Determinants of Well-Being of Adolescent Girls in Rural Rajasthan

Shirley Johnson-Lans*
Professor and Chair
Department of Economics
Vassar College, Poughkeepsie, N.Y., U.S.A.
sjlans@vassar.edu

Abstract:
Using an original micro-data set consisting of a sample of approximately 900 girls aged 10-18, the determinants of three measures of well-being are investigated. The three measures are literacy, lack of anemia symptoms, and not being married prior to age 15. The girls in the sample live in a cluster of rural villages near Jodhpur in the Thar Desert of Western Rajasthan. The villages differ primarily in the presence or absence of support from an NGO that provides rudimentary health care, health education, and classes in reading, writing, and arithmetic for girls.

A standard model of family utility maximization is employed, and regressions and probit equations are estimated. Explanatory variables include caste, religion, number of brothers and sisters, family income and wealth, landowning status of family, and mother's and father's literacy. Village and NGO fixed effects are included in alternative specifications of the model. NGO presence is a proxy variable for supply side conditions: availability of health care facilities and educational opportunities for girls and women.

The results are generally supportive of the literature on India and other developing nations that finds maternal literacy to be an important and robust positive indicator of the likelihood of a daughter being literate and a negative indicator of child marriage and anemia. Fathers' literacy and family income and wealth prove to be much less important, and landowning status of the family is found to be negatively associated with schooling and positively associated with child marriage.

*The author thanks the Global Foundation for Humanity for permission to use its Vassar Study data.

I. Introduction.

Girls and women in rural Rajasthan still live within a very traditional culture. Even though governmental programs have attempted to increase educational opportunities, provide community medical centers, and outlaw child marriage, many girls in the remote farming villages of Western Rajasthan still have little access to even rudimentary education and are married off at very young ages. The rate of malnutrition is very high, even by Indian standards, which are lower than those in the Industrialized nations of the West.

The Sample

A unique micro-data set has been constructed. In 2004, personal interviews and medical examinations were conducted on approximately 1000 adult women (over 18 years of age) and 1000 adolescent girls (10 to 18 years of age) in nine rural farming villages in the Thar Desert near Jodhpur, in the western part of the state of Rajasthan. [1] Other family members were also interviewed in order to obtain detailed information on the family's composition, its monthly cash income and holdings of land and animals, and health status and educational attainment of other family members. The data include a large number of health indicators; detailed information about girls' familiarity with health issues, including knowledge of how STDs and HIV/AIDS are transmitted, and information about why girls do or do not attend school.

The samples were constructed with respondents from each village randomly chosen from among households, and stratified so as to obtain the same proportion of the populations in each of the villages. Each individual included in the sample is from a separate household, and each girl chosen for the adolescent sample is the oldest female sibling. The latter provides a lower-bound with respect to the proportion receiving schooling, since older sisters are less likely to be allowed to attend even local village classes, given their responsibility for helping with housework and farming and care of

[1] The survey was designed by Shirley Johnson-Lans, Vassar College, and overseen by Dr. Kanti Chandra Joshi, Veerni Project Coordinator, and Mr. Chandra Shekhar Joshi, Jodhpur University.

younger children.

Since literacy rates and health may well vary among villages as well as by caste and religion, dummy variables for village effects are introduced, and a variable for each lower caste is included: caste 1 = "scheduled caste", caste 2 = "scheduled tribe", and caste 3 = "other backward castes" (OBC).[2] A dummy variable for "Muslim religion" distinguishes girls who are Muslim from those who are Hindu.[3]

A natural experiment is provided by the intervention of an NGO, the Veerni Project, which provides rudimentary medical care, health education, and local village schooling (classes in reading, writing, arithmetic, and health education) in a subset of the villages in this region. The nine sample villages consist of three that have experienced long-term (6-10 year) intervention from the Veerni Project, three that have received help from the Veerni Project for 2-3 years, and three that had not been included in the Veerni Project at the time of the survey.

Profile of Female Educational Attainment in the Study Villages

Only about 15 percent of the women in the adult sample are literate, and even fewer have completed formal primary level schooling. Literacy rates are even lower for lower caste women. In 1991, the literacy rate for scheduled caste women in all of rural Rajasthan was only 4.73 percent, the lowest rate in any Indian state.[4] In our sample, the proportion of literate scheduled caste women in 2004 was only about 0.7 percent; the proportion of scheduled tribal women was only 0.8 percent; and the proportion of literate adult women in the combined lower castes (scheduled caste, scheduled tribes,

---

[2]The category, scheduled castes, or dalit, is roughly equivalent to the term, no longer used, "untouchable".

[3]Only one woman and none of the girls in the samples listed themselves as neither Hindu nor Muslim. The category "other" was therefore omitted.

[4]Table 2, page 40, Narayanamoorthy and Kamble (2003).

and other backward castes (OBC) was only 6.5 percent.

Among the adolescent girls, although 75 percent are literate, less than three percent have had access to more than primary education.[5] Since only a tiny fraction of the women and girls in this study group of rural villages have received more than primary education, and many have become literate through attending the informal classes provided by the NGO, I have used literate/illiterate as the measure of women's and adolescent girls' education levels throughout this study.

