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Analysis of School Enrollment in Ghana: A Sequential Approach

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Abstract

In this paper, we depart from the standard way of analyzing school enrollment by accounting explicitly for educational selectivity in order to examine the determinants of child school enrollment in Ghana. Using data from the Ghana Living Standard Survey round 6 (GLSS 6), we estimate a three-step sequential logit model for the determinants of secondary school enrollment and its dependence on completing primary school. We find that family resources such as parental education, household income and the gender of the head of the household play a role in households' child schooling decisions. Educated parents are relatively more likely to enroll their children in primary school and keep them in school until they complete primary education. As well, we show that educated parents do not promote a gender-biased investment in the schooling of children at the primary level. While household welfare does not influence children's entry into primary school importantly, their completion of primary school depends on household welfare. The study sheds more light on the pro-male bias phenomenon regarding entry into primary school and primary school completion. Policies to promote the achievement of Sustainable Development Goal 4 in Ghana must be grade sensitive.

1. Introduction

For most countries, especially those in sub-Saharan Africa (SSA), the enrollment rates (gross and net) in secondary schools are substantially lower than that of primary schools. Average gross school enrollment rates at the primary and secondary levels stood at about 99.6% and 39.6% respectively in 2010 for SSA countries (World Bank, 2016). In Ghana, for instance, the gross enrollment rate in secondary schools is about two times lower than gross enrollment rate in primary schools (see Figure 1). Similarly, considering age-appropriate enrollment at the primary and secondary levels, we observe that the gap between net enrollment rate at the primary level and that for secondary have remained largely the same over the years. Net enrollment rate at the secondary level is about 20 percentage points lower than that for the primary level. Also, while gross enrollment rate at the primary level assumes an increasing trend over the period, 1999–2013, it appears, however, that the performance in terms of age appropriate enrollments at the primary and secondary levels have been relatively sluggish. This has implications on Ghana's ability to meet the proposed Sustainable Development Goal 4 (SDG 4) of ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all. The difference in enrollment rates at the primary and secondary levels gives an indication that enrollment at primary and secondary schools is influenced by different mechanisms such as differences in the quantity and quality of primary and secondary schools (Dreze and Kingdon, 1999). It may

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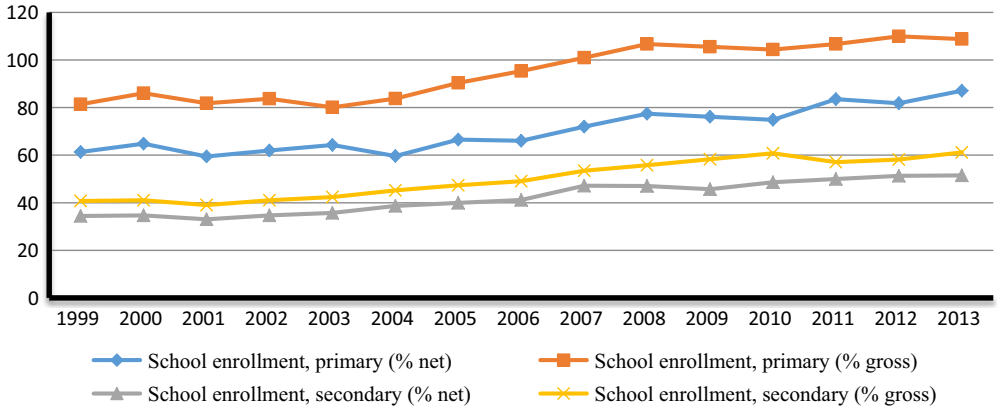

Figure 1. School Enrolment Rates (Primary and Secondary) for Ghana [Colour figure can be viewed at wileyonlinelibrary.com]
Source*: Authors' computation using data from World Bank (2016).*

also be explained by demand side factors such as drop-out or -in after primary school, and from failures in primary school (Tenikue, 2007). Given that enrollment at the primary and secondary levels is likely to be influenced by different factors, an understanding of the nature of child schooling should at least consider school progression from primary to secondary and higher levels, accounting for the conditional sequence with the previous level and the self-selection into the next higher level of schooling (Pal, 2004).

Nonetheless, extant literature on the determinants of school enrollment have investigated the subject matter by considering children of a given age group or grade (see, for instance, Psacharopoulos and Arriagada, 1987; Burney and Irfan, 1995; Dreze and Kingdon, 1999; Shapiro and Tambashe, 2000; Glick and Sahn, 2000; Sackey, 2007; Iddrisu, 2014). Most of these studies have employed static estimation techniques such as univariate probit/logit method to explain the probability that a child of given characteristics is enrolled in school or not. The drawback with these studies, however, is that they do not account for the distinction between enrollment at the primary and secondary schools and the sequence between the two levels. It is a fact that schooling is a sequencing process. The class that an individual is enrolled depends on the class that he/she has already completed. If an individual has not completed primary school, he/she will be enrolled in primary school. If she has, then she will be enrolled in secondary school. This means that parents are limited in the choice of the class or level where they can enroll their children and the constraint is child specific. For a developing country like Ghana, where the cost of primary schooling is low or non-existent relative to that of secondary schooling, this restriction may have important implications in child schooling decisions of households. Tenikue (2007) argues that the higher direct cost of schooling at the secondary level may put potential secondary school-going children, especially those from poor households at a higher risk of non-enrollment. Therefore, this study departs from the standard way of analyzing school (primary and secondary) enrollment in Ghana, by accounting, explicitly, for "educational selectivity" (Cameron and Heckman, 1998).

