

Opportunity Cost, Market Returns and Post-Primary Schooling: Evidence from Ghana¹

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Abstract

This study examines the effects of opportunity cost and labour market returns on post-primary school enrollment. Our findings suggest that the opportunity cost of schooling expenditure is the major constraint on secondary schooling, while the opportunity cost of time significantly impedes tertiary schooling. We also find that expectations about the informal market return is the main driver of secondary school enrollment, while formal market expectations affect tertiary enrollment. Finally, our results demonstrate heterogeneous effects of opportunity cost and labour market expectations across gender, household poverty status, and rural-urban dwelling, which have important policy implications to improve post-primary school enrollment in developing countries.

Keywords: Opportunity cost, formal market returns, informal market returns, post-primary school enrollment

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1. Introduction

Recognizing the pivotal role of education in an economy, many developing nations have improved access to primary education. The outcomes are impressive, with net enrollment rate increasing from 83 percent in 2000 to 91 percent in 2015 among developing countries. The sub-Saharan African region recorded the best improvement in primary education (UN, 2017). However, secondary and tertiary participation in less developed countries remains a challenge. In contrast to gradual improvement in primary education level, secondary school enrollment has dropped from 83 percent in 2000 to less than 70 per cent in 2013 among low-income countries. The drop corresponds to a more than 30 percent shrinkage in secondary school enrolments in the same period, despite a rise in total population in those countries (UN, 2017). The situation is gloomier in sub-Saharan Africa and Southern Asia, which account for 70 percent of 263 million adolescents and youth who were out of school in the world in 2014. Across sub-Saharan Africa region, only 36 percent of secondary school aged children are enrolled (UN, 2017).

While there is a need to improve post-primary education, the solution is usually more complex compared to that for primary education, which is usually subsidized by governments. At secondary and tertiary levels, not only are tuition fees much higher, student's time at school could also play a critical role, as many of them have reached an age which allow them to enter the labour market. On the benefit side, the marginal returns of time invested in education diminishes as the individual grows old (Psacharopoulos, 2014). Moreover, expected returns to education at this stage may play an important role in household's investments in children's education. In an intertemporal decision making, household invest in children's education in order to receive remittance from their children in future. Thus, the amount of investment in education could be influenced by their expectations on children's future earnings from the local labour market. Therefore, understanding how these factors interact to influence the households' decision to enroll children in secondary and tertiary institutions is crucial for effective policy formulation.

This study examines the composite and relative effect of opportunity cost, i.e., time and schooling expenditure, on children's post-primary school enrollments. We also explore the roles of expectations on returns to education from the formal and informal economies on schooling decisions, something previous studies have largely ignored. Finally, we demonstrate the

heterogeneous effects of opportunity cost and returns to education on children's school enrollments across gender, household poverty status, and rural-urban dwelling.

Our findings suggest that the composite effect of opportunity cost reduces the probability of secondary and tertiary school enrollment, and the effect is more evident at the tertiary level. Our decomposition analysis further shows that opportunity cost of schooling expenditure is the main driver of secondary school enrollment, while opportunity cost of time is the only significant predictor at the tertiary school level. Also, findings on expected returns to education reveal that while expectations from the informal sector are linked with the secondary schooling decision, tertiary enrollment is influenced by expectations from the formal sector. Interestingly, poor and rural households are more likely to send the boy child to school when there is a signal for higher returns to education in the labour market compared to urban and non-poor households. The gender-specific analysis suggests that the price elasticity for girls is a higher than boys regarding secondary school enrollment. However, this price elasticity is only significant for boys of tertiary school age. Finally, our findings on tertiary education suggest that opportunity cost has larger deterring effect on children from poor and rural households.

