ONE MORE YEAR OF SCHOOLING OR WORK: GRADE-TRANSITION AND CHILD LABOR IN RURAL BANGLADESH

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ABSTRACT

This paper aims to identify main factors hindering the achievement of universal primary education (Millennium Development Goal 2) for children in Rural Bangladesh using a large household survey data. It estimates a bivariate probit model to analyze the effects of parental education, household resources, and other child-specific and household characteristics on the grade-transition and child labor of children aged 7-14 years in Rural Bangladesh. We find that the effects of parental education, birth-order, and interruptions in schooling are *grade-specific*. Father's education has greater effect on the grade-transition in lower grades, while mother's education has greater effect on the grade-transition in higher grades. First-born children and children whose schooling has been interrupted in lower grades are less likely to transit to the next grade and are more likely to participate in the labor force.

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INTRODUCTION

In the last two decades, Bangladesh has made impressive gains in expanding access to schooling and eliminating gender disparity in the school enrollment and attainment (UNESCO 2012). However, it is unlikely to achieve the goal of universal primary school enrollment and completion for children by 2015 (Millennium Development Goal (MDG) 2) due to significant school drop-out rate in earlier grades (UNESCO 2012).

In this paper, we empirically examine factors affecting the grade-transition and the labor force participation of children aged 7-14 years in rural Bangladesh using the Multiple Indicator Cluster Survey (MICS) 3 2005-2006 data. We address following important questions: (i) effects of family background and resources and child-specific characteristics on the grade-transition and child labor and (ii) whether these effects vary across grade levels.

Our data shows that school enrollment for children aged 7-14 years with no prior schooling is near universal (97.22%) in rural Bangladesh. Almost all children in the age group 7-14 years had at least one year of schooling. But, data shows significant school drop-out starting from grade 2 with the average drop-out rate per-grade being 12.5% over grades 2-4. School drop-out rate varies considerably over grades and male children are more likely to drop out than female children.

Bangladesh is also a country with a very high incidence of child labor. Our calculation suggests that 41% of children aged 7-14 years participated in the labor market activities (at least 7 hours a week) in 2005-06. The labor force participation rate was significantly higher for female children (46.2%) compared to male children

(35.1%). About 32.6% of children combined study and work with the percentage of female children combining both activities (39.4%) being considerably higher than of male children (25.7%). Also the labor force participation varied considerably by grades for both male and female children, with the labor force participation being much higher in later grades.

Our paper makes two important contributions to the existing literature on schooling and child labor. Firstly, we jointly analyze factors affecting the grade-transition and the labor force participation of children. In the context of countries like Bangladesh where nearly all children of school-age enter school, the relevant question faced by parents is whether children should continue in school rather than whether they should enroll in school (Orazem and King 2007). Also, as discussed above, a considerable proportion of children combine work and study. The focus on the grade-transition of children enrolled in lower grades and their labor force participation allows us to directly identify main factors hindering the achievement of MDG 2 in rural Bangladesh.

Secondly, in our estimation we allow various household and child-specific factors to affect the grade-transition and the labor force participation decisions differently by grades. The return from schooling, its cost, and work opportunities depend on grade already completed. For example, in Bangladesh primary schooling is free, but not the secondary schooling. Secondary schools are far fewer in number than primary schools and schooling hours increase with grade. Both these factors reduce the opportunity to combine work with study for children in higher grades. Also, it is likely that more able and motivated children and children with more supportive and capable parents progress to higher grades. Thus, ignoring grades already completed in analyzing schooling decisions may lead to omitted variable bias.

In the paper, we develop a model in which parents make decision about the grade-transition and the labor force participation of their children taking grade *already completed* as given. At any point in time, a child can be in four states: `Study and Work', `Just Study', `Just Work' and `Neither Study nor Work" for a given grade already completed. We estimate a bivariate probit model for the grade-transition and the labor force participation by children for rural Bangladesh.

Our results show that parental education has a significant positive effect on the grade-transition and a significant negative effect on the labor force participation. Children of more educated parents are more likely to transit to the next grade and just study and are less likely to participate in the labor force, combine study and work, and just work. We also find that the positive effect of mother's education on the probability of grade-transition and just study is larger on children in higher grades. On the other hand, it has a greater negative effect on the probability of just work on children in higher grades. Overall results show that father's education has greater effect on the grade-transition in lower grades, while mother's education has greater effect on the grade-transition in higher grades.

Results suggest that birth-order has larger effect on the grade-transition and the labor force participation of children in lower grades. First-born children in lower grades are less likely to transit to the next grade and just study. On the other hand, they are more likely to participate in the labor force, combine study and work, and just work. Similarly, results show that children who experienced interruptions in schooling in lower grades are more likely to participate in the labor force and combine study and work, and are less likely to just study compared to children who experienced interruptions in schooling in higher grades.

There is a growing empirical literature which examines factors affecting schooling and the incidence of child labor in Bangladesh (references in the text). However, there are few studies which have examined factors affecting school progression and drop-out and child labor (Ridao-Cano 2001, Canals-Cerda and Ridao-Cano 2004, Sabates et. al. 2010). Ridao-Cano (2001) using data from 1996 Matlab Health and Socio-Economic Survey for *young adults* aged 15-25 years analyze the effect of prior (market) work experience on the transition from the primary to secondary school in rural Bangladesh. Canals-Cerda and Ridao-Cano (2004) generalize this analysis to examine the effects of prior work experience on school enrollment, completion of primary grade, and transition to secondary school for young adults. These studies find that prior work experience has a significant negative effect on the transition from one schooling level to other.

Sabates et. al. (2010) examine the effects of child labor and other household factors on school drop-out for children aged 6-15 years using data from the survey of six districts of rural Bangladesh for the period 2007-09 in a univariate framework. They find that child labor and parental income and education are significant determinants of school drop-out.