Using the latest round of the Ghana Living Standards Survey (GLSS 6), we construct a sequential model that relies on three sample-separating questions. (i) Is

the child enrolled in primary school? (ii) Has she completed primary school? (iii) Is she enrolled in secondary school? From these questions, we can deduce the following groups: (a) children enroll in primary school, (b) children not enrolled in primary school and who have not completed primary school, (c) children who have completed primary school but have not enrolled in secondary school, and (d) children who are enrolled in secondary school. This data structure is modeled with a three-step sequential logit model of school enrollment. Further, this approach allows us to examine both school enrollment (questions i and iii) and school attainment (question ii). The contribution of this study is threefold. First, the approach allows us to estimate (based on a three-stage sequential logit model) the determinants of enrollment at the secondary level and its dependence on completing primary school. Second, we are able to observe the differential impacts of the various explanatory variables on households' schooling decisions at different stages of education. Third, the findings from this study will serve as a useful guide to the development of educational policies that are geared towards achieving SDG 4.

This study provides important insights on households' decisions towards child schooling by examining the effects of child characteristics, household structure, family resources and locality variables on child schooling within a sequential logistic model. First, we observe that family resources such as parental education, household income and the gender of the head of the household plays a role in households' child schooling decisions. Parental education contributes significantly to the likelihood of children enrolling in primary school and completing primary school. Also, our results suggest that educated parents do not promote a gender-biased investment in the schooling of children at the primary level. While household welfare does not influence importantly children's entry into primary school since primary school entry costs are often low or non-existent, their completion of primary school depends crucially on the level of household welfare. Additionally, the study sheds more light on the pro-male bias phenomenon regarding entry into primary school and primary school completion. Our findings present important insights for educational policy formulation in developing countries.

The rest of the paper is organized as follows. Sections 2 and 3 present, respectively, the literature review and the methodological approach adopted by the study while section 4 discusses the empirical results of the study. Section 5 concludes the study.

2. Literature Review

Interest in the modeling of the determinants of child schooling in developing countries has been on the rise in recent times (from early 2000 to date). In the empirical literature, child school enrollment is influenced by a wide range of factors, including; household income (see, Chernichovsky and Meesook, 1985; Zimmerman, 2001; Jayachandran, 2002; Sackey, 2007; Rolleston, 2009), parental education (see, Psacharopoulos and Arriagada, 1987; Handa, 2002; Dostie and Jayaraman, 2003; DeGraff and Bilsborrow, 2003; Schaffner, 2004; Mani et al., 2009; Iddrisu, 2014; among many others), gender and age of the child (Conlisk, 1969; Dostie and Jayaraman, 2003; Sackey, 2007; Rolleston, 2009), sex of the household head (Lloyd and Blanc, 1996), locality (Psacharopoulos and Arriagada, 1987; Connelly and Zheng, 2003) and child work (Boozer and Suri, 2001; Amin et al., 2006; Rolleston, 2009). In terms of the effect of household income on school

enrollment, for instance, Burney and Irfan (1995) and Shapiro and Tambashe (2000) found that household income had a positive and significant effect on the probability of a child being enrolled in school while Kabubo-Mariara and Mwabu (2007) found that household poverty status influences child school enrollment insignificantly. Further, Keng (2004) found inconclusive evidence on the effect of household economic resources on child schooling in rural Cambodia. In Ghana, Sackey (2007) found that household resources are a significant determinant of school attendance for both boys and girls and that the effect is higher for girls than it is for boys while Iddrisu (2014) did not find any significant effect of household poverty status on child school enrollment in Ghana. The author maintained that this may be the result of the numerous educational sector policies such as the free basic education policy and the subsequent capitation grant and school feeding programs that reduced the direct cost of child schooling that is borne by households.

Haveman and Wolfe (1995), Connelly and Zheng (2003), Sackey (2007) and Iddrisu (2014) found that parental education had a significantly positive impact on the probability of child school enrollment. On the relative influences of father's vs mother's educational attainment on school enrollment, Haveman and Wolf (1995) observe that a mother's education tends to be more closely related to the schooling of children than that of the father, which is in sharp contrast to the findings of Burney and Irfan (1995) wherein mother's education was found to be inconsequential for children's school enrollment in rural Pakistan.

On the effect of gender on school enrollment, Dostie and Jayaraman (2003) and Rolleston (2009) established that girls are less likely to be enrolled in school than boys. This result was interpreted as indicating societal reluctance to invest in the schooling of a prospective housewife. The age of the child is associated significantly and positively with child school enrollment in a number of studies (Sackey, 2007). On the effect of the gender of the household head on the probability of enrollment, Lloyd and Blanc (1996) found that children from female-headed households are consistently more likely to be enrolled in school than children from male-headed households. Further, their results indicate that gender differences in school investments in children tend to be smaller in female-headed households. However, Galenson (1995) found that female headship is a significant negative predictor of boys schooling. Moreover, Connelly and Zheng (2003), Tenikue (2007) and Sackey (2007) found that children residing in urban areas are more likely to be enrolled in school than those living in rural areas. However, Rolleston (2009) found no significant effect in relation to locality.

Other studies have stated the importance of children's labor market activism in determining their participation in school, albeit with mixed results. For instance, while some studies have found a significant negative relationship between child schooling and child work (Rosenzweig and Evenson, 1977; Lavy, 1985; Canagarajah and Coulombe, 1997; Boozer and Suri, 2001; Amin et al., 2006; Rolleston, 2009), others (see Ravallion and Wodon, 2000) have shown that children's labor market participation and schooling are not mutually exclusive. Additionally, by disaggregating work into light work (household work/chores) and agricultural/non-agricultural work, Khanam and Ross (2005) found that there is a negative association between all types of work and the schooling of children aged 12–17 and hence, whether the work done by children is light work or not, there is a trade-off between child work and schooling. Similarly, using the 1991/92 Ghana Living Standards Survey and a trivariate probit model, Gage (2005) examined the

interrelationship between fosterage, schooling and children's labor force participation in Ghana. Gage (2005) demonstrates that children's labor force participation is negatively associated with their probability of attending school and that ignoring the endogeneity of child work in the schooling equation leads to biased estimates.

