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Is There Any Threshold in Mother's Education and Child Health Relationship? Evidence from Nigeria

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Abstract: Literature on mother's education and child health casually observes some nonlinearities and threshold in the relationship. Even though this nonlinearity or threshold has significant bearing on policy matters, any rigorous attempt to address this issue is missing in the literature. In this study we test the existence of such threshold using Demographic and Health Survey (DHS 2003) data for Nigeria. Large variations in the education policy and the public investment in education during 1950-1990 motivate the selection of the country and the construction of the instrument for endogenous mother's education. With height for age z score (HAZ) as a proxy for long run child health capital, regression results reveal that there is hardly any significant effects of mother's education on child health if mothers do not go past primary education. We use Hansen (2000) for threshold estimation and it also corroborates our hypothesis about the existence of a threshold. We argue that low cognitive ability through lower education, low quality of overall education, ineffective health education in curricula give rise to a *fixed cost*, and thus to the threshold in mother's education-child health relationship.

Keywords: mother's education, child health, threshold

JEL Classification: D13, I12

I. Introduction

Literature examining the effect of mother's education on child heath is quite extensive. Most of the literature has found positive correlation between mother's education and child health (Thomas et al, 1991; Glewwe, 1999; Kovsted, Portner and Tarp, 2003). Some studies found insignificant relationship (Glewwe and Desai, 1999), while a few found negative association (Lavy et al, 1996). However, this literature fails to answer one important question: How many years of schooling a mother needs to affect her child's health? We do not know whether the relationship between mother's education and child health is linear; that is, does one more year of education affect a child's health at the same rate for all levels of education? Is there any lumpiness in educational investment that a mother requires to meet before affecting her child's health in a significant way? If positive, what are the sources of non linearity or the threshold? In this study, we address these questions in examining the mother's education and child health relationship for Nigeria.

A small number of papers, studying the effect of mother's education on child health, provide some indications and casual observations on the presence of non linearity or threshold. Desai and Alva (1998) look into the effect of mother's education on child's height for age, mortality and immunization for 22 developing countries and have found mixed results. For some countries, such as Liberia, Bolivia, Brazil, Ecuador, Guatemala, Peru, and Thailand mother's primary education had no effect on child's health. In some cases where primary and higher education were both significantly important, non linearity is present in the sense that the magnitude of the effect of higher education was much greater than primary education[1]. Levy, Strauss, Thomas and Vreyer (1996) used the square of mother's education in the regression and

[1] This study treats mother's education as exogenous and therefore results should be interpreted with caution.

found that mother's education had a positive impact on child's health (Child Survival, Height for Age, Weight for Age) only after ten years of education[2]. Thomas (1994) also found some results that lower level of education had no impact on child's health. Though this literature pointed out possible existence of non linearity or threshold in the relationship, careful and full-blown examination of this issue is missing in the literature.

The study of the existence of a threshold in mother's education and child health relationship is important because of two reasons. Firstly, the presence of a threshold may lead to a poverty trap. Inadequate investment in education may bring forth deteriorating health of the successive generations which leads to lower productivity and income. This may worsen the income inequality situation within a country. Secondly, it has important bearing on policy issues. Most of the governments of developing countries provide subsidy to female primary education on the ground that the non market returns, for example, fertility, children's health, etc. are quite significant, even though its impact on female labor force participation is very low[3]. Therefore, if there is a threshold, that is, if mother's education has no impact on child health for low level of education, i.e., primary schooling, policy makers should take steps to remove the potential causes of threshold or rethink about the length of the subsidy program.

This paper extends mother's education–child health literature in two broad ways. Firstly, we study this relationship very closely, and systematically look for any threshold or nonlinearity using Demographic and Health Survey (DHS 2003) data for Nigeria. We examine the presence of a threshold with the regression analysis and also test its existence using Hansen (2000) which develops a statistical theory for threshold estimation in cross section regression context. The results from regression and threshold estimation confirm a threshold at around 5-6 years of

[2] In fact, this is the only study that explicitly points out the possibility of the existence of a threshold, though in the foot note.
[3] For detailed discussion of the market and non-market returns of female education see Schultz (2001).

mother's schooling, implying that the effect of mother's education on child health is significantly different below and above this threshold level.

Secondly, the literature examining the relationship between mother's education and child health mostly treat mother's education as exogenous. In our study we introduce a new set of instruments for endogenous mother's education. Using the fact that there was a large variation in public investment in education during 1950-1990 in Nigeria, we use the interaction terms between mother's childhood places of residence (when she was 12 years old) with her birth cohort as instruments for her education. Childhood place of residence captures regional variation and birth cohort captures variation of school supply over time. Thus these instruments capture the relevant school supply during her school going age which is correlated with mother's schooling and uncorrelated with the unobservables that could affect child health. We also use mother's religion as instrument for her education as religion influences acquisition of female formal education in Nigeria.

The rest of the paper is organized as follows: section II provides arguments why a threshold may arise in mother's education-child health relationship. Section III describes the data set, rationale for choosing Nigeria and descriptive statistics for some key variables. In section IV we propose an identification strategy as mother education is endogenous. Section V explains the results and section VI performs Hansen's test for threshold estimation. Section VII draws conclusion.

II. What Gives Rise to a Threshold?

Now the question is how non convexity or a threshold may arise in mother's education-child health relationship. We argue that low cognitive ability through lower education, low quality of overall education, ineffective health education in curricula give rise to a *fixed cost*, and thus to a threshold in mother's education-child health relationship.

Technically speaking, cognitive skill includes a large array of attributes, such as, memory, attention, perception, action, problem solving and mental imagery. We argue that mother's cognitive ability should reach a threshold in order to be efficacious in child health production. There is some evidence that low cognitive ability is associated with early child bearing, and birth related diseases of mother and child. Probability of having two births before age 20 is three times higher for the women with low cognitive skill than with the higher ones in USA. And early child bearing is associated with low birth weight and poor health status of the child (Darlene L., et al., 2002).

Quality of education is very important in this regard. The quality of education is central in literacy and numeracy skill development, health knowledge accumulation and its utilization. It is quite possible that a student with primary education may not be able to read and write at all in developing countries. If this is so, a threshold in child health-mother's education relationship is not unexpected. In order to probe this question more rigorously, we randomly selected 13 Sub Saharan countries, namely, Burkina Faso, Chad, Ethiopia, Gabon, Guinea, Kenya, Mozambique, Namibia, Niger, Nigeria, South Africa, Uganda and Zambia. We calculated the percentage of mothers who cannot read, but reported to have different levels of formal education. The mothers were given a card with a simple sentence written on it in her native language and were asked to read it[4]. The results are reported in Table 1.

