883 (3.99)**	-0.076 (0.23)	0.155 (0.92)	-1.171 (1.29)	0.458 (1.09)	-0.286 (1.25)
Whether father is literate, but has not completed primary school	-0.13 (1.83)	0.185 (1.70)	-0.125 (1.54)	0.199 (2.60)**	-0.098 (0.65)	0.014 (0.16)	0.038 (0.24)	-0.259 (0.87)	-0.179 (1.13)
Whether father completed primary school	-0.11 (1.27)	-0.196 (1.94)	-0.126 (1.70)	0.245 (3.30)**	-0.074 (0.53)	-0.004 (0.05)	-0.147 (0.96)	-0.159 (0.57)	-0.224 (1.50)
Whether father completed middle school	-0.098 (0.86)	-0.056 (0.50)	-0.388 (4.58)**	0.301 (3.15)**	0.003 (0.02)	0.062 (0.70)	-0.249 (1.40)	-0.347 (1.24)	-0.186 (1.25)
Whether father completed secondary or higher secondary school	-0.089 (0.43)	-0.363 (2.84)**	-0.414 (3.84)**	0.532 (3.21)**	-0.131 (0.78)	-0.025 (0.24)	-0.115 (0.38)	-0.704 (2.30)*	-0.34 (1.91)
Whether father completed higher education	-0.039 (0.10)	-0.622 (2.94)**	-0.702 (4.72)**	0.728 (2.37)*	-0.193 (0.78)	-0.089 (0.64)	0.179 (0.35)	-1.271z (3.02)**	-0.004 (0.02)
Rural sector dummy (rural=1 urban=0)	-0.117 (1.43)	0.452 (1.43)	0.942 (3.71)**	0.05 (0.65)	0.282 (0.78)	0.604 (3.09)**	0.206 (1.78)	0.673 (1.45)	0.042 (0.17)
Son's preference index	0.3 (15.84)**	0.312 (8.70)**	1.819 (29.71)**	0.271 (12.68)**	0.332 (8.20)**	1.732 (27.88)**	0.203 (7.34)**	0.344 (5.94)**	1.769 (21.15)**
Number of adults	-0.136 (6.36)**	-0.075 (2.72)**	0.131 (5.50)**	-0.153 (7.63)**	-0.21 (6.14)**	-0.003 (0.14)	-0.234 (7.62)**	-0.204 (5.06)**	0.097 (3.46)**
Constant	-6.191 (16.79)**	-6.789 (9.64)**	0.761 (1.52)	-7.329 (17.44)**	-4.962 (5.17)**	1.36 (2.72)**	-4.453 (6.25)**	-2.783 (1.86)	7.443 (9.72)**
Observations	6,507	4,598	5,315	5,527	2,498	4,514	2,528	1,185	3,019

Notes: Robust z statistics in parentheses; * significant at 5%; ** significant at 1%

Appendix 3 cont.

Appendix 3. (cont.)

Dependent variable: proxied fertility (no. of unmarried children under 15 yrs old of household head) (based on robust standard errors)