In sum, the above studies examined the determinants of child schooling by considering children of a certain age group or class/grade within a static estimation framework such as the univariate logit/probit, the ordinary least squares (OLS) and limited probability models (LPM). As indicated before, the limitation with these studies, however, is that they do not account for the distinction between enrollment at the primary and secondary schools and the sequence between the two levels, which may have a significant effect on child schooling decisions. To overcome this, a few studies have examined the determinants of school enrollment using a sequential probit/logit estimation technique (see Lillard and Willis, 1994; Pal, 2004; Tenikue, 2007; Buis, 2008). The sequential model allows us to estimate (based on a three-stage sequential logit model) the determinants of enrollment at the secondary level and their dependence on completing primary school. Further, the model allows for the simultaneous estimation of the determinants of school attendance (i.e. enrollment at secondary level) and attainment (i.e. completing primary school). Given the SDG of ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all, this study robustly examines which factors drive children to and away from school in Ghana using the sequential model.

3. Methodology and Data

Model for the Empirical Estimation

We adopt the sequential logit model proposed by Mare (1979, 1980, 1981), which describes the process of educational attainment as a sequence of decisions or steps. In this vein, we state that the demand of households for schooling is constrained by the last class that a child has successfully completed, that is, a child who has successfully completed the last class of primary school (that is, primary six, in Ghana) can only be enrolled in secondary school. These constraints are modeled in a sequential model of school enrollment. Whether or not a child passes the first, second and third transitions is represented by three indicator variables y_1, y_2 and y_3, respectively, which receive the value 1 when a child passes a transition and 0 when they fails that transition. y_1, y_2 and y_3 correspond to the first three stages of the educational transition (i.e. enrolled in primary school, completed primary school and enrolled in secondary school). Figure 2 depicts the structure of this process.

From Figure 2, we can identify four exclusive possibilities for any child: A, B, C and D. They correspond to: (A) the child is enrolled in primary school; (B) the child is not enrolled in school and has not completed primary school. This is the case of children who have never been at school and for those who started schooling and quit before the end of primary education; (C) the child is not enrolled in school and has completed primary school. This is the case of children who are not attending school but have completed primary school, a result that can be attributed to the fact that the entry cost in secondary school is higher (fees, books, travel cost, uniforms) than for primary school; and (D) the child is enrolled in school and has

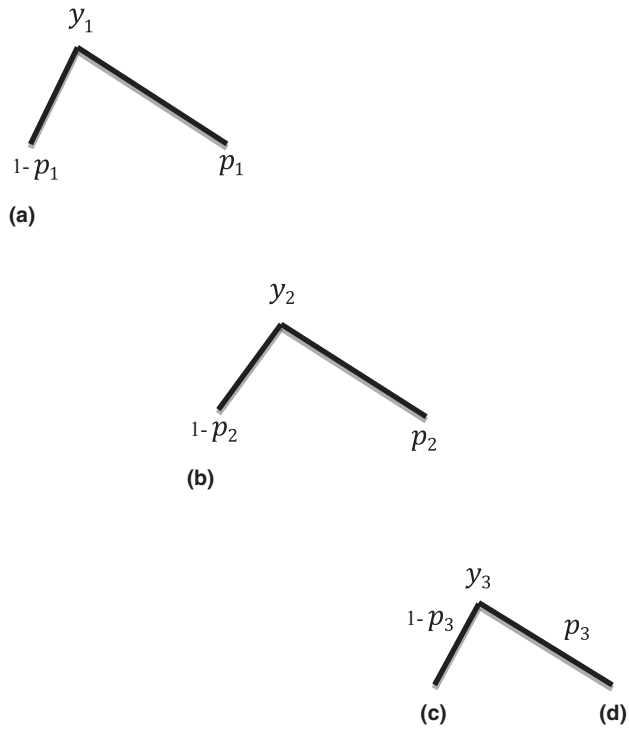

Figure 2. A Sequential Model of School Enrolment

completed primary school. This is the case of children who have completed primary school and are enrolled in secondary school.

What is clear from the above specification is that the stages are interconnected and thus, suggests that subsequent stages are subject to selectivity with respect to earlier stages. If n_j represents the total number of observations available at stage j ($j = 1, 2, 3$), then the total number of observations for the variable y_1 is $n = n_1 + n_2 + n_3$ (the total sample size). It is $(n_2 + n_3)$ for y_2 and n_3 for y_3. The number of observations decreases as one approaches the last stages. So, if a child has completed primary education, then she was "at risk" of passing the first two transitions, but not the third. The model assumes that one has to be "at risk" of passing a transition—that is, to have passed through all lower transitions—in order to make a decision at that transition about whether to continue education or to leave the system (Buis, 2008). Put differently, the model clearly represents the idea of educational selectivity; that is, individuals who are at risk of passing higher transitions constitute a selected subsample of the original sample (Mare, 1980; Cameron and Heckman, 1998). Consequently, the model is expressed as a form of correlated sequential logit model where the index functions at each decision point $j = 1, 2, 3$, for a child i belonging to the mth household is given as:[1]

$$Y_{jim} - \beta_j' X_{jim} + u_{jim} \tag{1}$$

where the chance of passing a particular transition depends on a set of covariates X_{jim} that vary by the stage at which such schooling decisions are made by households (j), the individual child (i) as well as the household (m). u_{jim} represents unobserved random terms and β_j' are vectors of parameters to be estimated.