Among the adolescent girls, caste appears to be a less important determinant of educational attainment than it is for the adult women. Seventy-one percent of the scheduled caste girls are literate, 75 percent of the OBC girls are literate, and 65 percent of the tribal girls are literate. This suggests that the combination of government affirmative action programs and the work of the NGO, known as the Veerni Project, is overcoming much of the educational disadvantage of lower caste membership.[6]

Female Health Conditions in the Study Villages.

Life in Rajasthani farming villages in the Thar desert is spartan, with income and nutrition dependant on rainfall. There is little government investment in infra-structure that will reduce poverty or improve health. No pipelines exist to bring water from less arid areas. This part of India is also not heavily endowed with aid from international organizations or large well-funded NGOs. Only rudimentary health care facilities are available within any of the villages.[7] Malnutrition, particularly iron deficiency, is very common in women and adolescent girls.

The following table, summarizes the prevalence of anemia among the women and girls in our

---

[5]Since the data were gathered, the Veerni Project (the NGO) has begun to sponsor secondary education for village girls at a private girls day school in Jodhpur. Over twenty girls from the villages now board at a hostel in order to attend the school.

[6]"Veerni" means "empowerment" in Hindi.

[7] The Veerni Project represents intervention on a very small-scale. It provides health education classes for women and girls, training for local health workers, and a weekly visit from a mobile medical unit with limited medical supplies and one physician.

samples, using the Indian hemoglobin standard for anemia:

Level of Anemia in Study Villages

Percentages of	Adolescent Girls	Adult Women
Total Anemic	76.3%	81.9%
Mildly Anemic	68.4%	59.2%
Moderately Anemic	6.7%	20.1%
Severely Anemic	1.26%	2.6%

Child Marriage in the Villages

In India many children are betrothed at birth or shortly thereafter. An adolescent girl may be unmarried; she may be married (betrothed) in that her parents have entered into a marriage contract on her behalf but not yet living with her husband and his family; or she may be effectively married, in which case she has had a marriage ceremony, left her parental family and probably her village, and gone to live in the home of her husband.

Among the girls in the sample, approximately two-thirds are betrothed before their first birthday. Twenty-seven percent are effectively married before they reach the age of 15. Thirty-two percent of the lower caste girls are married before age 15. However, if we exclude members of OBC, only 24.6 percent of the scheduled caste and scheduled tribal girls are effectively married before age 15.[8]

Intergenerational Effects of Parental Literacy

There is a broad consensus in the development literature that education of children, particularly female

[8] In Rajasthan, the Vishnoi caste, a merchant caste that is of relatively high economic status, is none-the-less self categorized as OBC. This entitles members of this caste to be eligible for various Indian affirmative action programs.

children, is positively affected by the education level of the mother.[9] Child health has also been widely found to be positively associated with mother's education level,[10] and infant and child mortality negatively associated with it.[11]

The process by which female literacy affects the well being of individual women and their families is, however, still a grey if not a black box. Does literacy change women's tastes with respect to how resources are allocated within families? Does it give them more power in the decision making within families and shift the family utility function from one which merely reflects the tastes of the male head of household (a unitary function) to one that reflects cooperation or bargaining? [12] And how much does father's literacy itself affect the extent to which resources are allocated to daughters? Looking at the effects on daughters of both mother's and father's literacy should cast some light on the effect of paternal literacy and on the decision making process itself.

II. Determinants of Health in Adolescent Girls.

We begin by assuming that the health of a daughter provides positive utility to the parents. Given their budget constraint and their "tastes", they will devote a certain amount of resources toward this end. As is common in health economics studies, daughter's health status is used as an indirect measure of the demand for health. The demand model used is similar to the familiar one employed by Henriques et al.[13] In their work, demand for child health on the part of the household is modeled as a function of a set of child characteristics, household or parental characteristics, and community characteristics. In this study, demand for adolescent girl

[9]Behrman and Rosensweig (2002) found this not to be true in the U.S. in a study using twin data, al though the findings of Wolfe and Behrman (1987) and many other scholars previously established the positive intergenerational effects of educating women in developing nations.

[10]Sandiford, et al (1995); Glewwe (1999).

[11]Bourne and Walker (1991), Cochrane (1979), Cleland and van Ginneken (1988), Aly and Grabowski (1990), Singh, (1994).

[12]The unitary model is usually attributed to Becker (1981). Representative work on cooperative or bargaining models is that of Manser and Brown (1980) and Horney and McElroy (1981).

[13]Henriques, Strauss and Thomas (1991).

health is modeled as a function of girl i's characteristics [age, marital status, education, in this case whether she is literate, caste, and religion], household or parental characteristics [number of family members, number of brothers, number of sisters, mother's education, father's education, family's poverty status, father's monthly income, family wealth, whether land is owned] and community characteristics [village or NGO fixed effects.]

The supply side controls, availability of health care facilities and health education, are proxied by the dummy variables for the presence or absence of the NGO. On the assumption that mother's and father's literacy does not by itself affect the price of providing food and health care to daughters, it is reasonable that the amount of daughter's health demanded by the family is a reflection of the family utility function.