[4] There were three categories of coding: i) cannot read at all ii) able to read only parts of sentences iii) able to read whole sentence. We only consider category (i).

Table 1: Percentage of Mothers Who Cannot Read with Different Levels of Education											
Country	Survey Year	No. Obs.	Years of Schooling 1	2	3	4	5	6	7	8
Burkina Faso	2003	12169	80.58	84.68	74.64	52.24	28.97	10.17	0	0
Chad	1996	7415	90.81	70.86	45.52	21.57	8.02	2.25	0	0
Ethiopia	2000	15222	4414	17.45	7.63	2.83	0.63	1.12	0	0
Gabon	2000	5755	76.18	60.72	34.99	26.77	15.96	3.66	0	0
Guinea	1999	6630	92.63	92.04	78.76	68.14	43.61	32.68	0	0
Kenya	2003	7874	89.28	72.71	57.43	42.96	26.61	10.71	8.20	2.67
Mozambique	2003	12355	93.67	80.31	44.72	15.91	4.76	0	0	0
Namibia	2000	6505	47.54	44.44	36.97	16.46	10.58	7.31	4.31	0
Niger	1998	7548	96.93	94.25	81.56	74.77	42.11	15.11	0	0
South Africa	1998	10842	40.07	25.63	11.63	8.59	4.24	1.82	0.83	0.71
Uganda	2001	7024	87.12	74.68	52.34	31.30	21.83	11.43	1.74	0
Zambia	2001	7459	81.47	89.12	82.43	65.77	51.49	34.80	14.61	0
Nigeria	2003	5721	100	92.20	75.85	70.68	58.95	42.79	16.58	0

Source: Author's calculation from Demographic and Health Survey (DHS) data from these countries. The DHS uses the same basic questionnaire for all countries which enables cross country comparisons.

It is interesting to observe that in Chad, Ethiopia, Mozambique, Namibia, Gabon and South Africa 1 to 20 percents of women with five years of education cannot read a simple sentence. In Burkina Faso and Kenya these percentages are 28 and 26 respectively while in Guinea and Niger they are just above 40. In Zambia and Nigeria, the situation is worse- 51 and 59 percent of women cannot read with five years of education. However, even in the countries where more than 40 percent of woman with five years of education cannot read (Guinea, Niger, Nigeria, Zambia), these percentages drop significantly after six years of education. For example, in Guinea and Niger there is no mother who cannot read with seven years of education. In Zambia and Nigeria, only around 15 percent of mothers with seven years of education cannot read. The evidence that the percentage of mothers who cannot read drops drastically after 4 to 7 years of schooling offers a strong indication that a threshold may exist in child health-mother education relationship.

Apart from developing the cognitive skill through education, a girl can acquire health related knowledge directly from her text books. If the curricula contain more useful and effective material on health related issues in higher educational levels than the primary level, lower level of education may be ineffective in improving child health. A study was conducted by Education Research Group of Liverpool School of Tropical Medicine on Health and AIDS education in primary and secondary schools in four countries in Africa and Asia, namely, Uganda, Ghana, Pakistan and India (Barnett, E. et. al, 1995). This study documented that health education was more comprehensive and effective in secondary level than the primary level[5].

III. Nigeria: Data and Descriptive Statistics

The choice of Nigeria is primarily motivated by the choice of instrument[6]. Mother's education in the child health production function is endogenous because the unobserved characteristics of the mother like her ability, motivation and determination etc. influence her educational attainment and also influence the health status of her children[7]. In our study we construct instruments for mother's education using the fact that there was a large variation in the education policy and the public investment in education in Nigeria.

We use the Demographic and Health Survey data from Nigeria (NDHS, 2003)[8]. It is a nationally-representative household survey containing relevant health variables for our analysis. A total of 7985 women in the age range of 15 to 49 were interviewed from 7225 households in Nigeria. Height and weight measurements of all children (4189) born in five years preceding the survey were collected. We dropped some observations which have height, weight, age of the

[5] For example, this study observes that in primary education curricula in Ghana, "Health education is integrated into various subjects, especially Life Skills, and also touched on in Agriculture, Science, Social Studies, Cultural Studies and for junior secondary school (JSS) curricula is similar to primary;……..most substantial 'health inputs' can be seen in JSS Life Skills textbook 3, chapter 9". For Uganda, it is reported that a special syllabus for health education was developed for junior secondary level. In India and Pakistan, health education is integrated in biology and population education and higher education contain more advanced curricula in health.

[6] Also from table 1, we see that the percentage of mothers who cannot read drops significantly after six years of education in Nigeria. This also gives some indication that a threshold may be present for this country.

[7] Given that female school enrollment was very low, mothers who acquire education are innately more able and motivated. Their ability and motivation are unobservable to the researcher and omitted from the regression. As a result the education coefficients suffer from endogeneity bias.

[8] DHS Nigeria 2003 is publicly available. The link to the data is http://www.measuredhs.com/. Stata is used for the empirical estimation. The .do file is available from the authors upon request.

children and information on parental education and age missing. This leaves us a sample of total 3826 children. NDHS also collects information on household characteristics, region of residence, parent and child characteristics, educational attainment, religion and different health measures of the children.

In our study we use height for age Z score (HAZ) as our indicator of child's health as HAZ reflects long run health capital of the child[9]. Since one of the motivations of this study is that the presence of a threshold may create a poverty trap, indicators of long run health capital is more relevant for our analysis.

We have created six dummies for mother's completed years of schooling: 1 to 3, 4 to 6, 7 to 9, 10 to 12 and 13 or more years of completed schooling, with no education as the reference group. The reasons for using these categories are two fold: firstly they reflect the educational system of Nigeria as Nigeria have 6-3-3-4 education system[10]. Secondly, we could have used dummies for each year of education. But the problem is that the number of observations for grades 1, 2, 3, 5, 7 and 10 are too small to precisely estimate the marginal effects (see figure 2). We also use another specification involving dummies for incomplete primary education (1-5 years), completed primary (6 years), incomplete junior secondary (7-8 years), completed junior secondary (9 years), secondary (10-12 years) and higher education (13+) in order to better understand the possible level of threshold.

Summary statistics of the variables used in the estimation are presented in Table 4. About 49 percent of the mothers do not have any formal education and about 24 percent have primary

[9] Z score is the difference between the value for an individual and the median value of the reference population for the same age or height divided by the standard deviation of the reference population. The reference standard is one that is recommended by WHO.
[10] Grade 1 to 6=primary; 7 to 9=junior secondary; 10 to 12=higher secondary; 13 and above=higher

level education. Fathers have on an average 6 years of education. 37 percent of our sample population lives in an urban area. 57% of the mothers grew up in villages.