By assuming that the error terms are uncorrelated (that is, u_{jim} are independent across transitions), it is possible to estimate the parameters β_j' using separate binary choice models for each decision point $j = 1, 2, 3$. However, within the sequential framework, these decisions are not independent and thus failing to account for the selectivity across stages potentially biases the estimates. Therefore, we assume that u_{jim} are correlated across stages (see, e.g. Lillard and Willis (1994) and Tenikue (2010) for a detailed discussion on this issue) with a covariance matrix of the form:

$$\begin{pmatrix} 1 & \rho_{21} & \rho_{31} \\ \rho_{21} & 1 & \rho_{32} \\ \rho_{31} & \rho_{32} & 1 \end{pmatrix}.$$

The assumption of correlated errors implies that the off-diagonal elements are non-zero (that is, the matrix is not an identity matrix). In the sequential logit model, separate logistic regressions are estimated for each step or decision on the subsample that is "at risk" of making that transition. Following Buis (2011), we outline a logistic regression for each transition on the subsample that is at risk as shown in equations (2), (3) and (4) below:[2]

$$p_1 = \Pr(y_1 = 1|x, u) = \phi(\alpha_{01} + \alpha_{11}x + \alpha_{u1}u) \tag{2}$$

$$p_2 = \Pr(y_2 = 1|x, u, y_1 = 1) = \phi(\alpha_{02} + \alpha_{12}x + \alpha_{u2}u) \tag{3}$$

$$p_3 = \Pr(y_3 = 1|x, u, y_1 = 1, y_2 = 1) = \phi(\alpha_{03} + \alpha_{13}x + \alpha_{u3}u). \tag{4}$$

Equations (2)–(4) shows that the probabilities, p_1, p_2 and p_3 are related to the explanatory variables x and u through the function $\Delta()$. The function $\Delta()$ is defined such that $\Delta(.) = \exp(.)/1 + \exp(.)$. This function ensures that the predicted probabilities always remain between 0 and 1, by modeling the effects of the explanatory variables as S-shaped curves. The coefficients of x and u (α_{11}, α_{u1}; α_{12}, α_{u2} and α_{13}, α_{u3}) can be interpreted as log odds ratios, while the constants (α_{01}, α_{02} and α_{03}) represent the baseline log odds of passing the first, second and the third transitions.

Data

The study utilized the latest wave of the Ghana Living Standards Survey (GLSS 6) conducted in 2012/13. The GLSS 6 is a multidimensional household survey that collected information on a wide variety of household and individual level variables, including detailed demographic characteristics of the population, education, health, employment and time use, migration, housing conditions and household agriculture. It consists of about 16,772 rural and urban households and 72,372 individuals. The education system in Ghana consists of 2 years of kindergarten,[3] 6 years of primary schooling followed by 3 years of Junior High School (JHS) and 3 years of Senior High School (SHS). While no compulsory universal entrance examinations are required for entry into primary and JHS, compulsory national-level examinations are conducted to qualify individuals into SHS and beyond. Leavers of the JHS system are required to sit for the Basic Education Certificate Examination (BECE), which serves as a qualifying examination for entry into the next higher level of

schooling (SHS in this case) while leavers of the SHS system are required to sit for the West African Senior Secondary Certificate Examination (WASSCE). The basic education roadmap begins with the 2 years of kindergarten through to the end of JHS. Thus, from 2002 the basic education landscape in Ghana changed from a 9-year track system to an 11-year track system as shown in Figure 3. For the purpose of the empirical analysis in this paper, we consider the subsample of children in the 6–19 years age group.

Variables

The dependent variable in the sequential model of child schooling decisions is constructed as a categorical variable based on the "tree system" presented in Figure 2. Based on the empirical literature review carried out in section 2, we deem it appropriate to include the following explanatory variables in the household schooling demand equations: (i) individual child characteristics—the class of covariates under this category include, age of the child and its square, the sex of the child and whether the child is working or not; (ii) family resources—in examining the influence of family resources on child schooling we include as regressors the educational experience of the child's father and mother, the gender of the household head and the welfare or total expenditure of the child's household. Our use of household total expenditure as a measure of household welfare is consistent with the conventional wisdom that household total expenditure, unlike household income, better captures the permanent income of the household (see Maitra (2003) for a detailed discussion on this issue). Further, the Ghana Statistical Service (GSS) uses the total household expenditure per adult equivalent as a measure of household welfare; (iii) household structure—earlier studies (see, Gage, 2005) have explored the effect of household composition on child schooling decisions. We use the size of the individual's household and its square to capture this effect; (iv) locality—the effect of rural/urban residence is also explored. We are, however, unable to control for supply side factors such as the availability of school infrastructure on child schooling decisions because, as in earlier waves of the GLSS, information on school

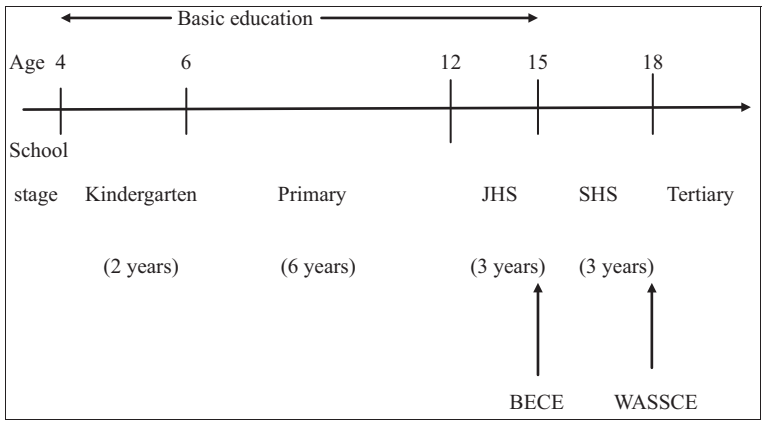

Figure 3. The Current Educational System in Ghana
Source*: Authors' illustration.*

availability is only available in the community survey of GLSS, which was restricted to rural areas. That is, information on school availability is limited to only rural communities. The effect of the locality indicator (urban vs rural) may however provide clues about the role of supply side factors in child schooling decisions since, for instance, the availability of school infrastructure is disproportionately lower in rural areas than in urban areas. Table 1 presents the description of the regression variables while the descriptive statistics of the regression parameters are presented in Table 2.

The descriptive statistics reveals that about 89% of children in the 6–19 age group are enrolled in school while the logarithm of household welfare or expenditure is 1.7 on average. The average age of children in the sample is 13 years and about a third of the children are engaged in labor market activities. Over 42% of children have fathers with a schooling experience while only about one-fourth of children have mothers who have some schooling experience. Close to 46% of the children are males and less than 2% of the children reside in male-headed households. Children residing in urban areas are less than half of the sample and the average household size is six members.