Decisions about investment in daughters' human capital may involve interdependent decisions about investment in health and education. However, daughter's literacy status is included in the list of explanatory variables in the health equations since her own education level may affect her ability to improve her own health. Marital status is relevant to parental decisions about investment in a daughter since, once she is married off, she no longer requires her parents contributing to her livelihood nor is investment in her human capital likely to result in any future contribution to the parents' welfare (other than possibly providing them with superior grandchildren.)

The first indicator used to measure daughter's health is whether or not she exhibits symptoms of anemia. A probit was run for "probability of a girl exhibiting anemia symptoms". In this probit estimation, the likelihood of an adolescent girl showing anemia symptoms is determined according to the index function

$$y^*(i) = \beta(1) + \beta(2)x(i2) + \ldots + \beta(k)x(ik) + u(i)$$

where $y^*(i)$ is interpreted as the additional utility that family i would get by choosing $y(i) = 0$ rather than $y(i) = 1$.

Tables Ia and Ib show the marginal effects of the explanatory variables when the equation is estimated using NGO effects and, alternatively, village fixed effects. Note that when village fixed effects are introduced, the significance of mother's literacy declines, though it is still significant at a 10 percent level. A girl's own literacy status remains a significant determinant of the likelihood of her exhibiting anemia symptoms.

Another common measure of health is body mass index (BMI). In poor regions of the world, a higher BMI is usually associated with improved health, unlike in the United States, where it may be an indication of an unhealthy state of excess weight. OLS regressions were run with an adolescent girl's BMI as the dependent variable. The set of explanatory variables remain the same. With and without village fixed effects, only family

monthly income and caste appear to make a difference to a girl's BMI. Higher family income and being a member of a scheduled tribe are both associated with significantly higher BMI. However, the explanatory power of the equation is not great, the adjusted R-squared equaling only 4.37 percent. In a specification that includes village fixed effects, the adjusted R-squared increased to only about 5.13 percent.[see Table 2.]

III. Determinants of Literacy in Adolescent Girls

Parents have to decide that it is worthwhile to allocate resources to daughters' education or girls will not be allowed to attend government schools or even the local NGO sponsored classes in the villages. An important component of the cost of educating a daughter in this environment is the opportunity cost, e.g. the cost of not having her available to help in the household or fields.[14] The number of siblings she has may be important in two ways. The opportunity cost of allowing a daughter to attend classes will vary with the number of substitutes available for her contribution to home or agricultural production, and the per capita budget constraint will be tighter if the family income must be spread over more family members.

A demand model similar to that described in II above is used. The same set of personal and family explanatory variables are employed, plus dummy variables for "household has electricity" and "family has a TV or radio".

The relevant supply side effect is the availability of schooling. This is measured by dummy variables for long- and short-run Veerni Project presence and by distance to school. The latter is measured by a dummy variable based on the girl's response to the question, "Did you encounter difficulty pursuing studies due to distance to school?" The response to this question is used as a proxy variable for distance to school, since no reliable information was found on actual availability and location of schools. Government statistics provide only data about number of schools "on the books". Many of these do not in fact exist or are not open due to lack of a teacher.

Table 3a shows significant positive effects of the presence of the NGO, family income, having a literate mother, and having electricity in the home on the probability of a girl being literate. Being a member of a scheduled tribe or of muslim religion have negative effects. An alternative specification of the equation, including village fixed effects, was also estimated. Results are shown in Table 3b. Although there are some significant

[14]This is the only cost in the case of the NGO sponsored village classes, since attendance at these classes, unlike the free government schools, does not require travel, a uniform, or the purchase of books and other supplies .

village effects, the significance and magnitudes of effects of the other variables are not substantially changed. An estimating equation using an alternative specification of the parental literacy variables substituted an interaction term, (mother literate * father illiterate) "oddcouple", for "father illiterate". This alternate specification did not alter the magnitude or significance of mother's literacy and "oddcouple" was statistically insignificant.

IV. Determinants of Marital Status of Adolescent Girls

As noted above, an adolescent girl may be unmarried; she may be married (betrothed) in the sense that her parents have entered into a marriage contract on her behalf; or she may be effectively married. Probits were run for the probability that an adolescent girl would be effectively married at a young age (before age 15). The usual set of personal and family characteristics were employed as explanatory variables, with the exception that the girl's literacy was omitted from these estimating equations, since her education level is almost certainly conditional on her marital status.[15] Families are less likely to invest in a daughter's education if she is already married, since any return on their human capital investment will accrue to the husband's not the parental family. Families that favor child marriages are also less likely to be "progressive" in attitude toward the value of educating daughters.

The variable, "father illiterate" is not statistically significant. [See Table 4a.] An alternative specification of the equation substitutes the interaction between literate mother and illiterate father (oddcouple) for father's illiteracy. The results are shown in Table 4b. Whereas mother's literacy is statistically significant in both equations, the magnitude of its effect on a daughter being married before age 15 is greater in specification 4b. Since the interaction term separates out the minority of mothers who are themselves literate but married to illiterate men, the variable for literate mother, "mom lit", shows the effect of literacy on daughter's literacy in families in which both mothers and fathers are literate. . When the downward effect of a literate mother interacting with an illiterate father is removed, the power of her being literate is increased. Thus both parents being literate enhances the effect of the mother's literacy. This supports the hypothesis that education within the family is a public good with positive externalities.[16]

[15]Field (2005) provides an interesting strategy for instrumenting to deal with the interdependency of early marriage and educational attainment of girls.