Lifetime permanent income of the household is an important determinant of the long run health status of the child and should be included in the health regression to control for the income effect. As the data on permanent income is rarely available to the researchers, current income or current expenditure is often used as a proxy. But there is an obvious measurement error when current income is used[11]. Again, total income of the household is likely to be endogenous to the household health decisions (participation and hours are jointly determined with health inputs). To avoid this bias often non labor income and wealth information of the household is used as a proxy for permanent income. Unfortunately, NDHS 2003 did not collect any income or expenditure data but it collected a host of household asset information ranging from ownership of a television, a radio, a bicycle, a scooter as well as dwelling characteristics such as the source of drinking water, type of sanitation facilities and the type of material for house's floor and roof. A wealth index is constructed by NDHS using these asset information and principle component analysis[12]. This wealth index is used as a proxy for (permanent) income and the living standard of the household[13].

Access to health facilities and neighborhood living conditions are important determinants of a child's health in developing countries. Unfortunately NDHS 2003 did not collect any

[11] Respondents sometimes conceal their income. Also income from agriculture, self employment has accounting issues. Moreover, in household surveys, sometimes one person reports about the income earned by all the household members, leading to measurement problems.

[12] Each asset is assigned a weight (factor score) generated through principle component analysis and the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and standard deviation of one. Each household was then assigned a score for each asset, and the scores were summed for each household. This index has been consistent with expenditure and income measure and tested for several countries. *Nigeria Demographic and Health Survey 2003.*National Population commission and ORC Macro, 2004

[13]The wealth index may also be endogenous in child health production function. Alternative specifications were run excluding the wealth index, in which case father's education was treated as a proxy for household permanent income.

information about the availability of health personnel, health facilities or any indicators of community living conditions. But the survey included questions such as whether the mother received prenatal care, whether she was visited by family planning worker in the last 12 months, and whether the household have piped water inside the household etc. These are all binary variables. Information from these variables was used to construct variables that are reasonable proxies for access and availability of health services and standard of living conditions in the neighborhood.

The NDHS 2003 had about 365 clusters covering all the administrative units of Nigeria. A cluster level measure of accessibility and availability of health services for each household i in cluster j was generated by averaging these variables over all the household in the cluster j excluding the household i within each cluster. These variables were calculated using the whole NDHS sample of all women ages 15 to 49.

IV. Estimation Strategy and Issues

Thomas (1994) and Strauss and Thomas (1995) developed theoretical models of household decision making to derive the reduced form demand function for child health. Following their specification we estimate the following regression equation:

$$H_{ij} = \alpha_0 + \beta_1 S_j + \beta_2 C_{ij} + \beta_3 P_j + \beta_4 R_j + \varepsilon_{ij}$$

Where, H_{ij} is height for age Z score of the child i in household j, S denotes the vector of mother's education dummies, C is the vector of child's characteristics (age, age sq, sex), P includes parent and household characteristics (parent's age, father's education, household wealth and asset index), R is the vector of regional and urban dummies, ε is the error term[14].

[14] The child health production function shows how health and nutritional inputs provided by the household, local environmental conditions and child's genetic endowment jointly determines child's health capital. See Glewwe (1999) for a detailed discussion about the inputs of child health production function.

To account for possible endogeneity of mother's education through mother's unobservable attributes, e.g., ability, we use instrumental variable estimation technique. Following the spirit of Duflo (2001) we introduce a set of instruments-- the interaction terms between mother's childhood place of residence and mother's birth cohort[15]. Duflo (2001) exploited the massive school construction program undertaken by the Indonesian Government between 1973-78 and used the interaction between an individual's birth cohort and the number of schools built in the region of birth as instruments for individual's level of schooling.

Nigeria's National Policy on Education was formulated in 1969 and revised in 1981. The 6-3-3-4 system of education is the result of this policy. The government started universal free primary education in 1976. Construction of schools accelerated at different rates in different time periods and regions. Table 2 shows the construction of educational institutions in Nigeria in different decades.

Table 2: Numbers of Newly Established Schools

Year	<1949	1950-59	1960-69	1970-79	1980-89	1990-99
Number of Education Institution	2,986	6,100	1,555	16,000	3,592	9,431

Source: School Education in Nigeria, The World Bank, October 3, 2003

We see that there is a wide variation in numbers of newly established schools in different decades and this reflect differential accessibility of schools for mothers born in different decades. Also the public education investment varied by urbanicity, i.e. whether it is a city, small town or village. Moja (2000) and World Bank assessment study (The World Bank, 2003) report that there are stark differences in rural and urban areas in terms of public investment in school infrastructure, provision of support materials etc. Thus mother's birth cohort captures the variation of public education investment over time and childhood place of residence captures regional variation. Thus the interaction between mother's birth cohorts and childhood place of

[15] The regions where the mother went to school are not available in the NDHS. Therefore we used the variable where she lived when she was 12 years of age in constructing our instruments.

residences (urbanicity) captures differential access to school for the mothers[16]. This is evident in table 3.

Table 3: Average Years of Education, by Mother' Cohort and Childhood Place of Residence						
Average Education (Standard errors)				t Statistics Indicating the Difference in Average Education Between These Places		
Cohort	Village	Town	City	(Village-Town)	(Town-City)	(Village-City)
1953-59	0.99 (2.52)	1.84 (4.34)	1.33 (2.12)	1.58	0.39	0.45
1960-69	3.25 (4.34)	4.07 (4.82)	6.89 (5.70)	2.97	5.76	9.06
1970-79	3.03 (4.17)	5.16 (5.03)	8.61 (4.93)	11.88	11.48	22.84
1980-88	2.32 (3.69)	3.99 (4.34)	5.98 (5.21)	6.96	4.33	9.78

Source: Author's calculation from Demographic and Health Survey (DHS) 2003 data for Nigeria.

We classified all the mothers in the sample into four birth cohorts, 1953-59, 1960-69, 1970-79 and 1980-88 in light of table 2. This will enable us to examine the effects of differential rates of construction of educational institutions on the average level of mother's schooling for each cohort. Table 3 shows the average level of education of the mothers for different cohorts and place of their residence in their school going age and the t-statistics between regional differences. We see that the average level of education varies significantly across regions for each cohort[17]. The average level of education is different for different cohorts with younger mothers having more education compared to older mothers irrespective of their childhood place of residence. This can be attributed to increase in school building in the period of 1950-60 and 1970-80. Note that the average level of education dropped for the youngest cohort across all three places due to less educational investment in the decades of 1980s and early 90s (see table 2). Table 5 shows the variation in average level of education between mothers born in different cohorts for each place of residence in childhood. We find that there is significant difference in

[16] It can be argued that the instruments may be endogenous if quality of education varies by cohort and urbanicity. Quality of education captured in unobservable also affects child health. Table 6 shows the percentage of mothers who are illiterate but claimed to have some formal schooling, across cohorts and childhood places of residence when she was 12 years old. The results show that there is not much difference in quality of education for each cohort living in a village, town or a city, except for mothers born between 1970 and 1979. Though only in two out of twelve cases we found significant differences, this may raise questions about the exogeneity of the instruments. But the Sargan's over-identification test provides strong evidence about the exogeneity criterion of the instruments.