Empirical Estimation Issues

The study empirically explores the determinants of child schooling decisions using a sequential model. In this vein, we estimate both a full sample model as well as gender disaggregated models to provide further evidence on how the effect of the various covariates may vary across gender. Importantly, we compare the results of the sequential model with those of a binary dependent variable model of school enrollment for children within the 6–19 age cohort.[4] An important estimation problem that needs to be addressed in this case, however, is the endogeneity of some of the right-hand side variables. The problem of endogeneity may arise from measurement error, simultaneity and misspecification. Among the set of regressors included in this estimation, we have reason to believe that children's participation in the labor market (child work) is potentially endogenous given that children's participation in the labor market and/or schooling are made simultaneously and may be influenced by the same potentially unobserved factors.[5] Failing therefore to account for the endogeneity of child work would likely bias the estimated effect of child work on child schooling decisions. To address this concern, we estimate the determinants of child school enrollment using a bivariate probit model that controls for the endogeneity of child work. The bivariate probit model estimates two structural equations[6] simultaneously and tests the hypothesis that their error terms are correlated. If the errors are correlated then endogeneity is said to be present in the model. Arendt and Holm (2006) note that in the presence of one endogenous binary regressor, the maximum likelihood estimator of the bivariate probit model yields consistent and asymptotically efficient parameter estimates. The results of the endogeneity test, both the full sample and the subsamples (6–11 and 12–19 age groups), is shown in Table 3.

In Table 3, ρ measures the degree of correlation between the error terms of the structural equations. If ρ is significantly different from zero, it means that the errors are correlated and hence there is endogeneity. A negative value for ρ indicates that the unobserved variables have opposite effects on the two outcomes while a positive ρ value indicates that the unobserved variables influence the outcome variables in the same direction. The results of the endogeneity test

Table 1. Description of Regression Variables

Variable	*Description*
Enrollmentsq3	Categorical: It is the sequential variable of school progression. It takes values from 0 to 3—it assumes a value of: 0 if the individual is not enrolled in primary school and/or has never enrolled in school, 1 if the individual is enrolled in primary school, 2 if the individual is not enrolled in primary school but has completed primary school, and 3 if the individual is enrolled in secondary school
tenroll1	Binary: It measures the enrolment status of an individual within the 6–19 age group. This variable does not account for the sequential nature of child schooling. It takes a value of 1 for those enrolled in primary or secondary school and zero otherwise
Household welfare	Continuous: This variable measures the welfare of the individual's household. We use the logarithm of "household total expenditure per adult equivalent"
Age	Continuous: It captures the age of the individual
Age_squared	Continuous: It is the square of age. It is meant to capture the nonlinearity in the effect of age on enrolment
Urban	Binary: It captures the locality of the individual. It assumes a value of 1 if the individual is from an urban area and zero otherwise
Household_size	Continuous: It captures the size of the individual's household
Household_size2	Continuous: This is the square of household size. It is meant to capture the nonlinearity in the effect of household size on child schooling
Father's education	Binary: It captures the educational experience of the individual's father. It assumes a value of 1 if the individual's father has some educational experience and zero otherwise
Mother's education	Binary: It captures the educational experience of the individual's mother. It assumes a value of 1 if the individual's mother has some educational experience and zero otherwise
Sex_male	Binary: It captures the sex of the individual and it assumes a value of 1 if male and zero otherwise
Childwork	Binary: It captures whether or not the individual is engaged in child work and it assumes a value of 1 if engaged and zero otherwise
Sex_head_male	Binary: It captures the gender of the head of the child's household. It takes a value of 1 if the head is a male and zero otherwise

indicates that child work is endogenous to child schooling in the full sample as well as in the older children (12–19 age group) subsample. Specifically, the estimated value of ρ is significantly different from zero at the 5% and 1% levels of significance in the full sample and in the 12–19 age group subsample respectively. However, for the younger children (6–11 age group) subsample, we find evidence that child work is not endogenous to child schooling and so it is therefore not necessary to control for the endogeneity of child work when estimating a schooling-decision model for children in this age group. In essence, what this means is that an estimation of the model of child schooling decisions for both the full sample and the 12–19 age group subsample will lead to biased estimates if the endogeneity of child work is not controlled for while this may necessarily not be the case for those in the 6–11 age group. As indicated we run a bivariate probit estimation to control for endogeneity of child work in the static model. However, in the sequential estimation technique, the endogeneity of child work cannot be

Table 2. Summary Statistics of Regression Variables

Variable	*Observations*	*Mean*	*SD*	*Min*	*Max*
tenroll1	4474	0.8904783	0.3123275	0	1
Enrollmentsq3	3717	1.215765	0.8986529	0	3
Household welfare	4474	1.658081	0.7260817	−1.372291	4.465556
Age	4474	12.68105	3.871391	6	19
Age_squared	4474	175.7932	98.7983	36	361
Urban	4474	0.4613321	0.4985583	0	1
Household_size	4474	6.094099	3.171786	1	24
Household_size2	4474	47.19602	54.76509	1	576
Father's education	4474	0.4217702	0.4938974	0	1
Mother's education	4474	0.2581582	0.4376704	0	1
Sex_male	4474	0.459544	0.4984163	0	1
Childwork	4474	0.3214126	0.467071	0	1
Sex_head_male	4474	0.0111757	0.1051345	0	1

Note: SD = standard deviation

Table 3. Results of the Endogeneity Test between Child Schooling and Child Labor Force Participation (Based on the Bivariate Probit Model)

Correlation between disturbance terms	*Full sample (Age group 6–19)*		*Subsample (Age group 6–11)*		*Subsample (Age group 12–19)*	
	Coefficient	*Linearized SE*	*Coefficient*	*Linearized SE*	*Coefficient*	*Linearized SE*
Rho (ρ)	−0.436**	0.206	0.418	0.560	−0.445***	0.151
No. of observations	4474		1778		2696	

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$. SE = standard error.

controlled for because the model is limited in this regard. This, together with the general lack of support for the non-endogeneity of the child work variable in child schooling models as is evident in both the full sample and the subsample (12–19 age group) bivariate estimations, we find it plausible not to include child work as an explanatory variable in the sequential model of child schooling. Further, our empirical estimation accounts for the presence of unobserved normally distributed variables that are uncorrelated with any of the observed variables but only in the first transition.