Despite the low enrollment rates of higher education among developing countries and the important role it plays in economic transition, the extant literature on post-primary education has not provided enough evidence to inform policy. Extant of literature on child labour suggests that children's time in the local labour market could be an important input in the household production function. Children's earnings serve as an additional source of income for the household, especially among the poor and rural households (Basu & Van, 1998; Ray, 2000; Ravallion & Wood, 2000; de Carvalho Filho, 2012). The "luxury axiom" by Basu and Van (1998), suggests that children work only when the households cannot meet their basic needs, thus, implies that children from poor households are more likely to drop out of the education system. Therefore, the outside option of children's time in school play an important role in households' decision to enroll their children in either secondary or tertiary school. However, this feature at the higher education level has received little attention in the literature.

In addition to the opportunity cost of schooling time, monetary costs serve as another constraint to access post-primary education. They can be substantial if there is not any type of government subsidies. Cost of schooling is not limited to tuition fees. Other costs such as uniforms and sports

clothes, books and school supplies, transportation to and from school, and food, boarding and lodging can be a significant burden for many households. Ample evidence suggests that governments' fee subsidies at the primary school level is the main drivers for an increases in enrollment, and mitigation of inequalities resulting from gender, income, and region (Deininger, 2001; Asankha & Takashi, 2011; Langsten, 2017). Other types of government subsidies such as school meals have been shown to improve primary school outcomes such as enrollment and test scores (Belot, & James, 2011; Jayaraman & Simroth, 2015; Afridi, 2011). Studies on cost and post-primary education have measured cost using the shadow price of education, such as distance to school (Tansel, 1997; Lavy., 1996; Glewwe & Jacoby, 1994), and school-reported cost (Birdsall & Orivel, 1996; Glick & Sahn, 2006).

Although findings from these studies suggest that cost impedes schooling outcomes, there are two concerns that need to be addressed before drawing conclusions regarding the nexus between cost and schooling outcomes. First is the possible problem of endogeneity in determining cost from the supply-side. As argued by Glewwe and Patrinos (1999), cost of schooling is endogenous to household and child specific attributes, and cannot be treated as being exogenously determined by schools. Therefore, the use of household level data on schooling expenditure would demonstrate how these attributes interact with costs in influencing household decisions on school enrollments. In other words, modelling the private cost of schooling shifts attention from the school level to the household level, and this approach allows public policy to influence intra-household decision making. Lack of understanding these effects could lead to costly educational policies with little impact on school outcomes. Omoeva and Gale (2016), for example, used household data from Uganda to examine the impact of Universal Secondary Education (USE) policy on household educational expenditure per child at lower secondary school. The policy provides capitation grants to students based on their grades in the final exams before leaving primary school. The authors conclude that such policy reduced household educational expenditure per child by 60 percent, but did not detect any impact on school attendance or grade repetition.

The second concern is the lack of research on the heterogeneous effect of opportunity costs on school enrollment, especially, across gender, household poverty status, and rural-urban dwelling. Gender preference in household decision making, for example, is traceable to the prevailing socio-cultural norms and gender inequality in the labour market (Attanasio, Meghir, & Salvati, 2017;

Glick, 2008; Glick, 2000; Alderman and Gertler, 1997; Tansel, 1997; Deolalikar, 1993). Becker (1981), also, attributes such gender gaps to the underlying economic conditions in the household. In terms of educational investment, it has been argued that girls tend to receive less investment than boys at the primary school level, especially in rural areas and in low income countries (Adelman et al., 1996; Behrman & Knowles, 1999). Asankha and Takashi (2011) investigated the impact of Uganda's Universal Secondary Education (USE) policy on enrollments, and found a significant increase in girl's enrollment in public schools, but no effect for boys. However, this effect could vary depending on the poverty status of the household and whether the household is in a rural or urban area.

The high opportunity cost at the higher education level suggests, therefore, that households would make educational investment decisions in a dynamic life-cycle setting. Houesholds make rational decisions by considering the expected returns to their children's education in future before enrolling them in either secondary or tertiary school in the current period. Although existing studies have demonstrated this nexus (see Donovan & Swinnerton, 2010; Chamarbarbagwala, 2008; Anderson, King & Wang, 2003; Yamauchi-Kawana, 1997), they ignore the role of the informality that exist in the labour market of many developing countries. The labour market in many developing countries are dominated by informal activities which are usually unregulated and untaxed. Depending on the structure of the labour market, these dynamics could play an important role in educational investments. Hence, we examine how this labour market structure affects school enrollments.