[17] Mothers were asked where they lived when they were 12 years of age. The categories were a village, a small town or a big city.

the mean level of education between cohorts and this reflect that mothers belonging to different cohorts had differential access as indicated in table 2. Thus the variation of public education investment across regions and over time is reflected in differential average years of schooling of mothers. This motivates us to use the interaction between mother's childhood place of residence and her birth cohort as instrument for mother's education.

We also use mother's religion dummies as instruments. We used two dummies for Christian and Muslim and treat animist and other religion as the omitted category. About 58% women in the sample are Muslims and 41% are Christians. Differential religious beliefs are argued to have influence on the choice of school type (i.e., traditional public schools, religious, English medium) enrollment and drop out decision of female. Thus mother's religion serves as a good instrument for her education[18].

V. Estimation Results

Consider column (1) and (2) of Table 7 first. These two columns present the ordinary least squares (OLS) and instrumental variables (IV) estimates of equation 1 respectively which include mother's education dummies, child's age, sex, father's age and education (basic specification). Since Hausman test rejects OLS over IV (see table 7), we will concentrate on the IV results only and refer to OLS in order to shed light on the direction and magnitude of the biasness of the estimates. Both OLS and IV estimates confirm that first three years of mother's education has no impact on child's health. Child's health improves for the education level beyond three and the effects are not linear in education. The estimated coefficient is positive and significant for 4 to 6 years of education. The magnitude of the education dummies becomes

[18] Kovsted, Portner and Tarp (2003) used religion of the mother as an instrument for mother's health knowledge which they identify as the channel through which mother's education influences child's health.

smaller after 4 to 6 years of education. However, for more than 12 years of education, the effect again picks up. One possible explanation could be the empowerment and income effect. Women with more than 12 years of education are more likely to participate in the formal labor market and are more empowered to take household decisions; to direct resources that would affect child health positively.

The instrumental variable estimate of the education dummies are much bigger than corresponding OLS estimates. One possible explanation is the measurement error in schooling variable, which may lead to downward bias in the OLS estimate, partially offsetting any upward ability biases (Angrist and Krueger, 1991; Staiger and Stock, 1997; Card, 1995; Harmon and Walker, 1995)[19]. Moreover this measurement error effect is compounded if ability bias in OLS estimates is relatively small[20]. However, measurement error in schooling variable alone may not explain such big differences (Card, 2001). Heterogeneity in marginal returns to schooling or the differences in the marginal cost of schooling may contribute to bigger IV estimates than OLS. Since our instruments are supply side innovation by the government over time and space, individual's responses to this innovation may be heterogeneous. It is likely that increase in the supply of schools lowers the cost of schooling more for some mothers than others. These mothers with lower marginal cost enrolled or continued in school who otherwise would not have done so. The marginal effect of education for this group is very high and this may be reflected in bigger IV estimates than OLS.

The signs of the other controls are reasonable. It is interesting to observe that the girl dummy is positive and significant, meaning that a girl child enjoys better health, even though

[19] See Card, David (2001) for an excellent survey of 11 recent papers where IV estimates are bigger than OLS.
[20] Angrist and Newey (1991) in their fixed effects estimation of returns to schooling using panel data, find that the schooling coefficient is biased downwards even after removing the effects of fixed ability components in wage equation.

strong son preference of the parents is common in the literature. However, this result is not at odd with the literature. Lavy et al (1996) found that female child has more chances of survival and enjoys better health, measured with HAZ, and this phenomenon is attributed to the exogenous health endowments. The negative coefficient of child's age and positive coefficient of its square indicate the common pattern that child malnutrition initially declines with age and then improves at later ages. Father's education positively affects child health. This probably captures some income effect as well.

Now consider column 3 and 4 of table 7. Here we add a wealth index provided by NDHS, regional dummies, urban residence and the neighborhood variables proxied by percent of households in the neighborhood having access to piped water, receiving prenatal care and visited by family planning workers. The purpose of these two columns is to check how the effects of the variables in basic specification change with the inclusion of household income and neighborhood variables. The size of the estimates of column 1 and 2 become smaller with the inclusion of new controls. Though OLS results show that first three years of education has no impact, like column 1 and 2, 4 to 6 years of education is barely significant at 10%. However, this significance of 4 to 6 years of education goes away with IV, that is for IV estimation, mother's education tends to impact child's health after six years of education. Mother's 4 to 6 years of education was probably capturing some impact of household wealth status and some neighborhood effect. We find that the coefficients of 1 to 3 years and 4 to 6 years of education are not statistically different from each other or zero in column 4 of table 7. But they are significantly different (with large F test values) from mother's 7 to 9 years, 10 to 12 years and higher education. Most importantly, the coefficients of 4 to 6 and 7 to 9 years of education are significantly different from each other[21]. There is also a big jump in the magnitude of the effect of 7 to 9 years of education from the 1 to 3 or 4 to 6 years of education. These results indicate the presence of a threshold in mother's education child heath relationship.

With the control of family wealth, father's education has become insignificant. However, the wealth index itself is significant and positive[22]. Living in the Northern part of Nigeria has significant negative impact on child health. Northern part especially north eastern and north western are the most economically backward regions with least access to piped water and appropriate sanitation[23]. The only neighborhood variable that is significant is piped water and it is found to improve child health.

Results from the Hansen-Sargent J statistics for over-identification and Wu-Hausman F test and Durbin-Wu-Hausman chi-sq test for endogeneity are presented in the bottom section of table 7[24]. It is evident that the instruments pass the over-identification test and therefore can be considered as valid instruments and are appropriately excluded from the second stage regressions. To assess the explanatory power of the identifying instruments from the first stage regression, F tests are conducted for their joint significance and the results are shown in table 9. The F stats are roughly between 2.68 and 17.61. The null hypothesis of no explanatory power is resoundingly rejected at 1 percent or better with p values of 0.000 for almost all specifications[25].