Rest of the paper is organized as follows. Section 2 presents a simple theoretical framework to draw out the effects of individual, household, and socio-economic characteristics on the grade-transition and child labor. Section 3 provides preliminary analysis of data. Section 4 describes the econometric model and the explanatory variables used in the estimation. Section 5 discusses the regression results. Section 6 concludes and discusses the policy implications.

THE THERORETICAL MODEL

We first present a simple theoretical model of schooling and child labor based on Kumar (2013) to motivate the empirical analysis. Consider a household consisting of a parent (*p*) and a child (*k*). In period 1, child is endowed with one unit of time, which can be used for work, study, and leisure. The time spent studying in period 1 increases the human capital/earnings of child next period. All decisions regarding child are made by the parent.

Let l and s be the time spent working and studying respectively by child in period 1. The human capital function of a child is given by $E(h_2, B)$ where h_2 is the human capital of child in period 2, and B is the vector of exogenous factors which can affect the human capital function such as scholastic ability/motivation of children, parental ability/motivation, children capacity to work, and household and school environment. h_2 is given by

$$h_2 = (1-\delta)h_1 + s \qquad (2.1)$$

where h_1 is the *highest grade completed previously by the child* and δ is the rate of depreciation of human capital. In the rest of the paper, we refer to h_1 as *grade-completed*. The human capital function is an increasing and concave function of h_2 with $E(0, B)>0$.[1] Consumption of child in period 2 depends on its human capital, h_2.

The parent is altruistic and her utility depends not only on her own consumption in period 1, c_1^p, but also on the utility of child. The utility of child depends on her leisure in period 1 and consumption in period 2, c_2^k. The parental utility function is given by

$$W^p = U(c_1^p) + \lambda[U(c_2^k) - M(l+s)] \qquad (2.2)$$

where function $U()$ is a twice continuously differentiable, strictly increasing, and concave function of consumption. $M()$ is a twice continuously differentiable, strictly increasing, and convex function of disutility incurred from studying and working, $l+s$. Parameter $0<\lambda<1$ measures the degree of parental altruism.

Let w and p_s be the earnings of the child and the cost of schooling per unit of time respectively. The parent chooses time spent working and studying by child and her own consumption, taking grade-completed, h_1, as given. Let A be the earnings of the parent. The budget constraints in two periods are

$$c_1^p = A + wl - p_s s \;\& \qquad (2.3)$$

$$c_2^k = E(h_2, B). \qquad (2.4)$$

The parental optimization problem is

$$\max_{c_1^p, l, s} U(c_1^p) + \lambda[U(c_2^k) - M(l+s)]$$

subject to the budget constraints 2.3 and 2.4. The first order conditions associated with the optimal choices are

$$l: \ U_c(c_1^p)w = \lambda M_l(l+s), \ \text{if } l > 0; \tag{2.5}$$

$$l: \ U_c(c_1^p)w \leq \lambda M_l(l+s), \ \text{if } l = 0; \tag{2.6}$$

$$s: \ \lambda U_c(c_2^k)E_s(h_2, B) = U_c(c_1^p)p_s + \lambda M_s(l+s), \ \text{if } s > 0 \ \& \tag{2.7}$$

$$s: \ \lambda U_c(c_2^k)E_s(h_2, B) \leq U_c(c_1^p)p_s + \lambda M_s(l+s), \ \text{if } s = 0. \tag{2.8}$$

(2.5) equates the marginal benefit of child labor with its marginal cost. If the marginal cost of child labor exceeds its marginal benefit, the parent would choose *l=0*. (2.6) characterizes this condition. Similarly, (2.7) equates the marginal benefit of studying to its marginal cost. If the marginal cost of studying exceeds its marginal benefit, the parent would choose *s=0*, and the child would not transit to the next grade. (2.8) characterizes this condition.

Using the first order conditions and the budget constraints, one can derive the optimal time spent studying, $s^*(h_1; A, B, p_s, w, \lambda, \delta)$, and working, $l^*(h_1; A, B, p_s, w, \lambda, \delta)$, with $s^*>0$ indicating grade-transition. The first order conditions show that a child in a household can be in four states: `study and work' ($s>0, l>0$), `just study' ($s>0, l=0$), `just work' ($s=0, l>0$), and `neither study nor work' ($s=0, l=0$) in period 1 for a given grade-completed, h_1. Let $S \in [0,1]$ and $L \in [0,1]$ denote the grade-transition and the labor force participation status of a child, where 0 indicates non-participation and 1 indicates participation in the relevant activity.

Using the optimal strategies of the parent, s^* and l^*, one can derive the indirect utility or the value function of a particular type of household. Let $V_{SL}(h_1)$ be the value function of a household in state *SL*. A utility maximizing parent will choose the state with the highest value function, i.e.

$$max < V_{11}(h_1), V_{10}(h_1), V_{01}(h_1), V_{00}(h_1) > . \tag{2.9}$$

Suppose now that in the economy there are large number of heterogeneous households, which potentially differ in terms of grade-completed, earnings, degree of altruism, human capital function, and other economic, social, and demographic characteristics. Then each parent having a child with grade-completed, h_1, will choose the state with the highest value function. This will determine the probability that a child with grade-completed, h_1, is in the state *SL* in the economy.

DATA

Data are drawn from the rural samples of the Bangladesh Multiple Indicator Cluster Survey 3 for 2005-2006, a nationally representative survey especially designed to monitor the situation of children and women. This survey was conducted in 2005 during the June-October period. It provides detailed information on the employment activities of children, the time allocated to various employment activities, and schooling. The employment activities include household chores, working in the household farms and businesses as well as working for outsiders.

The sample consists of 36,326 children aged 7-14 years in 21457 households with 18,077 male and 18,249 female children. It provides information on whether a child attended school in the survey year (school year 2005) and in the previous year (school year 2004), the highest grade completed in previous years (prior to year 2005), number of hours worked by children in various employment activities in the reference week, and other child-specific, household-specific, and community characteristics.