[16]Gleason (2003).

The NGO effect, presence of the Veerni project in a village, is omitted in these equations since the Veerni project was consciously set up in villages that were relatively more backward with respect to practices of child marriage and since the primary contribution of the NGO to improving the lives of adolescent girls is the provision of primary education. Whether the girls are allowed to attend classes is not likely to be independent of their marital status.

Being lower caste, either Caste 1 or Caste 3, significantly increases the probability of a girl's being subjected to a child marriage, with the probability being greatest is she is a member of Caste 3 (OBC), which in this setting means Vishnoi Caste, in the majority of cases. See footnote 8 for a description of the Vishnoi. Being in a land-owning family also increases the probability that a girl will have her family marry her off before age fifteen. In an earlier paper, when father's literacy was not factored in, a girl was also more likely to be a child bride if she had a brother, but the effect was small, the probability increasing by about 2 percent for each additional brother. [17] In these equations, the effect of having brothers is not statistically significant.

V. Discussion.

This paper provides some support for the hypotheses that there are positive effects of mothers' literacy on daughters' health, educational attainment, and ability to avoid child marriage. Since fathers' literacy status does not have statistically significant marginal effects on daughters' well-being, it appears to be the existence of a literate mother that changes the allocation of resources within the family so that daughters are less anemic, (probably as a result of receiving more and better food), more likely to go to school, and less likely to be subjected to marriage before age fifteen.

Since 75 percent of the adolescent girls in the sample were literate compared with 15 percent of the adult women, factors other than mother's literacy, such as availability of conveniently located tuition-free classes, are clearly necessary to explain the increase in literacy rates of the younger generation. The NGO variable is used to capture this. It may also pick up some other effects, such as the empowerment of women that the Veerni project helps promote.

In an earlier working paper, which did not include information on fathers' literacy status, women appeared to discriminate in favor of sons in the allocation of resources within the family[18]. In fact, this tendency

[17] Johnson-Lans and Kamdar (2005) p. 16.
[18] Ibid.

seemed to be more pronounced in literate women, when socio-economic status was taken into account. However, when father's literacy is included as an explanatory variable and when land-owning status and a better measure of family wealth are used, this perverse effect of women's literacy disappears.[19] In fact, evidence of son preference with respect to impact on daughters' BMI, probability of anemia, probability of attaining literacy, or being a child bride is lacking in this current study. This suggests that omitted variable effects were being picked up in the earlier study.

We do not know whether literate women have different attitudes or whether their "tastes" are unaltered but they have stronger voices within the family. However, we do know that the effect of mother's literacy on preventing child marriage is stronger when the fathers of their daughters are also literate. This does provide a hint that the decision about daughters is at least partly a matter of bargaining. And certainly it supports the view that education within a family has positive externalities. However, since a variety of factors other than literacy, including size of dowry, are known to affect women's power within the family, we can not be sure how much literacy affects the bargaining outcomes. While family decision making in rural Rajasthan remains of theoretical interest, the practical consequences on investment in daughters' human capital are the same regardless of the family dynamics. Families with literate mothers, for whatever reason, allocate more resources to daughters.

Several other important implications of the empirical results should be mentioned. Families that have homes with electricity seem to be more progressive in attitudes toward daughters, when other factors such as parental literacy and income and wealth are held constant. This may be the result of their having more access to the media. This study also supports the view that scheduled tribal girls and Muslim girls are benefitting less from governmental and NGO provision of schooling, since even when we control for family economic status, parental literacy, number of siblings, and availability of schooling, a smaller proportion of these girls attain literacy. The findings also suggest that the "other backward castes" are more prone to subject their daughters to child marriage than are either of the two castes considered to be the most deprived (castes 1 and 2). [20] What would be considered by westerners to be a reactionary attitude is thus shown to be most prevalent in a group that is less economically deprived than either the scheduled castes or scheduled tribes.

[19]The family wealth variable was constructed by valuing each unit of farm land and each animal at its local price and then summing the value of all animals and land holdings. However, no attempt was made to include other assets, such as gold jewelry, in the computation of family wealth.

[20]Effective marriage of girls before the age of fifteen appears to be non-existent in Muslim families.

References.

1. Alderman, Harold et al., *Child Nutrition, Child Health, and School Enrollment, A Longitudinal Analysis,* The World Bank, Policy Research Paper Series # 1700 (1999).

2. Basu, Kaushik, et al., "Is Literacy Shared Within Households? Theory and Evidence for Bangladesh," *Labour Economics*, 8:6 (December 2001): 649-665.

3. Behrman, J.R. "Schooling in Asia: Selected Micro Evidence on Determinants and Effects and Policy Implications," In *Restructuring Asian Economics for the New Millennium,* Vol. 9-A (Amsterdam: Elsevier, JAI, 2001): 105-64.