Our contribution to the literature is twofold. First, we use household level data on schooling expenditure and wages to demonstrate the heterogeneous effects of opportunity cost of time and money on secondary and tertiary school enrollment. We do so by looking into gender differences, household poverty status and rural-urban dwelling. No study has revealed so many facets nuances of the role of opportunity costs on post-primary school enrollment to our best knowledge. Secondly, we explore the relative effects of formal and informal labour market expectations on the households' decision to enroll their children in school. The decomposition, which reflects the prevailing labour markets in many developing countries, enables us to examine the link between returns to education and schooling decisions in more details.

The rest of the paper is organized as follows. Sections 2 and 3 respectively present an overview of education in Ghana and our measurement of opportunity cost. In section 4, we present a theoretical model followed by the empirical strategy in section 5. Section 6 describes the data and the descriptive statistics. This is followed by a discussion of results in section 7. The final section concludes with policy recommendations.

2. Overview of Ghana's educational system

The Ghanaian education system is categorized into three cumulative parts; basic, secondary and tertiary education. Basic schooling starts at age 6 and ends at age 15, which is made up of 6 years of primary schooling and 3 years of junior high school education. Basic education ends with a Basic Education Certificate Examination (BECE), and it is structured for 9 years of schooling. According to the 1992 Constitution of Ghana, basic education is compulsory and free for every Ghanaian child of school-going age (Afoakwa & Dauda, 2016; Senadza 2012). As of 2015/16, gross enrollment rate² (GER) and net enrollment rate (NER) stood at 111.3% and 91.5% respectively (MoE, 2016). This represents a significant success in access to primary education in Ghana. According to the UNESCO (2015) report on education, Ghana exceeded the MGD's goal of universal primary education in 2013/14 by recording a 107.3% gross enrollment rate.

Basic education is followed by secondary and tertiary education. Secondary education consists of senior secondary/high school as well as technical and vocational institutions, and last for 3 years. It usually begins at age 15 to 18. Before 2006, Senior Secondary/High School (SHS) students ended their studies by sitting the Senior Secondary Certificate Examination (SSCE), but since 2006, SHS graduates take the West African Senior Secondary Certificate Examination (WASSCE). The Ghana Statistical Service (GSS) estimates that about 86.5% of the population do not have a secondary school qualification. Females are usually disadvantaged (GSS, 2014). The Ghana Education Services report indicates a low but increasing trend in gross and net secondary

² Gross enrollment rate is number of children enrolled in a given education level, regardless of age, as a percentage of the total population of the same level of education. Net enrollment rate is number of children enrolled in a given level of education who belong to the official corresponding age group of that level of education, expressed as a percentage of the total population of the same age group

enrollment rate since 2012. Gross secondary school enrolment rate for 2015/16 was 49.6%, net enrollment was 25.2% during the same year (MoE, 2016).

Tertiary education in Ghana is the umbrella of all Universities and University Colleges as well as Polytechnics. Other professional and specialized institutions such as Teacher and Nurses' Training Colleges are also considered as tertiary education. Only universities can award bachelor's degree, which usually takes 4 years to complete. All other tertiary institutions award such as nursing, agriculture, teacher training colleges and polytechnics award certificate and diploma programs of 3 years duration. (Effah & Senadza 2008). Tertiary education normally begins at age 19 and last for 3 or 4 years. Tertiary enrollment has marginally increased also from 217,543 in 2010/11 to 320,746 in 2014/15 (MoE, 2016). In this study, we define post-primary education to include secondary and tertiary education because both primary and junior high education are free and has seen significant improvements in access over the past decades.