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[21] The F stat values for the test of equality of coefficients are available in page 29.
[22] When the wealth index was dropped from the specification, father's education becomes significant, implying that it is a proxy for permanent income of the household.
[23] These results are available in the working paper.
[24] Hansen-Sargent J stat for over identification: Ho:the instruments are uncorrelated with the error term and are correctly excluded from the stage two regression; Ha:the instruments are correlated with the error term and are incorrectly excluded from the main(stage two) regression. Wu-Hausman F test and Durbin-Wu-Hausman chi-sq test: Ho: Regressors are exogenous, i.e. OLS should be employed and Ha: Regressors are endogenus, i.e. Instrumental variables (2SLS) regression should be employed.
[25] Bound, Baker and Jaeger (1995) expressed concern about weak instruments bias if the F stat is not close to 10. Staiger and Stock (1997) further suggested that the value of F stat should be close to 10 as rule of thumb to signal strong explanatory power. Since the F statistic for some instruments is below 10, the instruments might be weakly correlated with the included endogenous variables and in that case the inferences might be misleading. Most of the literature on the solutions to the problem of weak instruments is very recent. Stock, Wright and Yogo (2002) noted

We redo the same exercise as in table 7 with six categories for the mother's education and report the results in table 8. In specification 1 (table 7) we categorize mother's education according to schooling system because of small number of observation in some grades. In order to better understand the possible location of threshold, we divide mother's education into six groups according to whether she has completed different levels – primary, junior secondary, etc. The education dummies in this specification are incomplete primary (grade 1-5), completed primary (grade 6), incomplete junior secondary (grade 7-8), completed junior secondary (grade 9) and higher secondary (grade 10-12) and higher education (13+). The results in column 4 show that incomplete primary (1-5) has no effect on child health. Completed primary and incomplete junior secondary have positive impact though they are statistically significant at 11% and 10.4% respectively. Completed junior secondary and higher education have positive and significant effects.

To sum up the results, it is consistently found that secondary and higher education have positive and significant impact while mothers with below 6 years of education have no impact on child's health. Since we cannot pin point the exact grade at which a threshold exists from regression results, we use Hansen's (2000) method of threshold estimation.

VI. Threshold Estimation: Hansen (2000)

Hansen (2000) develops a statistical theory for threshold estimation in cross section regression context, though it can also be used in time series analysis[26]. An exogenously given

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some easily computable estimation methods that provide partially robust inferences in the presence of weak instruments. These are basically k class estimators with different values of k that improve on two stage least square estimates when the instruments are weak. See Stock, Wright and Yogo (2002) for a detailed description of the k class estimators. Therefore, we ran Fuller-k and still find similar pattern as in table column 4 in table 7. These results are available in table 10.

[26] The program for sample splitting and threshold estimation written in Gauss is available from Bruce Hansen's webpage: http://www.ssc.wisc.edu/~bhansen/progs/progs_paper.htm

variable, called the 'threshold variable', is used to split the sample, which can or cannot be a regressor. This theory derives the asymptotic distribution of the OLS estimates of the threshold parameter. This threshold estimation is extensively used in empirical growth literature[27]. Since this technique is new in micro development literature, we provide a brief and non-technical outline of this method.

The structural equation in a threshold regression model is:

(1) $y_i = \theta_1 x_i + e_i \qquad q_i \le \gamma$

(2) $y_i = \theta_2 x_i + e_i \qquad q_i \succ \gamma$

The observed sample is $\{y_i, x_i, q_i\}_{i=1}^{n}$ where q_i is the threshold variable; and y_i and x_i are the dependent variable and explanatory variable (m vector) respectively. The threshold variable q_i is assumed to have a continuous distribution and may be an element of explanatory variables x_i. A threshold regression model takes the form (1)-(2), and allows the regression parameter to differ depending on the value of q_i. Defining a binary variable $d_i(\gamma) = \{q_i \le \gamma\}$ where $\{\cdot\}$ is the indicator function and setting $x_i(\gamma) = x_i d_i(\gamma)$, (1)-(2), can be written as a single equation

(3) $y_i = \theta' x_i + \delta_n x_i(\gamma) + e_i$

Where, $\theta = \theta_2$. The regression parameters are (θ, δ_n, γ). The estimates ($\hat{\theta}, \hat{\delta}, \hat{\gamma}$) are obtained by minimizing the least squares residual sum of squares $S_n(\theta, \delta, \gamma)$. The least squares estimates are obtained through concentration. Conditional on γ, the regression equation is linear in θ and δ_n, yielding the conditional OLS estimates of $\hat{\theta}(\gamma)$ and $\hat{\delta}(\gamma)$ by regression of Y on X. The concentrated residual sum of square function is $S_n(\gamma) = S_n(\hat{\theta}(\gamma), \hat{\delta}(\gamma), \gamma)$ and $\hat{\gamma}$ is the value that minimizes $S_n(\gamma)$.

[27] For a review of non-linearity and multiple regimes in growth estimation, see Durlauf et. al (2004), Page 89-96.

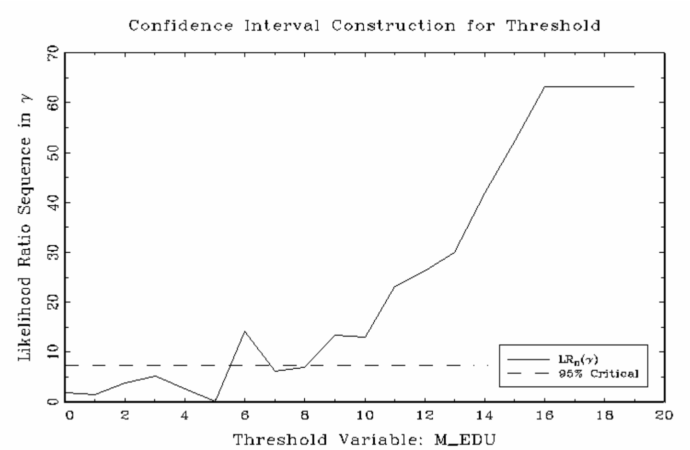
To test the presence of a threshold, Hansen proposed a likelihood ratio statistic under the null, $H_0 : \gamma = \gamma_0$, which has the following functional form: $LR_n(\gamma) = n\frac{S_n(\gamma) - S_n(\hat{\gamma})}{S_n(\hat{\gamma})}$. The likelihood ratio test under the null is to reject for large values of $LR_n(\gamma_0)$. The asymptotic p values for the likelihood ratio test are given by $P_n = 1-(1-\exp(-\frac{1}{2}LR_n(\gamma_0)^2))^2$, as the distribution function for likelihood ratio is available in a simple closed form.

They also describe a procedure to construct heteroskedasticity robust and asymptotically correct confidence interval based on the likelihood ratio statistic $LR_n(\gamma)$.Using the Gauss program provided by Hansen (2000), the p values in the paper are calculated using 1000 bootstrap replications.