4. Empirical Results

In this section, we present the empirical results on the determinants of child schooling. The discussion of the empirical findings sets out with the presentation of the results from the sequential estimation of child schooling decisions and how that compares with the findings from the binary dependent variable model of the

determinants of child schooling. Basically, we discuss how the results obtained from the sequential estimation of child schooling compares with those from the binary dependent variable estimation, in particular, when we account for the endogeneity of child work in the child schooling model. This is followed by a discussion of the results from a gender disaggregated model of the determinants of child schooling within a sequential estimation framework.

Discussion of Results: Sequential and Static Models

The results (marginal effects) from both the sequential estimation and the static estimation of the determinants of child schooling are presented in Table 4. Model 1 presents the estimated outcomes from the sequential model while model 2 presents the results from the binary dependent variable models (with and without controlling for the endogeneity of child work). In model 1, estimations (1)–(3) represent the three transitions involved in a household's child schooling decisions. Estimation (1) compares the choice of "not enrolled in primary vs enrolled in primary or more" while estimations (2) and (3) compare the choice of "enrolled in primary vs completed primary or more" and "completed primary vs enrolled in secondary", respectively. In effect, given the explanatory variables we estimate equations (1), (2) and (3). The bottom part of Table 4 presents a number of model fitting properties, satisfying more generally the issue of educational selectivity across stages. In fact, the presence of educational selectivity at each transition implies that the distribution of the unobserved factors will change over the transitions. Statistics such as $p(atrisk)$ and corr(e,x) confirm the presence of educational selectivity across stages. In particular, $p(atrisk)$ shows that the population that is at risk of passing each transition declines as we approach higher transitions while corr(e,x) indicates the presence of higher correlations between the error terms and the covariates as we approach higher transitions. In model (2), the results from both bivariate probit and simple probit are presented in columns (5) and (6) respectively.

From the empirical results of the sequential model in Table 4, it is realized that parental education (that is, the educational experience of both the child's father and mother) has a beneficial effect on the first two transitions (that is, "whether to enroll in primary or not" and "whether to complete primary school or not"). However, the case is not the same for the effect of parental education on the chance of passing the third transition (that is, "whether to enroll in secondary school or not"). In particular, parental education has an inconsequential effect on child schooling behavior at the third transition. Further, it is important to point out that both fathers and mothers educational experiences exert higher positive influences on the likelihood of passing the second transition than the first transition. That is, while educated parents are believed to invest more in their children's education since they are more likely to put a higher premium on the benefits of education, this parental education effect on child schooling is stronger only for decisions regarding children's stay in primary school until completion. Also, we observed that the marginal impact of mother's education is higher than that of fathers in the first transition, thus lending credence to the fact that a mother's educational experience tends to be more closely related to the child's schooling than that of fathers, especially for younger children (Haveman and Wolf, 1995).

The age of a child explains household child schooling choices significantly at the first two transitions. The effect of age on household child schooling decisions is positive, indicating, for example, that older children are more likely to be enrolled

Table 4. Marginal Effects of the Determinants of Child Schooling (Sequential and Binary Dependent Variable Models)

	Model 1			*Model 2*	
	Sequential model			*Binary dependent variable model*	
Variables	*(1) _1_2_3v0*	*(2) _2_3v1*	*(3) _3v2*	*Bivariate probit model (tenroll1)*	*Simple probit model (tenroll1)*
Father's education (base = no education)	0.359*** (0.135)	0.677*** (0.156)	−0.284 (0.276)	0.104 (0.071)	0.069 (0.072)
Mother's education (base = no education)	0.377** (0.150)	0.671*** (0.181)	0.315 (0.333)	0.269*** (0.084)	0.275*** (0.087)
Household welfare	0.023 (0.090)	0.441*** (0.110)	−0.032 (0.214)	−0.010 (0.053)	−0.028 (0.054)
Sex_male base = female)	0.084 (0.325)	−0.178 (1.047)	1.267*** (3.084)	0.261*** (0.064)	0.258*** (0.066)
Household_size	−0.166** (0.066)	−0.143* (0.076)	0.059 (0.148)	0.018 (0.032)	0.024 (0.035)
Household_size2	0.008** (0.004)	0.005 (0.005)	−0.002 (0.010)	0.000 (0.002)	−0.000 (0.002)
Age	1.827*** (0.100)	4.203*** (0.422)	1.372 (1.655)	0.224*** (0.084)	0.321*** (0.066)
Age2	−0.073*** (0.004)	−0.112*** (0.014)	−0.071 (0.048)	−0.015*** (0.003)	−0.019*** (0.002)
Childwork (base = not working)				0.221 (0.301)	−0.469*** (0.069)
Urban (base = rural)	0.258** (0.126)	0.258* (0.152)	−0.016 (0.297)	0.193* (0.100)	0.038 (0.074)
Sex_head_male (base=female)	−1.812*** (0.634)	−0.533 (0.771)	−1.003 (0.887)	−0.463* (0.246)	−0.227 (0.227)
Constant	−7.916*** (0.648)	−38.087*** (3.120)	−1.829 (14.197)	0.884* (0.489)	0.627 (0.491)
p(*atrisk*)	1.000	0.852	0.007		
corr (*e*,*x*)	0.001	−0.011	−0.022		
sd(*e*)	1.000	0.953	0.962		
Observations	3717	3717	3717	4474	4474

Notes: Robust standard errors in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$. (iii) *sd*(*e*) shows the level at which the effect of the standardized unobserved variable is fixed at in each transitional estimation. In the first transition, this effect is fixed at 1. *p*(*atrisk*) shows the proportion of the population that is at risk of passing a given transition. It declines as one moves towards higher transitions. *corr*(*e,x*) indicates the degree of correlation between the unobserved random terms and the regression parameters.