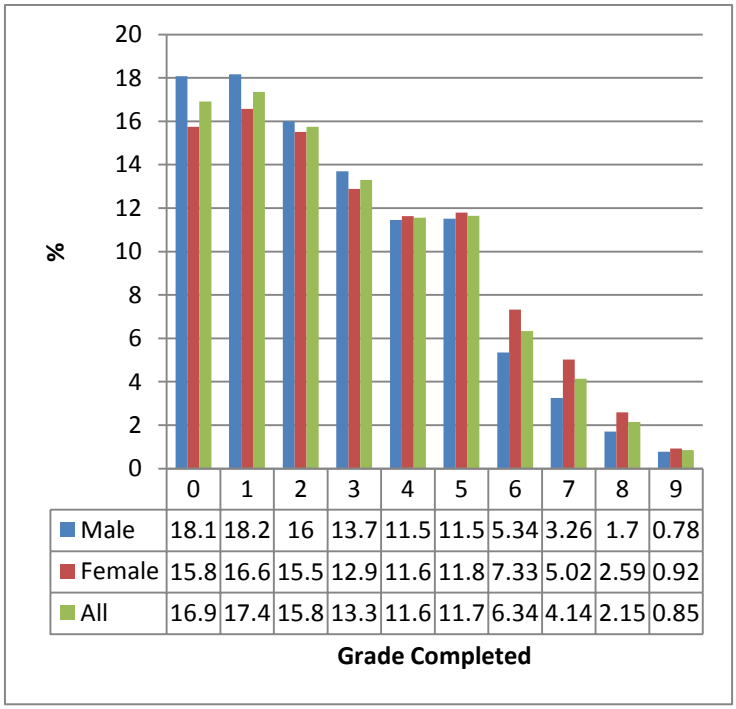
Using this information, we create dummy variables for the grade-transition and the labor force participation by children. The grade previously completed (grade-completed) is coded 0, if no grade has been completed by a child, 1 if a child has completed grade 1 and so on. Thus, number 5 indicates that a child has completed primary

school. The dummy for grade-transition takes value 1 if the child attended school in the school year 2005 and 0 otherwise.

The dummy for labor force participation takes value 1 if a child worked 7 hours or more in the reference week and 0 otherwise. Work activities include household chores, working in the household farms and businesses as well as working for outsiders. The cut-off of 7 hours is taken for several reasons. This minimal level of threshold is more likely to create trade-off among schooling, work, and leisure. It may also help to reduce the effects of measurement error. Work by children, especially for female children, is likely to be under-reported or even not reported for those working few hours (Edmonds 2007). Treating very low observed hours of employment as not employed helps to address such inconsistencies.

Figure 1 plots the distribution of children over grade-completed. The reported grade-completed varies between grade 0 to grade 10. Since very few children have reported grade-completed 10 (less than 0.1%), we have combined the number of children with grade-completed 9 and 10 in the analysis. In the data, 86.5% of children have grade-completed five or less. The proportion of female children having completed some secondary schooling (15.9%) is higher than for male children (11.08%).

FIGURE 1: DISTRIBUTION OF CHILDREN OVER GRADE COMPLETED



	0	1	2	3	4	5	6	7	8	9
Male	18.1	18.2	16	13.7	11.5	11.5	5.34	3.26	1.7	0.78
Female	15.8	16.6	15.5	12.9	11.6	11.8	7.33	5.02	2.59	0.92
All	16.9	17.4	15.8	13.3	11.6	11.7	6.34	4.14	2.15	0.85

Table 1 reports the probabilities of grade-transition and labor force participation by children. It shows that the marginal probability of grade-transition was 0.89, with the probability of grade-transition of female children (0.92) being higher than of male children (0.87). 41% of children participated in work activities, with the marginal probability of labor force participation for female children (0.46) being substantially higher than for male children (0.35). Thus, female children are more likely to transit to the next grade and also participate in labor activities.

TABLE 1: MARGINAL AND JOINT PROBABILITIES OF SCHOOL AND LABOR FORCE PARTICIPATION

Variable	Male	Female	Total
	Marginal Probabilities		
Grade-Transition	0.871	0.916	0.894
Labor Participation (> 7 Hours/Week)	0.351	0.462	0.407
	Joint Probabilities		
Study and Work	0.257	0.394	0.326
Just Study	0.614	0.522	0.568
Just Work	0.094	0.068	0.081
Neither Study Nor Work	0.035	0.015	0.0249
Total Observations	18077	18249	36326

Table 1 also shows that 33% of children combined study and work with this percentage being considerably higher for female children (39.4%) compared to male children (25.7%). Majority of children specialized in studying (56.8%) with significantly more male children specializing in studying (61.4%) than female children (52.2%). About 8% of children specialized in work with male children more likely (9.4%) to specialize in work than female children (6.8%).

Figure 2 plots the probability of grade-transition over grade-completed. It shows that the probability of grade-transition has a U-shaped relationship with grade-completed, with this probability being the lowest at grade-completed 5. Data shows substantial decline in the probability of grade-transition between grade-completed 2 to 5, particularly for male children.