In our analysis of threshold estimation mother's education is the threshold variable. In contrast to our regression analysis, mother's education is used as a continuous variable. All the other control variables are exactly the same as the third column of Table 7. Figure 1 shows the normalized likelihood ratio sequence $LR_n^*(\gamma)$ statistic as a function of the threshold variable – mother's education. The least square estimate γ is the value that minimizes the function $LR_n^*(\gamma)$ at $\hat{\gamma}$ = 5. The asymptotic 95% critical value is represented by the dotted line. Its intersection with $LR_n^*(\gamma)$ displays the confidence interval [0,8]. The value of LM statistic is 68.57 with bootstrap p value is 0.00. Therefore, LM test strongly rejects the null that there is no threshold. Thus, the result confirm that there is a threshold at five years of mother's schooling, implying the effect of mother's education on child health is significantly different if mother has more than five years of education.[28]

[28] Hansen (2000) derives the asymptotic distribution of only OLS estimates of the threshold parameter. It cannot deal with the case when the threshold variable is endogenous. There is no such test available at present for endogenous threshold variable. However, we included the predicted value of mother's education from the first stage

Figure 1: Threshold in Mother's Education in Child Health Production Function.



VII. Conclusion

In this paper we study the effect of mother's education on child health for Nigeria. Though the literature indicates the existence of nonlinearity and threshold in the relationship, no attempt has been taken to examine this issue, despite its significant implications on public policy. Regression results indicate threshold at 4-6 years of education. The problem of endogeneity of mother's education has been taken care of with a set of new instruments. The interaction terms between mother's birth cohorts and childhood place of residences are used as instruments for mother's education and these capture differential access to school for the mothers. The presence of a threshold at primary level of education found in regression results are also confirmed by Hansen (2000). We introduce Hansen (2000), a threshold estimation technique in regression context, to empirical micro literature. We also explore the possible causes that might give rise to a threshold in mother's education-child health relationship. It is argued that low cognitive ability through lower education, low quality of overall education and ineffective health education in curricula may give rise to a *fixed cost*, and thus to a threshold in mother's education-child health relationship.

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regression using the instruments discussed above as a threshold variable and redid the same exercise. In this case we also find split at five years of education with LM test statistic and bootstrap p value being 64.52 and 0.000 respectively. We bootstrapped the estimated statistics using 1000 replications to correct the standard error of the estimates.

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Figure 2: Histogram Depicting the Frequency Distribution of Mothers Education.

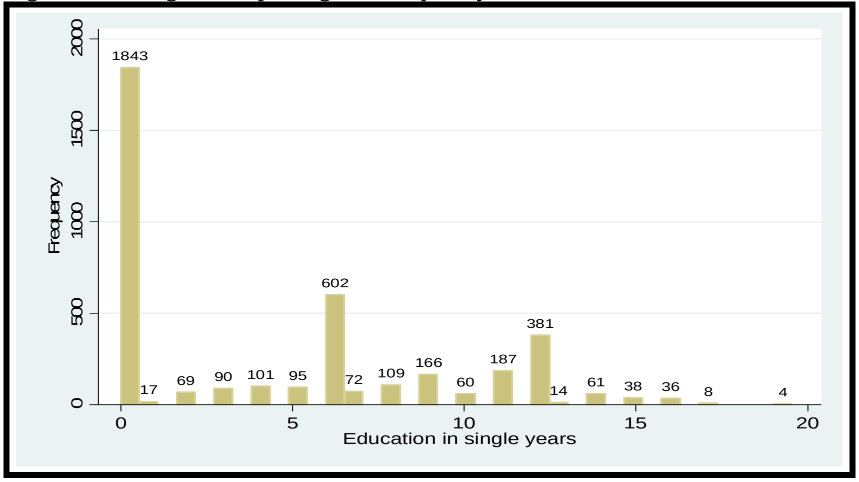

Table 4: Descriptive Statistics		
Name of the Variable	Mean	Std. Deviation
HAZ	-1.49	1.78
Girl	0.497	0.499
Age in Months	27.374	16.971
Father's Age	40.001	10.028
Father's Education	6.090	5.603
Mother's Education	4.294	4.856
Wealth Index Factor Score	-0.7461	0.9774
Urban Area, % of population	36.962	0.465
Division, % of population (NE)	0.245	0.424
Division, % of population (NW)	0.27	0.467
Division, % of population (SE)	0.08	0.256
Division, % of population (SS)	0.12	0.314
Division, % of population (SW)	0.12	0.306
Division, % of population (NC)	0.18	0.318
Mother's Age	29.15	6.83
% of Mother Grew Up in Village	57.103	0.493
% of Mother Grew Up in Town	31.219	0.461
% of Mother Grew Up in a Metropolitan City	11.676	0.315
% of Mother born in 1953-59	3.106	0.177
% of Mother born in 1960-69	24.381	0.423
% of Mother born in 1974-1978	53.106	0.499
% of Mother born in 1969-1973	19.404	0.395
Mother has no education	49.001	0.500
Mother has 1-3 years of Education	4.273	0.182
Mother has 4-6 years of Education	19.733	0.392
Mother has 7-9 years of education	8.383	0.275
Mother has 10-12 years of education	15.568	0.363
Mother has13+ years of education	4.001	0.190
Religion of the Mother: Christian	40.119	0.4832
Religion of the Mother: Muslim	58.274	0.4861
Religion of the Mother: Animist/Traditionalist	0.01	0.132
Religion of the Mother: Other	0.002	0.040
% of households in the neighborhood having Piped Water (%)	16.292	0.277
% of mothers in the neighborhood receiving prenatal care	64.641	.331
% of mothers in the neighborhood visited by family planning worker	4.341	.067
N	3826	

Table 5: Variation in Average Level of Education Across Cohorts within Each Place of Residence in Childhood			
	t-Statistic Indicating the Difference in Average Education Between Different Cohorts		
Difference in Cohorts	Village	Town	City
[(1953-59) – (1960-69)]	6.02	2.83	3.34
[(1953-59) – (1970-79)]	5.71	4.15	5.08
[(1953-59) – (1980-88)]	4.11	3.01	3.05
[(1960-69) – (1970-79)]	1.26	3.62	3.47
[(1960-69) – (1980-88)]	4.62	0.26	1.37
[(1970-79) – (1980-88)]	4.02	4.13	5.15

Table 6: Quality of Education, by Mother' Cohort and Childhood Place of Residence						
	Education Quality (Standard Error)			t statistics Indicating the Difference in Education Quality Between the Places		
Cohort	Village	Town	City	(Village-Town)	(Town-City)	(Village-City)
1953-59	14.18 (35.01)	13.16 (34.22)	13.65 (49.35)	0.16	1.59	1.08
1960-69	12.83 (33.46)	10.68 (30.93)	12.76 (33.47)	1.06	0.68	0.02
1970-79	12.74 (33.36)	11.73 (32.20)	6.25 (24.24)	0.77	3.01	3.59
1980-88	13.38 (34.07)	13.71 (34.44)	10.79 (31.15)	0.15	0.85	0.80