	West Bengal			Orissa			Bihar		
	1993	1998	2004	1993	1998	2004	1993	1999	2004
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Mother's age	0.666 (39.09)**	0.654 (27.99)**	0.161 (8.47)**	0.61 (18.29)**	0.543 (13.47)**	0.022 (0.92)	0.617 (30.36)**	0.633 (23.66)**	0.146 (7.24)**
(Mother's age) ²	-0.01 (40.62)**	-0.009 (29.77)**	-0.002 (8.79)**	-0.009 (19.27)**	-0.008 (14.55)**	0 (1.58)	-0.009 (31.09)**	-0.009 (24.71)**	-0.002 (7.18)**
Scheduled tribe (ST) dummy (ST=1, otherwise=0)	0.271 (1.33)	0.086 (0.35)	-0.443 (2.01)*	0.002 (0.02)	0.373 (3.05)**	0.277 (3.52)**	0.138 (1.45)	0.175 (1.38)	-0.279 (3.18)**
Scheduled Caste (SC) dummy (SC=1, otherwise=0)	-0.123 (2.29)*	0.25 (3.25)**	0.612 (2.75)**	-0.1 (1.09)	0.361 (3.36)**	-0.172 (1.94)	0.088 (1.34)	0.18 (1.99)*	0.367 (3.75)**
Non-agricultural self-employment dummy (Non-agricultural self.employ. =1, otherwise 0)	0.525 (6.27)**	0.483 (2.35)*	0.559 (3.64)**	0.219 (1.82)	0.339 (1.33)	(0.85) 0.181	0.445 (4.41)**	0.469 (2.20)*	0.753 (4.60)**
Agricultural self-employment dummy (Agricultural self-employment=1, otherwise=0)	0.5 (6.70)**	0.318 (1.68)	0.588 (3.80)**	0.343 (2.86)**	0.27 (1.35)	0.135 (0.63)	0.422 (4.77)**	0.161 (0.96)	0.581 (3.44)**
Mother's wage	0.000016 (1.31)	-0.00004 (2.18)*	-0.008 (7.16)**	-0.0001 (0.09)	-0.0006 (2.70)**	-0.0005 (3.37)**	-0.00001 (0.39)	-0.001 (4.71)**	-0.0008 (6.32)**
Father's wage	0.00002 (3.90)**	0.0003 (1.66)	0.0004 (5.19)**	-0.0001 (1.07)	0.0003 (1.76)	0.0002 (1.41)	-0.00001 (1.82)	0.0005 (3.18)**	0.0004 (5.10)**
Land owned	-0.01 (9.04)**	-0.01 (2.46)*	-0.002 (9.25)**	-0.007 (4.01)**	-0.006 (3.18)**	-0.001 (7.96)**	-0.006 (5.34)**	-0.011 (6.58)**	-0.001 (10.46)**
Muslim dummy (Muslim=1, otherwise=0)	0.589 (10.25)**	0.723 (7.78)**	0.135 (1.66)	0.981 (3.85)**	1.067 (4.04)**	0.837 (2.58)**	0.751 (10.66)**	0.601 (5.35)**	-0.009 (0.10)
Whether mother is literate, but has not completed primary school	-0.156 (1.60)	-0.372 (2.94)**	-0.537 (4.62)**	0.061 (0.54)	-0.221 (1.89)	-0.319 (3.44)**	-0.011 (0.10)	-0.121 (0.94)	-0.459 (4.51)**
Whether mother completed primary school	-0.101 (1.06)	-0.531 (4.44)**	-0.581 (6.77)**	-0.073 (0.48)	-0.069 (0.44)	-0.293 (2.54)*	0.124 (0.87)	-0.313 (1.90)	-0.589 (5.32)**
Whether mother completed middle school	-0.356 (1.95)	-0.668 (5.19)**	-0.807 (8.34)**	-0.004 (0.02)	-0.434 (2.73)**	-0.42 (3.67)**	0.013 (0.07)	-0.464 (2.78)**	-0.707 (6.33)**

Appendix 3. (cont.)

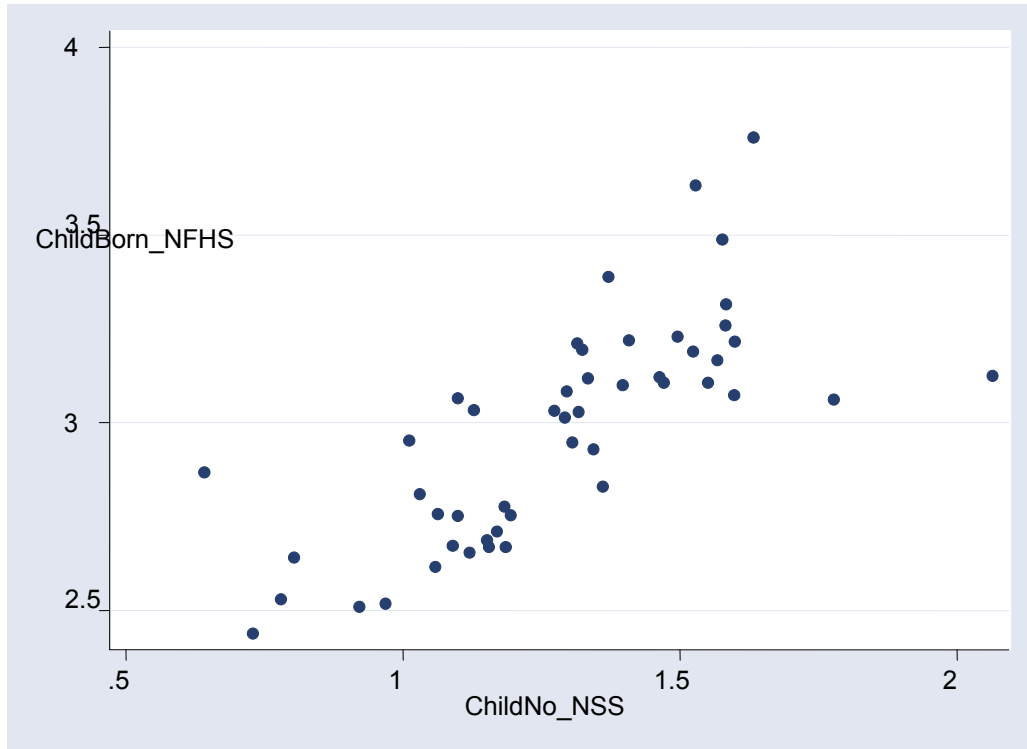
Dependent variable: proxied fertility (no. of unmarried children under 15 yrs old of household head) (based on robust standard errors)