FIGURE 2: GRADE TRANSITION OVER GRADE COMPLETED

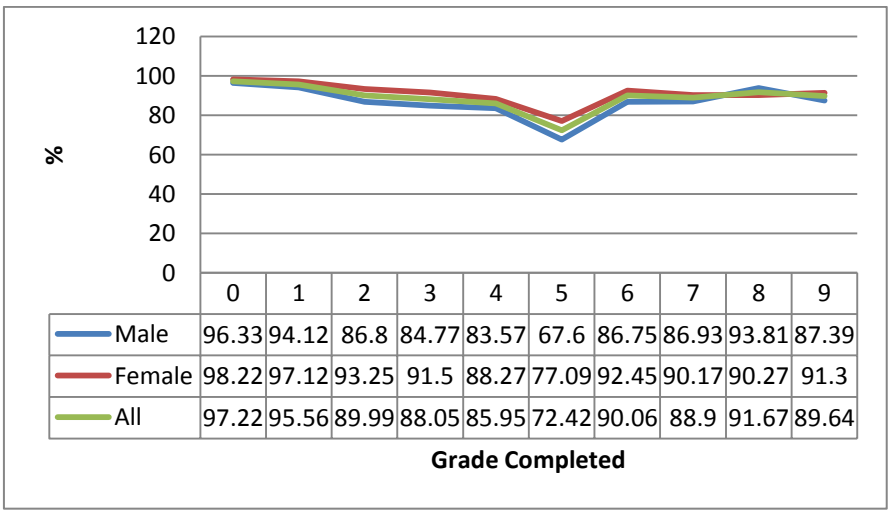
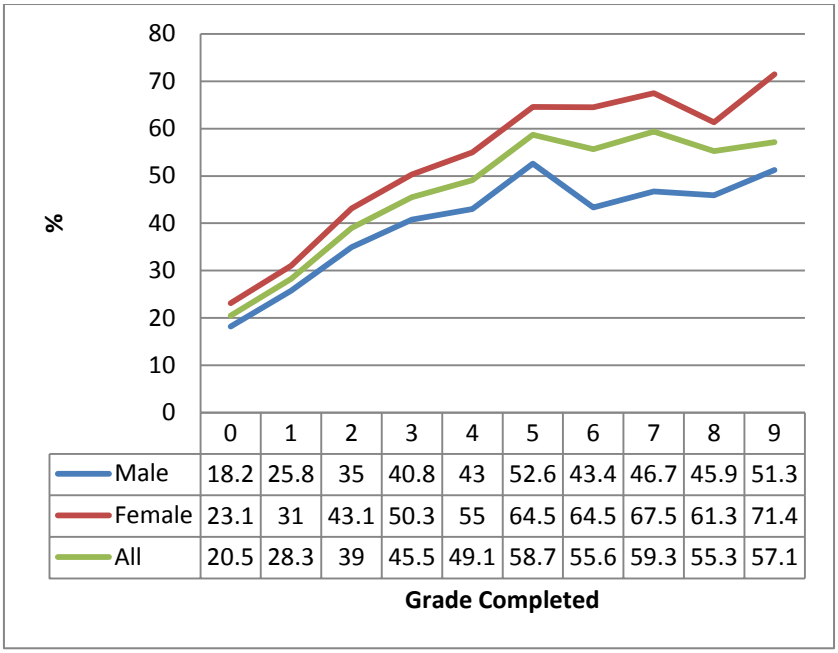


Figure 3 plots the probability of labor force participation over grade-completed. It shows that the probability of labor force participation is an increasing and concave function of grade-completed. The probability of labor force participation increases sharply with grade till grade-completed 5. Figure also shows that the probability of labor force participation by female children is higher than of male children for all grade-completed.

FIGURE 3: LABOR FORCE PARTICIPATION OVER GRADE COMPLETED



ECONOMERTIC MODEL AND EEPLANATORY VARIABLES

Econometric Model

The theoretical model suggests that both the grade-transition and the labor force participation by children are jointly determined. Thus, we use the bivariate probit regression model to jointly estimate the grade-transition and the labor force participation equations. The model allows for the fact that the error terms of the grade-transition equation and the labor force participation equation can be correlated. Let sp_i and lp_i denote the probabilities of grade-transition and labor force participation by the ith child respectively. Then the estimated equations are

$$sp_i = \kappa X_i + \nu_i \; \& \qquad (4.1)$$

$$lp_i = \gamma X_i + \epsilon_i \qquad (4.2)$$

where X is the matrix of explanatory variables including grade-completed, κ and γ are the associated vectors of coefficients, and $v \sim N(0,1)$ and $\varepsilon \sim N(0,1)$ are joint normally distributed error terms with $cov(v, \varepsilon) = \rho$. In the estimation, the standard errors are clustered at the household level to take into account correlation across siblings within a family.

Note that at the time of decision making by the parent, grade-completed by a child is a predetermined variable. However, it is the result of past decisions made by the parent and depends on all the factors in B such as the ability of children and their motivation, the parental background, and the school and the household environment. Thus, grade-completed will not be exogenous variable in a fuller model and the association between grade-completed and the grade-transition and the labor force participation cannot be interpreted as a causal relationship.

Explanatory Variables

As discussed earlier, the human capital function of a child depends on grade-completed and other child-specific, household-specific, and community characteristics. Grade-completed may have a non-linear relationship with the grade-transition and the labor force participation. Thus, we use grade-completed (Grade-Comp) and its square (Grade-Comp-Sqr) as explanatory variables.

We proxy components of vector B by the gender of the child, educational level of parents, whether the child repeated his/her grade and whether there was interruption in schooling of the child in previous years. To account for gender differences, we create a dummy variable (Male), which takes value 1 if a child is male and 0 otherwise. We interact grade-completed with male dummy (Male*Grade-Comp) in order to capture the differential effects of gender on the grade-transition and child labor over grade-completed.

Literature suggests that educational levels of father and mother have a significant positive effect on the human capital investment of their children (Orazem and King 2007). This positive effect may be due to genetics or the educated parents may be putting more value on the education of their children and providing them with a more supportive learning environment. Parental education may have differential effect on the grade-transition and the labor force participation of children depending on grade-completed. Children in higher grades may require more direct involvement of parents in their studies. Alternatively, the ability of parents to help in studies of their children in higher grades may be limited, particularly for parents with low educational levels. Additionally to the extent, children with higher ability and motivation progress to higher grades, parental support, education, and ability may have greater effect on them. Thus, the effect of parental education and ability may have larger effects on the grade-transition and the labor force participation in later grades. At the same time, children with very high ability and motivation may progress to higher grades and transit to the next grade regardless of parental background. In this case, there may not be a significant effect of parental education on the grade-transition and its effect may not vary over grade-completed. In addition, father's and mother's education may have differential effect on the human capital investment of children (Doss 2013). This differential effect may be due to differences in their preference for education and relative bargaining power in the household decision making.