Note: quality of education is captured by percentage of mothers who are illiterate but claimed to have some formal schooling

Table 7: Impact of Mother's Education on Child's Height for Age : Specification I				
	(1) OLS	(2) IV	(3) OLS	(4) IV
Mother's Education 1_3	0.117	4.008	-0.133	-0.348
	(0.452)	(0.171)	(0.379)	(0.861)
Mother's Education 4_6	0.682	2.909	0.172	0.021
	(0.000)**	(0.002)**	(0.086)+	(0.980)
Mother's Education 7_9	0.825	1.268	0.202	2.599
	(0.000)**	(0.084)+	(0.118)	(0.046)*
Mother's Education 10_12	0.982	1.161	0.226	1.451
	(0.000)**	(0.010)**	(0.066)+	(0.012)*
Mother's Education 13+	1.494	7.437	0.631	5.120
	(0.000)**	(0.000)**	(0.001)**	(0.004)**
Girl Child	0.180	0.233	0.144	0.192
	(0.007)**	(0.011)*	(0.023)*	(0.011)*
Age in Months	-0.102	-0.101	-0.105	-0.100
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Age Squared	0.001	0.001	0.001	0.001
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Father's Education	0.027	0.055	0.004	0.048
	(0.001)**	(0.024)*	(0.613)	(0.203)
Father's Age	0.009	0.001	-0.002	-0.004
	(0.005)**	(0.796)	(0.511)	(0.375)
Mother's Age	-0.017	-0.029	-0.004	-0.021
	(0.084)+	(0.072)+	(0.643)	(0.093)+
WIFS			0.116	0.358
			(0.088)+	(0.042)*
Urban Area			-0.067	-0.035
			(0.457)	(0.772)
Piped Water (%)			0.215	0.371
			(0.092)+	(0.035)*
Prenatal Care (%)			0.195	0.273
			(0.197)	(0.369)
Visited by FP Worker (%)			0.350	-0.066
			(0.440)	(0.914)
Over-identification Test (d.f.)		5.59 (8)		7.938 (8)
[P Value]		[0.6927]		[0.4396]
Wu-Hausman Test (d.f)		20.50 (5)		3.24 (5)
[P Value]		[0.00000]		[0.00636]
Durbin-Wu-Hausman Test (d.f.)		100.31 (5)		16.27 (5)
[P Value]		[0.00000]		[0.00612]
Observations	3826	3826	3826	3826
R-squared	0.169		0.254	

Other Controls Include: 5 Division dummies: North East, North West, South East, South South, South West
Robust p values in parentheses, + significant at 10%; * significant at 5%; ** significant at 1%
Instrument Set=Mother's birth cohort*Childhood place of residence and Muslim and Christian Religion

Table 8: Impact of Mother's Education on Child's Height for Age : Specification II				
	(1) OLS	(2) IV	(3) OLS	(4) IV
Mother's Education 1_5	0.391	3.201	-0.011	0.407
	(0.001)**	(0.149)	(0.931)	(0.814)
Mother's Education 6	0.702	2.337	0.191	0.644
	(0.000)**	(0.044)*	(0.074)+	(0.112)
Mother's Education 7_8	0.789	1.001	0.187	0.278
	(0.000)**	(0.677)	(0.231)	(0.104)
Mother's Education 9	0.873	3.551	0.212	6.596
	(0.000)**	(0.419)	(0.226)	(0.084)+
Mother's Education 10_12	0.982	1.121	0.213	1.135
	(0.000)**	(0.013)*	(0.068)+	(0.071)+
Mother's Education 13+	1.494	7.084	0.631	3.036
	(0.000)**	(0.000)**	(0.001)**	(0.038)*
Girl Child	0.180	0.248	0.144	0.191
	(0.007)**	(0.008)**	(0.023)*	(0.026)*
Age in Months	-0.102	-0.099	-0.105	-0.096
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Age Squared	0.001	0.001	0.001	0.001
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Father's Education	0.027	0.056	0.004	0.039
	(0.001)**	(0.015)*	(0.647)	(0.023)*
Father's Age	0.009	0.001	-0.002	-0.006
	(0.003)**	(0.789)	(0.513)	(0.351)
Mother's Age	-0.017	-0.034	-0.004	-0.030
	(0.092)+	(0.067)+	(0.636)	(0.060)+
WIFS			0.111	-0.122
			(0.100)+	(0.549)
Urban Area			-0.067	-0.214
			(0.458)	(0.211)
Piped Water (%)			0.215	0.417
			(0.109)	(0.045)*
Prenatal Care (%)			0.202	0.048
			(0.182)	(0.812)
Visited by FP Worker (%)			0.319	0.885
			(0.481)	(0.373)
Over-identification Test (d.f.)		5.381 (7)		3.618 (7)
[P Value]		[0.6136]		[0.8226]
Wu-Hausman Test (d.f)		17.30 (6)		3.43 (6)
[P Value]		[0.00000]		[0.00222]
Durbin-Wu-Hausman Test (d.f.)		101.60 (6)		20.64 (6)
[P Value]		[0.00000]		[0.00212]
R-squared	0.168		0.254	
Observations	3826	3826	3826	3826

Other Controls Include: 5 Division dummies: North East, North West, South East, South South, South West
Robust p values in parentheses, + significant at 10%; * significant at 5%; ** significant at 1%
Instrument Set=Mother's birth cohort*Childhood place of residence and Muslim and Christian Religion

Table 9: F Tests for First Stage Child Health Regressions (For table 7)		
For Column (2)	F(13, 3819)	p-value
Edu 1_3	2.87	0.0004
Edu 4_6	11.02	0.0000
Edu 7_9	10.21	0.0000
Edu 10_12	17.61	0.0000
Edu 13+	4.88	0.0000
For Column (4)	F(13, 3807)	p-value
Edu 1_3	2.68	0.0002
Edu 4_6	4.90	0.0000
Edu 7_9	6.97	0.0000
Edu 10_12	8.23	0.0000
Edu 13+	3.41	0.0000
F Tests for First Stage Child Health Regressions (For Table 8)		
For Column (2)	F(13, 3819)	p-value
Edu 1_5	4.14	0.0000
Edu 6	6.60	0.0000
Edu 7_8	5.45	0.0000
Edu 9	4.69	0.0000
Edu 10_12	16.81	0.0000
Edu 13+	5.72	0.0000
For Column (4)	F(13, 3807)	p-value
Edu 1_5	2.43	0.0028
Edu 6	3.69	0.0000
Edu 7_8	4.27	0.0000
Edu 9	3.24	0.0001
Edu 10_12	8.56	0.0000
Edu 13+	4.53	0.0000

Instrument Set =Mother's birth cohort*Childhood place of residence and Muslim and Christian Religion.