	West Bengal			Orissa			Bihar		
	1993	1998	2004	1993	1998	2004	1993	1999	2004
	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)	Coeff. (t-value)
Whether mother completed secondary or higher secondary school	-1.182 (2.56)*	-0.532 (4.44)**	-0.863 (7.69)**	-0.204 (0.28)	-0.072 (0.42)	-0.225 (1.49)	0.018 (0.04)	-0.162 (1.06)	-0.512 (4.30)**
Whether mother completed higher education	-1.96 (2.89)**	-0.531 (1.94)	0.246 (1.40)	-0.341 (0.32)	-0.141 (0.41)	0.853 (3.23)**	-0.664 (0.91)	0.35 (1.13)	0.119 (0.54)
Whether father is literate, but has not completed primary school	0.173 (2.35)*	-0.051 (0.51)	-0.246 (2.54)*	0.186 (1.96)	0.136 (1.20)	0.131 (1.46)	0.277 (3.24)**	0.116 (1.21)	0.091 (1.04)
Whether father completed primary school	0.245 (3.03)**	0.012 (0.13)	-0.253 (3.53)**	0.266 (1.93)	-0.14 (0.90)	0.04 (0.41)	0.364 (3.47)**	-0.076 (0.63)	-0.164 (1.85)
Whether father completed middle school	0.515 (4.71)**	0.021 (0.24)	-0.339 (4.70)**	0.46 (2.75)**	-0.096 (0.73)	-0.236 (2.33)*	0.488 (3.94)**	-0.108 (1.03)	-0.108 (1.26)
Whether father completed secondary or higher secondary school	0.867 (3.86)**	-0.234 (2.11)*	-0.61 (6.09)**	0.416 (1.24)	-0.213 (1.29)	-0.324 (2.04)*	0.684 (2.69)**	-0.338 (2.55)*	-0.123 (1.12)
Whether father completed higher education	1.534 (3.75)**	-0.535 (2.84)**	-0.992 (7.20)**	0.365 (0.61)	-0.266 (0.98)	-0.64 (2.77)**	1.083 (2.37)*	-0.905 (3.95)**	-0.622 (3.79)**
Rural sector dummy (rural=1 urban=0)	-0.214 (2.54)*	0.894 (3.08)**	1.71 (8.01)**	0.039 (0.26)	1.035 (2.85)**	1.047 (3.50)**	-0.187 (1.65)	1.592 (4.98)**	1.6 (6.59)**
Son's preference index	0.226 (13.11)**	0.326 (11.00)**	1.904 (29.57)**	0.284 (10.48)**	0.39 (11.75)**	1.856 (24.89)**	0.239 (11.47)**	0.273 (9.79)**	1.956 (28.08)**
Number of adults	-0.125 (10.90)**	-0.124 (8.34)**	0.104 (6.74)**	-0.129 (5.56)**	-0.139 (5.46)**	0.041 (2.04)*	-0.171 (10.08)**	-0.161 (7.97)**	0.115 (6.35)**
Constant	-8.343 (28.61)**	-9.551 (16.35)**	-3.668 (7.65)**	-7.63 (13.56)**	-8.148 (9.77)**	-0.814 (1.32)	-7.863 (22.21)**	-10.212 (16.31)**	-3.743 (7.31)**
Observations	9,337	6,685	9,157	3,055	2,088	3,574	6,705	4,837	6,809