Data provides information on the educational attainment of both mother and father (none, primary incomplete, primary complete, secondary incomplete, secondary completed or higher). We create variables for education levels of mother (Mother-Edu) and father (Father-Edu) which take value from 0 to 4 with 0 indicating no education and 4 indicating secondary completed or higher. We interact mother and father education levels by male dummy (Mother-Edu*Male and Father-Edu*Male) and grade-completed (Mother-Edu*Grade-Comp and father Father-Edu*Grade-Comp).

Studies indicate that repetition of grades and interruptions in schooling have significant effect on the school dropout and enrollment (Orazem and King 2007, UNESCO 2012). Repetition of grades and interruptions in schooling may be due to lower scholastic ability and motivation of children or ill health and physical disabilities or other adverse circumstances.

Data provides information on whether a child attended school in the previous year (school year 2004) and the grade attended. Combining the information on the grade attended in the previous year with grade-completed by a child, we create a dummy variable to indicate whether the child completed the grade attended in the previous year (Non-Repeat). If the grade attended by a child in the previous year and the grade-completed are same, then this variable takes value 1 and 0 otherwise. We also interact this variable with the male dummy (Non-Repeat*Male) and grade-completed (Non-Repeat-Student*Grade-Comp).

Using the information on whether a child attended school in the previous year (school year 2004) and the grade-completed, we create a dummy variable (Gap-Student) to capture whether a child has interruption in schooling. If the child did not attend school in school year 2004, but reported grade-completed of at least 1, then this variable takes value 1 and 0 otherwise. We also interact this variable with the male dummy (Gap-Student*Male) and grade-completed (Gap-Student*Grade-Comp).

Empirical and theoretical literature suggests that income and wealth of households are important factors in determining access to education and the incidence of child labor (Orazem and King 2007, Edmonds 2007). In general, income and wealth are expected to have a positive effect on schooling and a negative effect on child labor. The reason is that poor and financially constrained households are less likely to afford the direct and the indirect costs of schooling. However, in the case of an imperfect labor market where opportunities of work are limited for children, wealthy households may have more productive work opportunities for children. This may induce a positive (negative) correlation between income/wealth and child labor (schooling) (see Bhalotra and Heady 2003 on the wealth paradox).

The MICS data provides a wealth score for each household which is based on the principal component analysis of different kinds of assets owned by the households. In the analysis, we use wealth-score (Wealth), its square (Wealth-Sqr), and its interaction with male dummy (Wealth*Male) as explanatory variables. To capture the differential effects of wealth on the grade-transition and child labor over grade-completed, we interact grade-completed with wealth-score (Wealth*Grade-Comp).

There is a large literature which suggests that birth-position of a child affects its schooling and labor force participation (see Edmonds 2007 for a review). To account for the effects of birth-position of a child, we create dummy for the birth-position with the eldest child coded as 1 (First-Born) and others as 0 and interact it with male dummy (First-Born*Male) and grade-completed (First-Born*Grade-Comp).

Explanatory variables also include other child-specific characteristics, household-specific characteristics, and regional and seasonal characteristics. Among other child-specific characteristics, we include age of the child (Age), its square (Age-Sqr), its interaction with male dummy (Age*Male), and dummy for whether a child is a direct relative of the household head (Dr). Dummy variable Dr takes value of 1 if a child is either the son or the daughter, nephew or niece, or grandchild of the household head and 0 otherwise.

The other household characteristics which are included are whether father (Father-Stay) or mother (Mother-Stay) lives in the household, number of children under age five (#Child<5), their interactions with male dummy (Father-Stay*Male, Mother-Stay*Male, #Child<5*Male), number of adults in the household (#Adults), and whether the household is connected with electricity (Elec). Dummy variable Father-Stay (Mother-Stay) takes value of 1 if father (mother) lives in the household and 0 otherwise. Dummy variable Elec takes value of 1 if the household has electricity connection, 0 otherwise. We also include the dummy for the religion of the household head (Muslim), coded 1 for being Muslim, 0 otherwise.

Apart from child and household specific characteristics, we include dummies for geographical regions and months. The MICS data was collected from 95 sub-districts of Bangladesh over five months (June, July, August, September, and October). Table A1 in appendix provides summary statistics of the dependent and the explanatory variables.

REGRESSION RESULTS

Table A2 in appendix presents regression results. Results show that the error terms of the estimated equations are negatively and significantly correlated (ρ = -0.28), justifying the use of bivariate probit model.

Below, we discuss the average marginal effects (AMEs) of main explanatory variables. The estimates of AMEs are based on the full regression model. For convenience, we group AMEs under different tables.

Table 2 presents the AMEs of grade-completed by children. Results show that grade-completed is significantly correlated with both the grade-transition and the labor force participation by children. We find that children with higher grade-completed are less likely to transit to the next grade and just study. They are more likely to work, combine both study and work, and just work. We do not find evidence of gender-differential in the effect of grade-completed.

TABLE 2: AVERAGE MARGINAL EFFECTS OF GRADE-COMPLETED

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
Grade-Comp	-0.0071*	0.0334*	0.0257*	-0.0329*	0.0077*	-0.0005
Grade-Comp-Sqr	0.0002	-0.0009	-0.0007	0.0009	-0.0002	0.0000
Grade-Comp*Male	-0.0003	-0.0024	-0.0023	0.0021	-0.0000	0.0003

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

Table 3 presents the AMEs of parental education. Results show that parental education (both mother's and father's) has significant effects on the grade-transition and the labor force participation of children. Children of more educated parents are more likely to transit to the next grade and just study. In addition, they are less likely to participate in the labor force and combine study and work and just work. We do not find evidence of gender differential in the effects of parental education on the grade-transition and the labor force participation.