4.Behrman, J.R. and M.R. Rosenzweig, "Does Increasing Women's Schooling Raise the Schooling of the Next Generation?" *American Economic Review*, 92: 1 (March 2002): 323-34.

5. Behrman, J.R. and M.R. Rosenzweig, "Does Increasing Women's Schooling Raise the Schooling of the Next Generation? Reply,"*American Economic Review*, 95: 5 (December 2005): 1745-51.

6. Behrman, J.R. and M.R. Rosenzweig, "Parental Wealth and Adult Children's Welfare in Marriage," *Review of Economics and Statistics*, 88: 3 (August 2006): 496-509.

7. Dreze, Jean and Geeta Gandhi Kingdon, "School Participation in Rural India", *Review of Development Economics*, 5:1 (February 2001): 1-24.

8. Dreze, Jean, and Amartya Sen, *Hunger and Public Action* (Oxford: Oxford University Press,1989).

9. Field, Erica, "Early Marriage and Female Schooling in Bangladesh," Working Paper, Harvard Economics Department, April, 2005.

10. Gleason, Suzanne, M, "Publicly Provided Goods and Intrafamily Resource Allocation: Female Child Survival in India." *Review of Development Economics*, 7:1 (February 2003): 71-85.

11. Grossman, Michael, *"*On the Concept of Health Capital and the Demand for Health," *Journal of Political Economy,* 80:2 (March-April 1972): 223-255.

12.. Henriques, Maria-Helena, John Strauss, and Duncan Thomas, "How Does Mother's Education Affect Child Height?" *The Journal of Human Resources,* 26:2 (Spring 1991): 183-211.

13. Horney, Mary and Marjorie McElroy, "Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand," *International Economic Review*, 22:2 (June 1981):333-349.

14. Johnson-Lans, Shirley and Shweta Kamdar, "Effects of Female Literacy in Villages in Rural Rajasthan," Vassar College Economics Department Working Paper # 76 (2005).

15. Kenkel, D. S., "Health Behavior, Health Knowledge, and Schooling,"*Journal of Political Economy,* 99:2 (April 1991):287-305.

16. Khan, A.H., "Comments on 'Literacy Transition and Female Nuptiality: Implications for Fertility in Pakistan,'" *Pakistani Development Review*, 24: 3/4 (Autumn-Winter 1985): 601-03.

17. Mancer, M. and M. Brown., "Marriage and Household Decision-Making: A Bargaining Analysis," *International Economic Review*, 21:1 (February 1980): 31-44.

18. Narayanamoorthy, A. and B.N.Kamble, "Trends and Determinants of Rural Literacy Among Scheduled Caste Population: a State Level Analysis," *Journal of Educational Planning and Administration*, XVII:1 (January 2003): 35-52.

19. Pal, Sarmistha, "An Analysis of Childhood Malnutrition in Rural India: Role of Gender, Income, and Other Household Characteristics," *World Development,* 27:7 (July 1999): 1151-1171.

20. Sandiford, P. et al., "The Impact of Women's Literacy on Child Health and Its Interaction with Access to Health Services," *Population Studies*, 49:1 (March 1995): 5-17.

21. Thomas, Duncan, "Intra-household Resource Allocation: An Inferential Approach," *The Journal of Human Resources*, 25:4 (Autumn 2000): 68-95.

22. Toor, Imran Ashraf and Rizwana Parveen, "Factors Influencing Girls' Primary Enrolment in Pakistan,"*The Lahore Journal of Economics*, 9:2 (2004): 141-157.

23. United Nations, *The World's Women, 1970-1990:Trends and Statistics* (New York: United Nations, 1991).

Table 1a

Probability That a Girl Will Exhibit Anemia Symptoms

with NGO fixed effect.

```
Probit regression                                 Number of obs  =        858
                                                    LR chi2(17)     =      60.25
                                                    Prob > chi2     =     0.0000
Log likelihood =  -381.1643                         Pseudo R2       =     0.0732

Marginal effects after probit
      y  = Pr(anemia_symptoms) (predict)         =  .16732094
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
 no NGO  |   .0233817      .03047    0.77   0.443  -.036335  .083098   .355478
     age |   .0210216       .0052    4.04   0.000   .010833   .03121   13.2331
  caste1*|  -.0230441      .03802   -0.61   0.544  -.097572  .051483   .184149
  caste2*|   .0890789      .05885    1.51   0.130  -.026274  .204432   .081585
  caste3*|  -.0866256      .03354   -2.58   0.010  -.152367 -.020884   .486014
  muslim*|  -.1290844      .03574   -3.61   0.000  -.199142 -.059027   .030303
unmarried|   .0249786      .02818    0.89   0.375  -.030251  .080209   .613054
literate*|  -.0718169      .03388   -2.12   0.034  -.138212 -.005422   .744755
fam pov* |   .0071628      .07014    0.10   0.919  -.130311  .144637   .036131
fam inc  |  -6.61e-06      .00001   -0.87   0.386  -.000022  8.3e-06   3024.13
# in fam |  -.0001297      .00872   -0.01   0.988  -.017217  .016957   7.59674
#brothers|   .0003557      .01434    0.02   0.980  -.027743  .028454   2.17716
#sisters |   .0171037      .01173    1.46   0.145  -.005887  .040094   2.54429
mom lit* |  -.0868731       .0399   -2.18   0.029  -.165084 -.008662    .06993
dad illit|   .0469384      .02795    1.68   0.093  -.007845  .101721   .433566
own land*|  -.0354764      .04758   -0.75   0.456  -.128737  .057784   .861305
wealth   |  -1.45e-08      .00000   -0.53   0.596  -6.8e-08  3.9e-08    666806
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Table 1b

Probability that a Girl will Exhibit Anemia Symptoms

with Village fixed effects.