and to complete primary school than younger ones. Enrollment at the secondary level is not significantly influenced by the age of the child. The square of age, however, had a negative sign, indicating the nonlinearity in the effect of the age

variable. Estimating the turning point of the age effect on, for instance, the chance of passing the first two transitions, we find that the turning point of the effect of age on the chance of passing the first transition is 12 years while that for the second transition is about 18 years, indicating that the positive influence of age on the chance of passing the first transition ceases to exist among individuals older than 12 years. In addition, the size of a child's household is a significant negative predictor of the likelihood of passing the first and second transitions (see estimations (1) and (2) in model 1 of Table 4). The square of household size is significantly positive but only in estimation (1), indicating that the effect of household size on the chance of passing the first transition is not necessarily negative—it depends on the level of household size. For instance, calculating the turning point of the effect of household size on the likelihood of passing the first transition, we find it to be about 10 members, indicating that the detrimental effect of household size on children's enrollment in primary school ceases to exist among children from households with a membership size of more than 10. This is suggestive of the fact that large-sized households may play a more supportive role in terms of freeing children from domestic and market related activities to attend school than small-sized households.

Gender is a significant positive predictor of the probability of passing only the third transition. Specifically, being a male as opposed to a female raises the chance that a child would be enrolled in secondary school. The insignificance of gender in driving the likelihood of passing the lower transitions is indicative of the recent trends (from 2007 to date) of school participation by boys and girls in Ghana. In recent times, that is from 2008 to date, gender differential in school participation seems to be non-existent in Ghana especially at the lower levels of education.[7] Furthermore, regarding the influence of household welfare as measured by the logarithm of household total expenditure per adult equivalent, we find that household welfare significantly explains the chance of passing only the second transition. In particular, children from high income households are more likely to complete primary school relative to those from lower income households. This finding suggests that household welfare exerts a differential effect on child schooling decisions across the various transitions of the basic education track and thus corroborates earlier findings in this direction (see, e.g. Tenikue, 2010).

Moreover, contrary to the findings of Tenikue (2010), we find that children residing in urban areas are significantly more likely to pass only the first transition compared with their rural counterparts. That is, residing in an urban area relative to a rural areas raises the likelihood that a child would be enrolled in primary school. This may reflect the relative availability of school resources in urban areas than in rural areas. Children from households that are headed by males are significantly less likely to enroll in primary compared with those from female-headed households, a reflection of the greater attachment of women to children's human capital development than men.

Juxtaposing these outcomes with the results from the (static) binary dependent variable model (model 2 in Table 4), we find some important differences. First, contrary to the results obtained in the sequential model of child schooling regarding the influence of parental education, only the educational experience of the child's mother has an important beneficial effect on child schooling decisions in the static model. The result from the static model is largely in line with previous empirical findings on the importance of parental education especially that of the mother in child schooling decisions (Haveman and Wolf, 1995). Similarly, unlike the

sequential estimation, the static estimation reveals that household welfare does not determine child schooling probabilities. Within the sequential model, we are however able to show that family resources such as father's education and household welfare are not entirely inconsequential in child schooling decisions, their effects depend on the level of schooling at which the decision is made.

Also, the gender of a child has an important effect on child schooling in the static model, making more visible a pro-male bias phenomenon as is the case in most empirical studies on child schooling (Dostie and Jayaraman, 2003; Rolleston, 2009). However, in the sequential model, we show that this bias is not important in explaining both primary school enrollment and completion of primary education, a result that is consistent with recent trends, that is from 2008 to date in school participation by boys and girls. Thus, the sequential estimation approach sheds more light on the role of gender in child schooling decisions. In addition, unlike in the sequential estimation, we include as a covariate children's participation in labor market activities in the static model of child schooling. Our findings point to the fact that children's participation in labor market activities does not influence child schooling decisions when we control for the endogeneity of child work (column 5 of Table 4). However, without controlling for the endogeneity of child work, we find that children's labor market participation is a significant negative determinant of child schooling probabilities (column 6 of Table 4). As indicated earlier, we place more emphasis on the results obtained from the bivariate probit estimation. While the size of a child's household matters for the chance of passing the first and second transitions in the sequential model, it had no influence on child schooling in the static model.

Discussion of Results: Gender Disaggregated Sequential Models

The importance of gender in explaining child schooling decisions as observed above provides a foundation for us to delve into the issue of how the determinants of child schooling may vary by the gender of the child within a sequential framework. The results (marginal effects) of the gender disaggregated sequential models of child schooling are presented in Table 5.

Important differences emerge in the analysis of the determinants of child schooling for boys and girls. For instance, variables such as parental education, household size, age and urban do not affect the transition probabilities of boys and girls in the same way. On the effect of parental education, we observe that while father's education significantly influences the schooling of boys, albeit only in the second transition, the educational experience of a girl's father has a significant beneficial effect on the likelihood of passing both first and second transitions. This indicates that for girls, educated fathers relative to uneducated fathers are more likely to enroll their children in primary school. The case is not the same for boys. In terms of the effect of mother's education, the results in Table 5 show that educated mothers are more likely to enroll their male children in primary school than their uneducated counterparts. At the same time, the findings suggest that educated parents give similar importance to the schooling of both boys and girls, especially regarding primary school completion. Thus, for family resources, in particular, parental education does not promote a gender-biased investment in the schooling of children at the primary level. Household welfare exerts similar effects on the schooling of boys and girls while the effect of household size on the schooling of boys and girls are dissimilar. Unlike boys, girls from large-sized households are significantly less likely to enroll in primary school.