TABLE 3: AVERGAE MARGINAL EFFECTS OF PARENTAL EDUCATION

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
Mother-Edu	0.0012	-0.0123**	-0.0104**	0.0116**	-0.0019	0.0007
Mother-Edu*Male	-0.0028	0.0001	-0.0018	-0.0011	0.0018	0.0010
Mother-Edu*Grade-Comp	0.0009**	-0.0011	-0.0004	0.0013***	-0.0007*	-0.0002
Father-Edu	0.0035**	-0.0159*	-0.0122*	0.0156*	-0.0037*	0.0002
Father-Edu*Male	-0.0011	0.0029	0.0020	-0.0031	0.0010	0.0001
Father-Edu*Grade-Comp	-0.0001	-0.0003	-0.0003	0.0002	0.0000	0.0001

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

We find that there are significant differences in the effects of mother's and father's education. In particular, we find that the marginal effects of the interaction term between mother's education and grade-completed on the marginal probability of grade-transition and the joint probability of just study are positive and highly significant. On the other hand, its marginal effect on the joint probability of just work is negative and highly significant.

These results suggest that effects of mother's education are grade-specific. It has larger positive effect on the probabilities of grade-transition and just study and larger negative effect on the probability of just work on children in higher grades. In addition, the comparison of marginal effects of father's and mother's education shows that the effect of father's education on the probabilities of grade-transition, just study and just work are

larger than the effects of mother education in lower grades. On the other hand, the effects of mother's education on these probabilities become larger in higher grades.

The result that parental education is a significant determinant of the grade-transition and the labor force participation by children in Bangladesh are in line with the results of previous studies, which find that parental education is an important determinant of school enrollment (Maitra 2003, Khanam 2008), grade-attainment (Maitra 2003, World bank 2007), school drop-out (Canals-Cerda and Ridao-Cano 2004, Sabates et. al 2010), and child labor (Delap 2001, Salmon 2005). The result that mother's education becomes more crucial for the grade-transition and specialization in studies and work for children in higher grades is consistent with the cultural and social norms which devolve child-care duties mostly on mothers. Mothers are more involved in the education of their children (Doss 2013) and the effect of their education is magnified with grade-completed. Swade and Lokshin (2009) find similar result for the rural areas of Pakistan.

Table 4 presents the AMEs of household wealth, birth-order, and connection to electricity. Results show that children from wealthy households are less likely to participate in the labor force and combine study and work and are more likely to specialize in studies.[2] However, we also find that the marginal probability of grade-transition has an inverted U-shaped relationship with Wealth with the turning point occurring at wealth scores of 1.63 and 0.78 for male and female children respectively.[3] In addition, there is a U-shaped relationship between the joint probability of just work and Wealth (with turning points occurring at wealth scores of 1.99 and 1.35 for male and female children respectively). We do not find evidence of Wealth having grade-specific effect on the grade-transition or the labor force participation of children.

TABLE 4: AVERAGE MARGINAL EFFECTS OF WEALTH, BIRTH-ORDER, AND ELECTRICITY CONNECTION

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
Wealth	0.0083***	-0.0596*	-0.0488*	0.0571*	-0.0108*	0.0025
Wealth-Sqr	-0.0053*	0.0067	0.0027	-0.0080***	0.0040*	0.0013***
Wealth*Male	0.0090*	0.0078	0.0129	-0.0039	-0.0051**	-0.0040*
Wealth*Grade-Comp	0.0009	-0.0015	-0.0008	0.0017	-0.0007	-0.0002
First-Born	-0.0114*	0.1111*	0.0936*	-0.1050*	0.0175*	-0.0061*
First-Born*Male	-0.0020	-0.0299*	-0.0284*	0.0264*	-0.0014	0.0035**
First-Born*Grade-Comp	0.0047*	-0.0164*	-0.0119*	0.0166*	-0.0045*	-0.0002
Elec	-0.0002	-0.0146**	-0.0133**	0.0132**	-0.0012	0.0014

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

The results that children from wealthy households are less likely to participate in the labor force and combine study and work and are more likely to specialize in studies are consistent with earlier studies which find that low income/wealth and financial constraints are important determinants of the incidence of child labor (Ravallion and Woodon 2000, Delap 2001, Amin et. al. 2004, Salmon 2005), school participation (Khanam 2008), grade-transition (Canals-Cerda and Ridao-Canals 2004, Sabates et. al. 2010) and grade attainment (Maitra 2003, World Bank 2007). However, results that children belonging to both very wealthy and poor households are less

likely to transit to the next grade and are more likely to specialize in labor and significant gender differences suggest a complex relationship among wealth, gender, grade-transition, and labor force participation.

One possible explanation for these results is that children belonging to poorer households work due to necessity, while children belonging to wealthier households work because of availability of greater and more productive opportunities to work. As discussed earlier, there is evidence that wealth - especially ownership of land - can have a positive impact on child labor, particularly of female children (Bhalotra and Heady 2003). Another possible explanation is that in wealthier households both mother and father may be involved in market work and household chores may devolve on children. Given the social and the cultural norms, such household chores are more likely to be done by female children. Salmon (2005) and Amin et. al. (2006a) find that children of working mothers, particularly female children, are more likely to work in Bangladesh.

Regarding effects of birth-order, results show that these effects are grade-specific. First-born children in lower grades are less likely to transit to the next grade and just study. On the other hand, they are more likely to participate in the labor force, combine study and work, and just work. These effects of birth-order become smaller or even get reversed on children in higher grades.

Overall, results suggest that birth-order has a significant effect on the grade-transition and the labor force participation of children in primary grades. Such grade-specific effect of birth-order can arise due to interaction among credit constraint faced by households, heterogeneity in the scholastic ability and the labor productivity of children, and social norm where older children are expected to contribute more to the household resources and take up household chores. Children who have completed higher grades may belong to better-off households and for these households credit-constraint may not bind. These children may also be of higher scholastic ability, and parents may choose to continue their schooling and reduce their labor force participation despite credit-constraint and social norms.

We also find significant gender differences in the effects of birth-order, with first-born male children are less likely to participate in the labor force and combine study and work and are more likely to just study and neither study nor work compared to first-born female children. The gender differential in the effect of birth-order is consistent with son-preference widely prevalent in Bangladesh (Khanam and Rahman 2007, Kumar 2013).

We also find that in households with electricity connection (Elec), children are less likely to work and combine study and work and are more likely to just study. The significant effect of Elec may due to the fact that households with electricity connection are better-off. In addition, areas with electricity connection may have better infrastructure and schools.