```
Probit regression                                 Number of obs   =        858
                                                  LR chi2(24)     =      86.95
                                                  Prob > chi2     =     0.0000
Log likelihood = -367.81393                       Pseudo R2       =     0.1057

Marginal effects after probit
      y  = Pr(anemia_symptoms) (predict)         =  .15984914
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
village1*|   -.020211       .0744   -0.27   0.786  -.166037  .125615   .061772
village2*|  -.1522626      .03176   -4.79   0.000  -.214511 -.090015   .100233
village3*|  -.1288976      .04596   -2.80   0.005   -.21898 -.038815   .200466
village4*|  -.1646007      .02908   -5.66   0.000  -.221602   -.1076   .115385
village5*|  -.1661525      .03091   -5.37   0.000   -.22674 -.105565   .115385
village6*|  -.1180023      .04508   -2.62   0.009  -.206366 -.029638   .051282
village7*|  -.1323416       .0465   -2.85   0.004  -.223481 -.041202   .189977
village8*|  -.1519421      .03461   -4.39   0.000  -.219773 -.084111   .135198
     age |   .0181729      .00524    3.47   0.001   .007908  .028437   13.2331
  caste1*|   .0047582      .04108    0.12   0.908  -.075751  .085268   .184149
  caste2*|   .1185107      .06267    1.89   0.059  -.004327  .241348   .081585
  caste3*|  -.0627028      .03468   -1.81   0.071  -.130669  .005264   .486014
  muslim*|  -.1255244      .04003   -3.14   0.002  -.203989  -.04706   .030303
unmarried|    .021978      .02817    0.78   0.435  -.033228  .077184   .613054
literate*|  -.0681369      .03375   -2.02   0.044  -.134288 -.001986   .744755
fam  pov*|  -.0352869      .05947   -0.59   0.553  -.151845  .081271   .036131
fam incom|  -.0000107      .00001   -1.34   0.181  -.000026  5.0e-06   3024.13
# in fam |  -.0055537      .00879   -0.63   0.528  -.022791  .011684   7.59674
#brothers|   .0006801      .01439    0.05   0.962  -.027533  .028893   2.17716
#sisters |   .0193387      .01185    1.63   0.103   -.00389  .042567   2.54429
mom lit* |  -.0703187      .04222   -1.67   0.096  -.153063  .012425    .06993
dad illit|   .0436825      .02845    1.54   0.125  -.012088  .099453   .433566
own land*|  -.0689771      .05376   -1.28   0.199   -.17434  .036386   .861305
   wealth|   2.47e-08      .00000    0.76   0.445  -3.9e-08  8.8e-08    666806
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Table 2

Determinants of Body-Mass-Index

Source	SS	df	MS	Number of obs =	858
Model	357951.663	17	21055.9802	F(17, 840) =	3.31
Residual	5351233.59	840	6370.51617	Prob > F =	0.0000
Total	5709185.25	857	6661.82643	R-squared =	0.0627
				Adj R-squared =	0.0437
				Root MSE =	79.816

bmi_weight~2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
no NGO	-2.473713	6.238662	-0.40	0.692	-14.71891	9.771483
age	-.7828249	1.190107	-0.66	0.511	-3.118757	1.553108
caste1	3.765279	8.965456	0.42	0.675	-13.83205	21.36261
caste2	26.49763	11.02544	2.40	0.016	4.856975	48.13828
caste3	-4.749609	7.289018	-0.65	0.515	-19.05644	9.557219
muslim	10.21342	17.8778	0.57	0.568	-24.87699	45.30382
unmarried	.2433889	6.103792	0.04	0.968	-11.73709	12.22386
literate	-5.864127	6.882596	-0.85	0.394	-19.37323	7.644978
family_pov~l	14.69881	15.13072	0.97	0.332	-14.99965	44.39727
fam income_	.0092705	.001516	6.11	0.000	.0062948	.0122462
# in family	-.8676983	1.90033	-0.46	0.648	-4.597651	2.862255
# brothers	-3.445872	3.026131	-1.14	0.255	-9.385539	2.493794
# sisters	-1.365026	2.499112	-0.55	0.585	-6.270263	3.54021
mom lit	17.89413	11.29128	1.58	0.113	-4.268306	40.05657
dad illit	-1.741726	5.834534	-0.30	0.765	-13.1937	9.710251
own land	-.356843	9.521032	-0.04	0.970	-19.04465	18.33096
wealth	3.07e-06	5.75e-06	0.53	0.594	-8.23e-06	.0000144
_cons	21.78252	24.4336	0.89	0.373	-26.17557	69.7406