3. Measurement of opportunity cost of schooling

In this paper, we measure the opportunity cost of both time in school and schooling expenditure. Opportunity cost of time is measured by considering the wages the child could earn on his/her time in a local labour market (Cesario, 1976; McConnell, 1975). In other words, how much he/she could have earned from working instead of going to school, is used to measure the economic value of time in school. This study, considers only the monetary gains from the child's time; non-monetary gains of time are not considered. In measuring the opportunity cost of time for secondary schooling, we compute the average wage for children of the same age cohort, 14-18, who are working with primary school qualification in the same district. That is, opportunity cost of time is the amount children at the same age and qualification would have earned if they decide to work instead of attending school. For children who are already working, their observed annual wages are used. Similarly, we compute the opportunity cost of time for tertiary education as the average wage for children of the same age cohort, 18-24, who are working with secondary school qualification in the same district.

Opportunity cost is schooling expenditure computed by first summing up the monetary cost schooling including tuition and registration fees, uniforms and sports clothes, books and school supplies, transport to and from school, and food, boarding and lodging fees per annum. Next, we

find the future values of it, so as to take into consideration the time value of money. The intuition is that a household could invest these monies into an interest-earning asset during the schooling period. This approach also allows us to capture risk aversion in households' decision making on their children's educational investments. For those who are not in school, the average cost per district is assigned to them. The future value of schooling expenditure is then computed using the formula:

$$FV = PV(1+r)^n \quad (1)$$

where present value PV captures the annual expenditure on schooling, r is the interest rate, which is 12.5 percent, the Bank of Ghana prime rate as of 2012. n is 3, being the number of years for secondary and tertiary education³. Then we divide the total future value by 3 to obtain the opportunity cost per annum. We do not compute the future value of the opportunity cost of the child's time in school because school time, unlike school cost, cannot be 'saved' in the sense of being stored or accumulated for future use. One can only transfer his/her time from one activity to another (Truong & Hensher, 1985).

4. Theoretical model

This study uses the framework of the intertemporal or dynamic household model. As argued by Chiappori and Mazzocco (2017), the major advantage of this model is that it allows for a consideration of an individual's outside options and their dynamics to affect intra-household decision making. Thus, this model allows us to examine how children's out-of-school utility in the first period together with expectations on returns to their education in the future to affect their investment in children's education in the current period. We assume that households make decision to allocate resources between consumption and education to maximize their life time utility based on full information on the local labour market. This is to say that households' utility in the second period is a function of the returns to their children education in the second period. We assume that in the second period, the household receive transfers from their children in the form of remittances, which is determined by the child's wealth in the second period (Adelman & King 1998; Anderson,

³ We assume an average of 3 years of investment for tertiary educational expenditure for consistency across all tertiary institutions.

King & Wang 2003). We build on Anderson, King and Wang's (2003) model by introducing gender differences into the dynamic household model. In this model, households derive their life-time utility (U) from consumption in the first period (C_1), second period consumption (C_2), and their boy and girl child's schooling (S_b, S_g). The household also derive utility from transfers from their children in the second period in the form of remittances (R_b, R_g).

$$U = u(C_1, C_2, S_b, S_g : R_b, R_g) \quad (2)$$

The life time utility of the household is maximized subject to two period income constraints.

$$Y_1 = w_{1b}(T_b - S_b)/T_b + w_{1g}(T_g - S_g)/T_g + \alpha w_{2b}^* + \delta w_{2g}^* + rA = P_1 C_1 + P_2^* C_2 + P_b S_b + P_g S_g \quad (3)$$

Household income in period one is derived from earnings of the parents (Y_1) and earnings of the boy (w_{1b}) and girl (w_{1g}) child in the local labour market. Thus, earnings of the boy and girl child while working full time at the prevailing primary education wage. Hence, actual earnings are reduced by the child's time in school, that is $w_{1b}(T_b - S_b)$ and $w_{1g}(T_g - S_g)$ for the boy and girl respectively. A is household asset ownership in period one, and r is the return on the asset in period two. For simplicity, we assume that all other household members are non-income earners. If α and δ are the respective probabilities that the boy and girl child will remit the household, then w_{2b}^* and w_{2g}^* are the expected income of the boy and girl respectively. Where the expected incomes are determined by the levels of schooling attained by the child and the expected returns to the educational investments as explained earlier. Equation (4) and (5) demonstrate the relationship between schooling and returns to education.