Table 5 presents the AMEs of schooling interruptions and grade repetitions. Results show that children who were not enrolled in the previous school year 2004 (Gap-Student) are significantly less likely to have grade-transition and are more likely to participate in the labor force. They are more likely to combine work and study and just work and are less likely to just study. In addition, they are more likely to neither study nor work. We also find significant gender differences, with a male Gap-Student more likely to participate in the labor force and combine work and study and less likely to just study and neither work nor study compared to a female Gap-Student. These results suggest that Gap-Students may be of relatively low stochastic ability/motivation or suffer from adverse family circumstances which force them to participate in the labor force and withdraw from school (Orazem and King 2007, Edmonds 2007). In the case, there are adverse income shocks to family, male children are more likely to drop-out of school and join the labor force given their better earnings opportunities and social norms which put restriction on girls working outside their homes.

TABLE 5: AVERGAE MARGINAL EFFECTS OF SCHOOL INTERRUPTIONS AND GRADE REPETITIONS

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
Gap-Student	-0.1148*	0.2158*	0.1222*	-0.2371*	0.0936*	0.0212*
Gap-student*Male	0.0037	0.0517**	0.0493**	-0.0457**	0.0024	-0.0061**
Gap-Student*Grade-Comp	-0.0020	-0.0147**	-0.0147**	0.0127**	-0.0001	0.0021*
Non-Repeat	0.0424*	0.0279*	0.0526*	-0.0102	-0.0247*	-0.0177
Non-Repeat*Male	0.0092**	-0.0198	-0.0121	0.0213	-0.0077**	-0.0015
Non-Repeat*Grade-Comp	0.0002	-0.0039	-0.0034	0.0036	-0.0005	0.0003

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

We also find that the effects of school interruptions are grade-specific. In particular, a Gap-Student with lower grade-completed is more likely to participate in the labor force and combine study and work, and is less likely to just study compared to a Gap-Student with higher grade-completed. The grade-specific effects of school interruptions may arise due to the fact that children with higher grade-completed may be of relatively higher scholastic ability and may belong to relatively better-off households.

We find that children who do not repeat their grades (Non-Repeat) are significantly more likely to have both grade-transition and labor force participation. They are more likely to combine work and study and are less likely to just work. Also male Non-Repeat students are more likely to transit to the next grade and are less likely to specialize in work than female children. Overall, these results suggest that children who repeat grades may suffer from illness and other physical disabilities, which put constraints on their schooling and labor force participation. Sabates et. al. (2010) also find that children who repeat their grades are more likely to drop out of school.

Table 6 presents the AMEs of other child-specific characteristics. Results show that male dummy (Male) has a significant positive effect on the marginal probability of grade-transition and a significant negative effect on the joint probability of just work and neither study nor work. These results suggest that despite commendable progress made in recent years in Bangladesh, gender bias against female children still adversely affects human capital investment of female children. Khanam (2008) also finds evidence of gender bias against female children in terms of school enrollment and labor force participation.

TABLE 6: AVERAGE MARGINAL EFFECTS OF OTHER CHILD-SPECIFIC CHARACTERISTICS

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
Male	0.1555*	-0.0244	0.0777	0.0777	-0.1022*	-0.0533*
Mother-Stay	0.0221*	-0.0685*	-0.0481**	0.0701*	-0.0205*	-0.0017
Mother-Stay*Male	-0.0098	0.0435	0.0332	-0.0430	0.0103	-0.0005
Father-Stay	0.0098	-0.0094	-0.0023	0.0121	-0.0071	-0.0026
Father-Stay*Male	-0.0131	0.0127	0.0031	-0.0162	0.0096	0.0035
Dr	0.0127*	-0.0144	-0.0049	0.0176	-0.0095*	-0.0032
Age	-0.0150**	0.1348*	0.1128*	-0.1278*	0.0220*	-0.0070**
Age-Sqr	0.0002	-0.0034*	-0.0030*	0.0032*	-0.0005**	0.0002***
Age*Male	-0.0257*	-0.0069	-0.0228	-0.0029	0.0159*	0.0098*

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

We find that whether mother lives at home (Mother-Stay) has a significant effect on both the grade-transition and the labor force participation. Children whose mother lives at home are more likely to have grade-transition and specialize in study. On the other hand, they are less likely to participate in the labor force, combine work and study, and specialize in labor. We do not find evidence of gender differential in the effect of Mother-Stay. The results suggest that in the absence of mother, household chores may devolve on children increasing their labor force participation and reducing their probability of grade-transition.

We also find that direct relatives (Dr) are more likely to have grade-transition and are less likely to specialize in labor. Finally, age (Age) has a significant effect on the grade-transition and the labor force participation. Older children are less likely to have grade-transition and just study and are more likely to participate in the labor force, combine study and work, and just work.

Table 7 presents the AMEs of other household-specific characteristics. Results show that in the households with greater number of young children (<5 years), children are more likely to participate in the labor force and combine study and work and are less likely to just study and neither study nor work. On the other hand, children in the households with greater number of adults are less likely to participate in the labor force, combine study and work, and just work and are more likely to just study and neither study nor work.

TABLE 7: AVERAGE MARGINAL EFFECTS OF OTHER HOUSEHOLD-SPECIFIC CHARACTERISTICS

	Marginal Probabilities		Joint Probabilities			
Variables	Grade-transition	Labor-Force Participation	Study and Work	Just Study	Just Work	Neither Study nor Work
#Child<5	0.0002	0.0153*	0.0140*	-0.0138*	0.0013	-0.0015**
#Child<5*Male	0.0001	-0.0048	-0.0044	0.0044	-0.0005	0.0004
#Adults	0.0004	-0.0076*	-0.0067*	0.0070*	-0.0009*	0.0006*
Muslim	-0.0014	0.0070	0.0055	-0.0069	0.0015	-0.0002

*Note: *, **, and *** indicate significance at 1%, 5%, and 10% respectively.*

The significant effects of #Child<5 and #Adults suggest that households face serious resource constraint in terms of time. Presence of younger children in the household increases the demand for labor for child care inducing households to use older children for child-care (Amin et. al. 2006a, Salmon 2005, Khanam and Rahman 2007). It may also increase household expenditure and older children may have to work to augment household resources. On the other hand, greater number of adults means that adult labor can be used for household chores and market work reducing the demand for child labor (Salmon 2005).