Table 3a

Probability of a Girl Being Literate

with NGO Fixed Effects

```
 Probit regression                                 Number of obs   =        858
                                                   LR chi2(19)     =     181.05
                                                   Prob > chi2     =     0.0000
 Log likelihood = -396.84042                       Pseudo R2       =     0.1857
```

Marginal effects after probit

```
      y  = Pr(literate) (predict)    =  .78820282
 ------------------------------------------------------------------------------
 variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
NGOlong* |   .1184155      .03428    3.45   0.001   .051228  .185602   .362471
NGOshort*|   .1345553      .03492    3.85   0.000   .066116  .202995   .282051
     age |  -.0503128      .00592   -8.50   0.000  -.061917 -.038709   13.2331
  caste1*|  -.0200874      .05098   -0.39   0.694  -.120008  .079834   .184149
  caste2*|  -.1606281      .07124   -2.25   0.024  -.300264 -.020992   .081585
  caste3*|  -.0055671      .04132   -0.13   0.893  -.086543  .075409   .486014
  muslim*|  -.2579874      .12468   -2.07   0.039  -.502364 -.013611   .030303
unmarried|   .0373505        .033    1.13   0.258  -.027324  .102025   .613054
fam inc  |   .0000294      .00001    3.03   0.002    .00001  .000048   3024.13
# in fam |  -.0095149      .01022   -0.93   0.352  -.029543  .010513   7.59674
#brothers|  -.0144849      .01648   -0.88   0.380  -.046793  .017823   2.17716
#sisters |   -.004945      .01358   -0.36   0.716  -.031563  .021673   2.54429
mom lit* |   .1340389      .04545    2.95   0.003   .044952  .223126    .06993
electr~y*|   .1160308      .03727    3.11   0.002   .042984  .189077   .560606
radio_tv*|   .0582178      .04105    1.42   0.156  -.022240  .138675   .287879
distance |    .017364      .04173    0.42   0.677  -.064416  .099144   .145688
dadillit*|  -.0444366      .03167   -1.40   0.161  -.106513   .01764   .433566
own land*|  -.0409363      .05889    0.70   0.487  -.074492  .156365   .861305
 wealth  |  -5.70e-08      .00000   -1.79   0.073  -1.2e-07  5.3e-09    666806
------------------------------------------------------------------------------
```

(*) dy/dx is for discrete change of dummy variable from 0 to

Table 3b

Probability of an Adolescent Girl Being Literate

With Village Fixed Effects.

```
Probit regression                                 Number of obs   =        858
                                                  LR chi2(25)     =     205.32
                                                  Prob > chi2     =     0.0000
Log likelihood = -384.70301                       Pseudo R2       =     0.2106

Marginal effects after probit
      y  = Pr(literate) (predict)         =  .79684888
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     age |  -.0486926      .00588   -8.29   0.000  -.060209 -.037176   13.2331
village1*|   .1798082       .0396    4.54   0.000   .102198  .257418   .061772
village2*|   .2189587       .0316    6.93   0.000   .157023  .280894   .100233
village3*|   .1160587      .06828    1.70   0.089   -.01777  .249887   .200466
village4*|   .2064445      .03725    5.54   0.000   .133441  .279448   .115385
village5*|   .1032266       .0727    1.42   0.156   -.03926  .245713   .115385
village6*|   .1874124      .03839    4.88   0.000   .112175   .26265   .051282
village7*|   .0624831      .08148    0.77   0.443  -.097224   .22219   .189977
village8*|   .1154397      .06481    1.78   0.075  -.011595  .242474   .135198
  caste1*|  -.0396029      .05309   -0.75   0.456  -.143656   .06445   .184149
  caste2*|  -.1899895      .07648   -2.48   0.013  -.339894 -.040085   .081585
  caste3*|  -.0195504      .04293   -0.46   0.649  -.103688  .064587   .486014
  muslim*|  -.3505357      .15759   -2.22   0.026  -.659409 -.041663   .030303
unmarried|   .0243794      .03271    0.75   0.456  -.039737  .088496   .613054
fam inc  |   .0000217      .00001    2.21   0.027   2.5e-06  .000041   3024.13
# in fam.|  -.0096659      .01027   -0.94   0.347  -.029804  .010472   7.59674
#brothers|  -.0130707      .01641   -0.80   0.426  -.045243  .019102   2.17716
#sisters |  -.0025831      .01372   -0.19   0.851  -.029472  .024306   2.54429
mom lit.*|   .1188588      .04814    2.47   0.014   .024501  .213217    .06993
electr~y*|   .1267905      .03748    3.38   0.001    .05334  .200241   .560606
radio_tv*|   .0671616      .04064    1.65   0.098  -.012497   .14682   .287879
schoolloc|   .0471553      .03882    1.21   0.224  -.028928  .123238   .145688
dad lllit|  -.0437681      .03213   -1.36   0.173  -.106737  .019201   .433566
own land*|   .0160719      .05823    0.28   0.783  -.098064  .130208   .861305
   wealth|  -8.25e-09      .00000   -0.22   0.828  -8.3e-08  6.6e-08    666806
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Table 4a

Determinants of a Girl < 15 Years of Age Being Effectively Married.

with Father's Illiteracy Considered.