$$w_{2b}^* = w_{1b} + \gamma S_b \quad (4)$$

$$w_{2g}^* = w_{1g} + \phi S_g \quad (5)$$

Where γ and ϕ are returns to boys' and girls' education respectively. If the returns to boys' girl's education are equal, then, $\gamma = \phi$ and both genders will receive the same amount of educational investment in period one. However, Boserup (1995) argues that in many developing countries, household expectation of returns to their girls' education is lower than that of boys, due

to either inequality in the labour market or prevailing socio-cultural norms. If this holds then girls would have lower expected returns to education than boys, hence, $\gamma > \phi$.

Also, household income in period one is spent on non-school consumption goods in period one ($P_1 C_1$), where (P_1) is the unit price and (C_1) is the quantity consumed, as well as expenditures on the boy and girl child's schooling. P_b and P_g are the respective prices for boys' girls' schooling. We conceptualise the price of schooling as the opportunity cost of schooling which includes time and schooling expenditure. That is, what the household must give up in order to keep their children at school. The price of schooling may not be the same for boys and girls depending on the value the household put on out-of-school utility of the different genders. It is argued that households tend to have higher opportunity cost for girls' education, especially when the household depends on them for domestic labour and child care support for younger siblings (Heward, 1999; McMahon, 1999; Smock, 1981). This, therefore, suggests that the price for girls' schooling would be higher than for boys, $P_b < P_g$. In period two, however, household spend on only non-school consumption goods $P_2^* C_2$, where P_2^* is the discounted unit price of the good in time two.

We now maximize household utility for S_b and S_g in equation (2) subject to constraints (3), (4) and (5). Allowing for variations in the opportunity cost of schooling, expected returns to education, and the probability of transfers from children's schooling, the first order conditions can be specified as:

$$U_{sb} = \lambda \{P_b - \delta\gamma + w_{1b}\} = \lambda \theta_{sb} \quad (6)$$

$$U_{sg} = \lambda \{P_g - \alpha\phi + w_{1g}\} = \lambda \theta_{sg} \quad (7)$$

$$U_{c1} = \lambda P_1 \quad (8)$$

$$U_{c2} = \lambda P_2^* \quad (9)$$

$$Y_1 = \sum w_{1b} (T_b - S_b) / T_b + w_{1g} (T_g - S_g) / T_g + \alpha\phi + \alpha\phi + rA = P_1 C_1 + P_2^* C_2 + \sum P_b S_b + P_g S_g \quad (10)$$

Where λ is the marginal utility of money, θ_{sb} and θ_{sg} are shadow prices of boys' and girls' schooling respectively. Since opportunity cost and returns to education are not equal for boys and girls $\theta_{sb} \neq \theta_{sg}$.

Finally, we specify the demand for post-primary schooling for girls and boys as:

$$S_b = s(P_b, P_1, P_2^*, r, w_{1b}, Y_1, \delta, \gamma) \quad (11)$$

$$S_g = s(P_g, P_1, P_2^*, r, w_{1g}, Y_1, \alpha, \phi) \quad (12)$$

Household utility is maximized when the marginal benefit from their children's education in terms of remittances from their children is equal to marginal opportunity cost of schooling (time and money). If the household, therefore, expect high remittances from their children's education in the second period, due to skilled job opportunities in the future, they will educate their children in period one (Chamarbarbagwala, 2008).

Proposition 1: if it is assumed that girls have higher cost of schooling ($P_b < P_g$), then we should expect a higher price elasticity for girls' post-primary schooling than for boys.

Proposition 2: if boys have higher returns to education than girls ($\gamma > \phi$), then we should expect a higher expectations effect for boys' post-primary schooling than for girls in our empirical analysis.

5. Empirical strategy

We first examine the composite effect of total opportunity cost on post-primary schooling, and then look into the relative effect of each of cost component on schooling decisions. This enables us to assess the relative roles that each of our two measures play on enrollment at different levels of education.