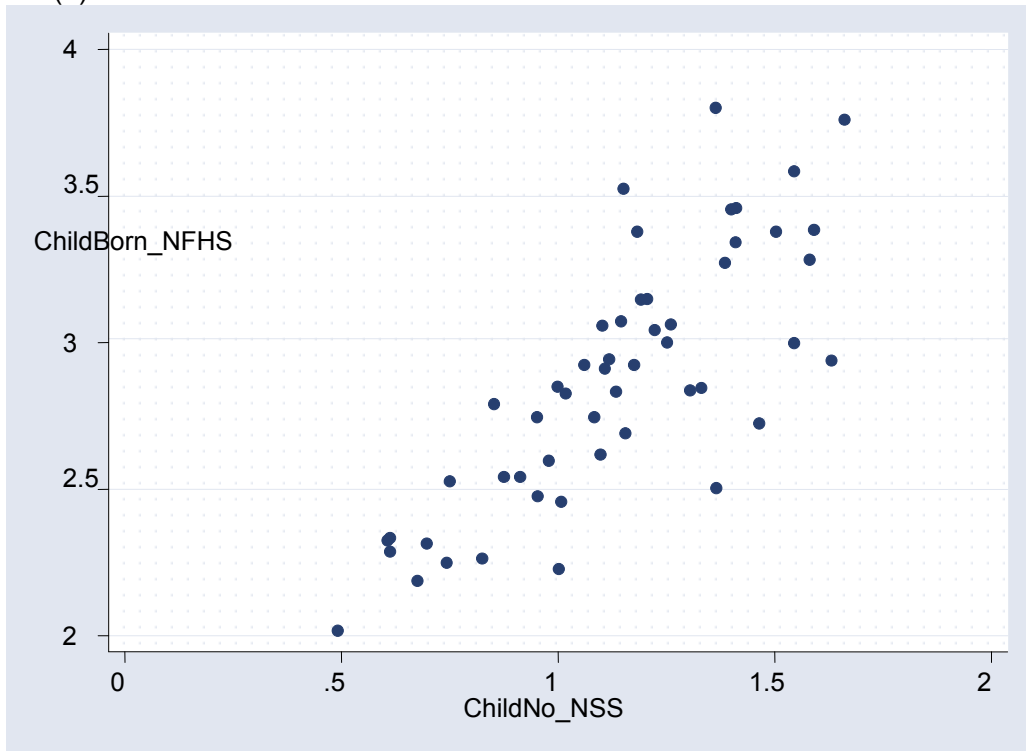
Notes: Robust z statistics in parentheses; * significant at 5%; ** significant at 1%

Appendix 4. Relationship of the no. of children (of the household head and spouse under 15) in NSS and the no. of children (a mother bears) in NFHS aggregated at state level for rural and urban areas

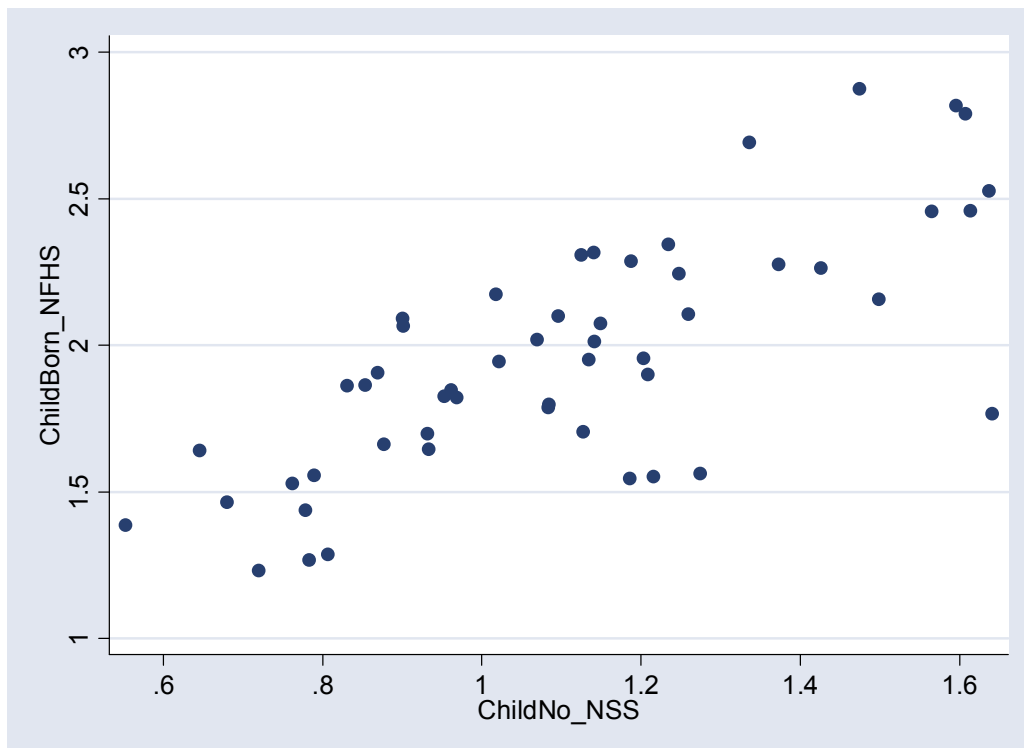
(1) NSS 50th round in 1993-94 and NFHS-1 in 1992-93



(2) NSS 55th round in 1999-2000 and NFHS-1 in 1998-99



(3) NSS 61st round in 2004-05 and NFHS-1 in 2005-06



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