Table 5. Sequential Estimation of the Determinants of Child Schooling (Gender Disaggregated Models): Marginal Effects

	Boys subsample			*Girls subsample*		
Variables	*(i) _1_2_3v0*	*(ii) _2_3v1*	*(iii) _3v2*	*(i) _1_2_3v0*	*(ii) _2_3v1*	*(iii) _3v2*
Father's education (base = no education)	0.065 (0.198)	0.857*** (0.229)	−0.363 (0.448)	0.592*** (0.185)	0.512** (0.212)	−0.208 (0.370)
Mother's education (base = no education)	0.487** (0.215)	0.667** (0.263)	0.266 (0.460)	0.296 (0.209)	0.673*** (0.252)	0.362 (0.495)
Household welfare	0.150 (0.131)	0.574*** (0.167)	−0.219 (0.305)	−0.065 (0.123)	0.343** (0.149)	0.095 (0.304)
Household_size	−0.152 (0.103)	−0.281** (0.110)	−0.244 (0.258)	−0.174** (0.083)	−0.008 (0.104)	0.294 (0.245)
Household_size2	0.009 (0.006)	0.014** (0.006)	0.015 (0.016)	0.008 (0.005)	−0.004 (0.007)	−0.015 (0.018)
Age	1.877*** (0.152)	3.491*** (0.590)	−2.608 (2.695)	1.934*** (0.134)	4.687*** (0.609)	4.577*** (1.680)
Age2	−0.070*** (0.006)	−0.089*** (0.020)	0.062 (0.081)	−0.077*** (0.005)	−0.131*** (0.020)	−0.173*** (0.052)
Urban (base = rural)	0.312 (0.197)	0.447** (0.218)	−0.198 (0.471)	0.586 (0.446)	−1.560 (1.514)	−4.058 (3.435)
Sex_head_male	−17.116*	2.809	−22.054			

5. Conclusion

School enrollment rates (gross and net), for most SSA countries including Ghana, are substantially higher at the primary level than they are at the secondary level. In this study we use the latest round of the Ghana Living Standards Survey (GLSS 6) to examine the determinants of secondary school enrollment and its dependence on completing primary school within a sequential logistic framework. In this way, the study departs from the standard way of analyzing school enrollment in Ghana by providing an explicit account for "educational selectivity." This approach adopted by the study has two advantages: (i) it allows us to estimate (based on a three-stage sequential logit model) the determinants of enrollment at the secondary level and its dependence on completing primary school; (ii) we are able to observe the differential effects of the various explanatory variables on child schooling decisions made at different educational transitions.

The empirical estimation of the study reveals a number of important findings. First, we observe that family resources such as parental education, household income and the gender of the head of the household plays a role in households' child schooling decisions. In the sequential model of child schooling, our findings suggest that relative to uneducated parents, educated parents are more likely to enroll their children in primary school and keep them in school until they complete primary education. As well, we show that educated parents do not promote a gender-biased investment in the schooling of children at the primary level. This serves as an important basis for the need to increase adult literacy.

Second, we demonstrate the non-importance of a pro-male bias phenomenon in explaining entry and completion of primary school, a result that is fairly consistent with recent trends (from 2006 to date) in child schooling in Ghana and elsewhere. Third, we establish that while household income is not very important in influencing children's entry into primary school since primary school entry costs are often low or non-existent, their completion of primary school depends crucially on the level of household welfare. This indicates that households may require more resources to ensure children's completion of primary school. Fourth, urban residence is a strong positive predictor of enrollment in primary school while male-headed households are significantly negatively associated with the likelihood of enrolling in primary school. Fifth, household size negatively affects the primary school enrollment probability of only girls while age exerts a positive influence on the schooling of boys and girls.

Finally, by examining the determinants of child schooling within a sequential framework, we demonstrate effectively that the family resources, individual characteristics, household structure and locality exerts dissimilar influences on child schooling decisions at different educational transitions. In this vein, the study provides an in-depth understanding of the determinants of child schooling. These findings provide important insights for the formulation and assessment of policies that are intended to improve child schooling and achieve the SDG 4. Specifically, the study recommends that policies to promote meaningful access to education must be well targeted by addressing the peculiarity of the problems confronting child schooling at the various levels of education. It is clear from our findings that the gender problem has been well fought, especially in case of primary school participation and now both boys and girls alike access primary education. However, the pro-male bias phenomenon still exists at the secondary education level among children who have completed primary education. Thus, efforts to promote equitable quality education for all must address the factors that contribute to the relative disadvantage of girls in accessing secondary education. Further, given the importance of parental education in child schooling, programs that seeks to promote adult literacy especially in rural areas will be influential in bringing more children to school than would otherwise have been possible.

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Notes

1. Similar assumptions are made in earlier studies (see, for instance, Lillard and Willis, 1994; Sawada and Lokshin, 2009; Tenikue, 2010; Buis, 2011). The sequential logit model is similar to the sequential probit model except that the logit link function is used rather than the probit link function (Buis, 2011).
2. Although separate logistic regressions are estimated for each of the subsamples that is "at risk" of passing a given transition, equations (2)–(4) show that p_1–p_1 are not independent.
3. It was not until 2002 that the government decided to absorb the preschool education into the formal education system. The preschool education, which is known as kindergarten, nursery or crèche serves as the foundation of a child's educational career and was previously run by the private sector.
4. The dependent variable in the binary dependent variable model captures the enrollment status of children aged 6–19 and it assumes a value of 1 if the individual is enrolled and zero otherwise.

5. While some empirical attempts in the analysis of schooling decisions have modeled these decisions as being exogenously influenced by child labor force participation (see Rolleston, 2009), concerns about the endogeneity of child labor force participation in schooling-decision models have been highlighted in, e.g. Gage (2005), with the outcome that failure to account for it results in biased estimates.
6. In this paper, the two structural equations are: (i) a model of the determinants of child schooling; and (ii) a model of the determinants of child labor force participation.
7. In Ghana, the net enrollment rates for boys and girls in primary schools stood at 88.4% and 88.7%, respectively, in 2014 while the primary school completion rates for boys and girls were 97.5% and 95.6%, respectively, in 2014 (see World Bank, 2016).