CONCLUSION

In this paper, we empirically examined factors affecting the grade-transition and the labor force participation of children aged 7-14 years in rural Bangladesh. Results show that father's education has larger effect on the grade-transition in lower grades, while mother's education has greater effect on the grade-transition in higher grades. First-born children and children whose schooling has been interrupted in primary grades are less likely to transit to the next grade and are more likely to participate in the labor force. Children from poorer households are more likely to participate in the labor force and combine study and work and are less likely to specialize in studies. We also find evidence of gender bias against female children in terms of human capital investment.

Appendix

TABLE A1: SUMMARY STATISTICS

Variable	Mean	Std. Dev.	Min	Max
Grade-Transition	0.89	0.31	0	1
Labor Force Participation	0.41	0.49	0	1
Grade-Completed	2.84	2.22	0	9
Age	10.34	2.25	7	14
Male	0.50	0.50	0	1
Gap-Student	0.08	0.29	0	1
Non-Repeat Student	0.79	0.41	0	1
First-Born	0.62	0.49	0	1
Direct Relative	0.95	0.21	0	1
Wealth Score	-0.33	0.59	-1.08	3.63
Mother's Education Level	0.93	1.2	0	4
Father's Education Level	1.55	1.61	0	4
Mother Lives in HH	0.95	0.21	0	1
Father Lives in HH	0.88	0.33	0	1
No. of Adults in HH	4.48	2.05	1	28
No. of Children Under 5	0.58	0.75	0	7
% of HH with Electricity Connection	0.37	0.48	0	1
% of HH with Muslim Household Heads	0.89	0.31	0	1

No. of observations: 36326. No. of Clusters: 21457

TABLE A2: REGRESSION RESULTS (BIVARIATE PROBIT)

	Grade-Transition Equation		Labor Force Participation Equation	
Variables	Coefficient	S.E.	Coefficient	S.E.
Grade-Comp	-0.1690*	0.0446	0.1067*	0.0209
Grade-Comp-Sqr	0.0041	0.0049	-0.0029	0.0019
Grade-Comp*Male	-0.0063	0.0242	-0.0076	0.0114
Gap-Student	-2.7159*	0.1648	0.6897*	0.0929
Gap-Student*Male	0.0869	0.1392	0.1653**	0.0793
Gap-Student*Grade-Comp	-0.0469	0.0411	-0.0471**	0.0219
Non-Repeat	1.0042*	0.1213	0.0892**	0.0416
Non-Repeat*Male	0.2183**	0.1085	-0.0634	0.0525
Non-Repeat*Grade-Comp	0.0059	0.0254	-0.0125	0.0149
Male	3.6778*	1.1283	-0.0781	0.3908
First-Born	-0.2686*	0.0923	0.3551*	0.0338
First-Born*Male	-0.0482	0.0878	-0.0955*	0.0352
First-Born*Grade-Comp	0.1119*	0.0214	-0.0524*	0.0096
Dr	0.3007*	0.0933	-0.0461	0.0551
Age	-0.3545**	0.1643	0.4307*	0.0562
Age-Sqr	0.0053	0.0074	-0.0109*	0.0027
Age*Male	-0.6091*	0.2070	-0.0221	0.0739
Mother-Edu	0.0275	0.0497	-0.0392**	0.0164
Mother-Edu*Male	-0.0664	0.0412	0.0002	0.0164
Mother-Edu*Grade-Comp	0.0224**	0.0097	-0.0035	0.0034
Father-Edu	0.0823**	0.0342	-0.0507*	0.0134
Father-Edu*Male	-0.0255	0.0341	0.0094	0.0141
Father-Edu*Grade-Comp	-0.0018	0.0060	-0.0009	0.0027
Wealth	0.1956***	0.1218	-0.1906*	0.0381
Wealth-Sqr	-0.1254*	0.0398	0.0214	0.0158
Wealth*Male	0.2141*	0.0848	0.0250	0.0308
Wealth*Grade-Comp	0.0204	0.0223	-0.0049	0.0066
Mother-Stay	0.5223*	0.1483	-0.2190*	0.0775
Mother-Stay*Male	-0.2321	0.2276	0.1390	0.1084
Father-Stay	0.2312	0.1581	-0.0301	0.0574
Father-Stay*Male	-0.3101	0.1979	0.0406	0.0770
#Child<5	0.0050	0.0375	0.0488*	0.0158
#Child<5*Male	0.0016	0.0469	-0.0155	0.0209
#Adults	0.0085	0.0107	-0.0242*	0.0052
Elec	-0.0038	0.0549	-0.0466**	0.0238
Muslim	-0.0322	0.0669	0.0225	0.0290
Constant	3.6905*	0.9304	-3.4340*	0.3052
Rho	-0.2758*	0.0225		
Log Likelihood	-21491.45			
Wald Chi-Sqr (208)	11561.68	0.0000		
No. of Observations	36326	No. of Clusters	21457	

*, **, and *** indicate significance levels at 1%, 5%, and 10% respectively. Regression includes regional and seasonal dummies. Standard errors are clustered at household level.

ENDNOTES

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[1] For any function $f(x)$, $f_x(x)$ and $f_{xx}(x)$ denote the first and the second derivative respectively.

[2] The joint probability of just study and Wealth has inverted U-shaped relationship. However, turning point occurs at the wealth score of 3.66, while the maximum wealth score in the data is 3.63. Thus for the relevant range of wealth score, there is a positive relationship between the two.

[3] Average, median, and 90th percentile wealth scores are -0.33, -0.51, and 0.34 respectively.

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