```
Probit regression                                 Number of obs   =        856
                                                  LR chi2(23)     =     175.26
                                                  Prob > chi2     =     0.0000
Log likelihood = -454.88679                       Pseudo R2       =     0.1615

Marginal effects after probit
      y  = Pr(effective_marriage) (predict)
         =   .2940939
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     age |   .0469687      .00652    7.21   0.000   .034196  .059741   13.2336
  caste1*|   .2230104      .06324    3.53   0.000    .09906  .346961   .184579
  caste2*|   .0805126      .07724    1.04   0.297   -.07087  .231895   .081776
  caste3*|   .3001768      .04473    6.71   0.000   .212515  .387839   .485981
  muslim*|  -.0266007      .13847   -0.19   0.848   -.29799  .244789   .030374
fam inc  |  -6.11e-06      .00001   -0.59   0.557  -.000026  .000014   3018.57
# in fam |   .0029615      .01176    0.25   0.801  -.020086  .026009   7.59813
#brothers|   .0320441      .01859    1.72   0.085  -.004391  .068479   2.17874
#sisters |   .0056502      .01573    0.36   0.719  -.025183  .036483   2.54439
 mom lit*|   -.143517      .05748   -2.50   0.013  -.256178 -.030856   .070093
dad illit|   .0522839      .03637    1.44   0.151  -.018996  .123564   .434579
     own*|   .1477323      .05069    2.91   0.004   .048373  .247091   .860981
electric*|  -.1308869      .04166   -3.14   0.002  -.212548 -.049225   .560748
radio_tv*|   .0258948      .04886    0.53   0.596  -.069873  .121662   .287383
wealth   |  -2.61e-08      .00000   -0.59   0.554  -1.1e-07  6.1e-08    666088
village1*|   .3432314      .15321    2.24   0.025   .042944  .643519   .061916
village2*|   .1824833      .15403    1.18   0.236  -.119414   .48438   .100467
village3*|   .3707729      .13691    2.71   0.007   .102437  .639109   .199766
village4*|   .2472681      .14947    1.65   0.098  -.045693   .54023   .115654
village5*|   .3943602      .14551    2.71   0.007   .109159  .679561   .115654
village6*|   .2670662       .1789    1.49   0.135  -.083573  .617705   .051402
village7*|   .3894952      .13836    2.82   0.005   .118322  .660668   .189252
village8*|   .2932904       .1453    2.02   0.044   .008509  .578072   .135514
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Table 4b

Determinants of a Girl < 15 Being Married

With interaction effect (mother literate* father illiterate = oddcouple)

```
Probit regression                                 Number of obs   =        856
                                                  LR chi2(23)     =     173.57
                                                  Prob > chi2     =     0.0000
Log likelihood = -455.73352                       Pseudo R2       =     0.1600


Marginal effects after probit
      y  = Pr(effective_marriage) (predict)
         =  .29353717
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     age |   .0468676      .00651    7.20   0.000   .034106  .059629   13.2336
  caste1*|   .2290469      .06315    3.63   0.000   .105278  .352816   .184579
  caste2*|   .0826627      .07737    1.07   0.285  -.068972  .234298   .081776
  caste3*|   .3032133      .04476    6.77   0.000   .215487  .390939   .485981
  muslim*|  -.0250206      .13947   -0.18   0.858  -.298378  .248337   .030374
fam inc  |  -7.07e-06      .00001   -0.68   0.497  -.000027  .000013   3018.57
# in fam |   .0040369      .01176    0.34   0.731  -.019004  .027078   7.59813
#brothers|   .0316889      .01856    1.71   0.088  -.004694  .068072   2.17874
#sisters |   .0067257      .01571    0.43   0.669   -.02406  .037511   2.54439
 mom lit*|    -.16988      .06867   -2.47   0.013  -.304462 -.035298   .070093
oddcoupl*|   .1013616      .17015    0.60   0.551  -.232124  .434847   .023364
     own*|   .1433775      .05113    2.80   0.005   .043164  .243591   .860981
electr~y*|  -.1339475      .04153   -3.23   0.001  -.215336 -.052559   .560748
radio_tv*|   .0269398      .04879    0.55   0.581  -.068693  .122573   .287383
  wealth |  -2.77e-08      .00000   -0.63   0.532  -1.1e-07  5.9e-08    666088
village1*|    .348546      .15305    2.28   0.023   .048564  .648528   .061916
village2*|   .1793117      .15435    1.16   0.245  -.123199  .481823   .100467
village3*|   .3691056      .13744    2.69   0.007   .099736  .638476   .199766
village4*|   .2335379      .14959    1.56   0.118  -.059651  .526726   .115654
village5*|     .39863      .14532    2.74   0.006     .1138   .68346   .115654
village6*|   .2887168      .17723    1.63   0.103  -.058656   .63609   .051402
village7*|   .3951764      .13814    2.86   0.004    .12443  .665922   .189252
village8*|   .3058779      .14484    2.11   0.035   .022003  .589753   .135514

------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```