Table 10: Impact of Mother's Education on Child's HAZ; Robust Estimates in the Presence of Weak Instruments					
	LIML	Fuller	BATSLS	Nagar	JIVE
Mother's Education 1_3	-0.347	-0.319	-1.685	-0.918	2.662
	(0.856)	(0.861)	(0.749)	(0.788)	(0.143)
Mother's Education 4_6	0.095	0.123	-0.683	-0.306	1.464
	(0.908)	(0.876)	(0.722)	(0.815)	(0.153)
Mother's Education 7_9	2.558	2.497	4.127	3.379	2.319
	(0.042)*	(0.037)*	(0.240)	(0.134)	(0.058)+
Mother's Education 10_12	1.479	1.472	1.659	1.570	1.017
	(0.009)**	(0.008)**	(0.042)*	(0.020)*	(0.061)+
Mother's Education 13+	5.208	5.151	5.557	5.609	4.652
	(0.003)**	(0.002)**	(0.098)+	(0.026)*	(0.001)**
Girl Child	0.191	0.190	0.215	0.204	0.213
	(0.011)*	(0.011)*	(0.022)*	(0.014)*	(0.000)**
Age	-0.100	-0.100	-0.098	-0.099	-0.099
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Age Squared	0.001	0.001	0.001	0.001	0.001
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Father's Education	0.049	0.048	0.057	0.055	0.031
	(0.003)**	(0.003)**	(0.011)*	(0.006)**	(0.017)*
Father's Age	-0.004	-0.004	-0.005	-0.004	-0.003
	(0.372)	(0.374)	(0.400)	(0.371)	(0.467)
Mother's Age	-0.021	-0.021	-0.024	-0.024	-0.008
	(0.091)+	(0.092)+	(0.119)	(0.098)+	(0.374)
WIFS	-0.353	-0.345	-0.516	-0.449	-0.128
	(0.044)*	(0.044)*	(0.079)+	(0.050)*	(0.403)
North East	-0.418	-0.413	-0.549	-0.487	-0.233
	(0.009)**	(0.008)**	(0.089)+	(0.033)*	(0.119)
North West	-0.959	-0.956	-1.028	-0.994	-0.775
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
South East	-0.027	-0.025	-0.092	-0.060	-0.032
	(0.902)	(0.909)	(0.760)	(0.816)	(0.834)
South South	-0.082	-0.076	-0.232	-0.157	0.085
	(0.726)	(0.738)	(0.606)	(0.628)	(0.529)
South West	-0.411	-0.410	-0.461	-0.432	-0.207
	(0.017)*	(0.015)*	(0.101)	(0.050)*	(0.120)
Urban Area	-0.032	-0.034	0.035	-0.000	-0.054
	(0.789)	(0.772)	(0.876)	(1.000)	(0.553)
Piped Water (%)	0.374	0.372	0.437	0.408	0.220
	(0.035)*	(0.035)*	(0.068)+	(0.046)*	(0.102)
Prenatal Care (%)	0.229	0.220	0.499	0.367	-0.248
	(0.426)	(0.432)	(0.456)	(0.414)	(0.349)
Visited by FP Worker (%)	-0.063	-0.052	-0.325	-0.202	0.419
	(0.917)	(0.930)	(0.719)	(0.784)	(0.396)
Observations	3804	3804	3804	3804	3804

Robust p values in parentheses, + significant at 10%; * significant at 5%; ** significant at 1%

F test for testing the equality of education dummies: Table 7, Column 4.

```
.  test edu1_3 edu4_6;

 ( 1)  edu1_3 = 0
 ( 2)  edu4_6 = 0

           chi2(  2) =    0.04
         Prob > chi2 =    0.9818

.  test edu4_6 edu7_9;

 ( 1)  edu4_6 = 0
 ( 2)  edu7_9 = 0

           chi2(  2) =    5.23
         Prob > chi2 =    0.0731

.  test edu4_6 edu10_12;

 ( 1)  edu4_6 = 0
 ( 2)  edu10_12 = 0

           chi2(  2) =    6.34
         Prob > chi2 =    0.0421

.  test edu4_6 eduh;

 ( 1)  edu4_6 = 0
 ( 2)  eduh = 0

           chi2(  2) =    8.99
         Prob > chi2 =    0.0112


. test edu1_3 = edu4_6;

 ( 1)  edu1_3 - edu4_6 = 0

           chi2(  1) =    0.04
         Prob > chi2 =    0.8479

. test edu4_6=edu7_9;

 ( 1)  edu4_6 - edu7_9 = 0

           chi2(  1) =    2.92
         Prob > chi2 =    0.0655

.  test edu4_6 =edu10_12;

 ( 1)  edu4_6 - edu10_12 = 0

           chi2(  1) =    2.99
         Prob > chi2 =    0.0579
```

```
. test edu4_6 =eduh;

 ( 1)  edu4_6 - eduh = 0

           chi2(  1) =    8.49
         Prob > chi2 =    0.0036

. test edu1_3=edu7_9;

 ( 1)  edu1_3 - edu7_9 = 0

           chi2(  1) =    2.10
         Prob > chi2 =    0.0941

. test edu1_3=edu10_12;

 ( 1)  edu1_3 - edu10_12 = 0

           chi2(  1) =    7.69
         Prob > chi2 =    0.0060

. test edu1_3=eduh;

 ( 1)  edu1_3 - eduh = 0

           chi2(  1) =    7.06
         Prob > chi2 =    0.0079

.  test edu4_6 edu7_9 edu10_12 eduh;

 ( 1)  edu4_6 = 0
 ( 2)  edu7_9 = 0
 ( 3)  edu10_12 = 0
 ( 4)  eduh = 0

           chi2(  4) =   18.96
         Prob > chi2 =    0.0008

.  test edu1_3 edu4_6 edu7_9 edu10_12 eduh;

 ( 1)  edu1_3 = 0
 ( 2)  edu4_6 = 0
 ( 3)  edu7_9 = 0
 ( 4)  edu10_12 = 0
 ( 5)  eduh = 0

           chi2(  5) =   19.03
         Prob > chi2 =    0.0019
.  test edu7_9 edu10_12 eduh;

 ( 1)  edu7_9 = 0
 ( 2)  edu10_12 = 0
 ( 3)  eduh = 0

           chi2(  3) =   18.92
         Prob > chi2 =    0.0003
```