5.1.1 Basic model

We consider households' investment in children's post-primary education as influenced by the opportunity cost of education and expected returns to education⁴. Thus, we assume that households' decision is influenced by expectation of the long term outcome of human capital formation of their children. We restrict our sample to children who have the qualification required

⁴ We assume a local labour market where children would work in their districts and the expected returns to education are based on wages in their local districts.

for entering either secondary or tertiary schooling. In doing so, we are able to exclude dropouts due to insufficient cognitive ability. We adopt this approach also because our data do not have information on children's cognitive ability. Since family background, especially parents' education also influences their investment in their children's human capital (Tansel, 1997), we control for parental education in our model, and other household factors. Our regression model is specified as:

$$y_{ij} = \alpha + \beta \hat{Opp_cost}_{ij} + \delta Edu_Returns_j + \eta X_{ij} + \delta C_{ij} + \varepsilon_{ij} \quad (13)$$

Where y_{ij} is schooling outcome of child i in district j . Our two main outcome variables are secondary and tertiary education enrolments, which are captured as dummy variables. It assumes the value of 1 when the child is enrolled at a secondary or tertiary institution, otherwise is 0. Children who are working while schooling are captured as enrolled, however, we later drop those children from the sample and re-estimate the models for sensitivity analysis, which is discussed in section 7. Opp_cost_{ij} is the opportunity cost of post-primary school enrollment of child i in district j , $Edu_Returns_j$ is the expected returns to post-primary schooling in district j , X_{ij} is a vector of household level characteristics such as female head, age of head, rural dwelling, household sexual harassment, household health expenditure, and schooling expenditure per capita income $\left\{ \frac{Sch_exp}{Hh_income/Hh_size} \right\}$, C_{ij} is a vector of child attributes, including gender, time spent

doing household chores, sick days, and late primary school enrolment. Following Chamarbarbagwala (2008) and Yamauchi-Kawana (1997), we measure expected returns to education as the average earnings of individuals aged 19-60 with secondary education in that district. In other words, this is the amount the household expects their children to earn in the local labour market after completing secondary school. For tertiary school enrolment, we use the average district earnings of individuals with tertiary education for individuals aged 24-60 years. By these measures, we assume that households form their expectation of the future returns to their children's education by using their local district information on current wages for educated adult workers compared to uneducated workers (Chamarbarbagwala, 2008). Therefore, that any other benefits from schooling are excluded in our analysis. We then decompose expected returns to education into formal and informal labour market depending on the type of economic activity the

individual is engaged in⁵. We also control for regional fixed effects which captures environmental and socio-cultural differences across the ten regions in Ghana. In equation (13), our main hypothesis is that $\hat{\beta} < 0$ and $\delta > 0$. In order to estimate equation (13), we assume that the error term is normally distributed and estimate the model using probit. We then perform a decomposition analysis based on gender, household poverty status, and rural-urban dwelling to test for the heterogeneity in the effect of opportunity cost and expectations on school enrollments.

5.2 *Potential endogeneity*

In estimating equation (13), one major threat is potential endogeneity issue coming from the measurement of opportunity cost of schooling. It is possible that our measurement might not be perfectly correct since household non-schooling utility for their children's education may be a function of different outside options apart from the child's potential wage from the labour market and the returns on their money investments, which our measure for opportunity cost might not capture. Also, households are not only likely to overestimate the cost of education, but are also likely to wrongly estimate these costs, especially those from low-income socio economic backgrounds (Grodsky & Jones, 2007; Horn, Chen, & Chapman, 2003). This, therefore, suggests that our measure for opportunity cost could be correlated with the error term in our main outcome equation. To provide consistent estimates, we need an appropriate technique which will identify our measure for opportunity cost. We, therefore, employ instrumental variable estimation technique.

Two instruments are used to identify opportunity cost: average district food price inflation between the period 2005 and 2012 and district wage deviations. An increase in food prices would affect children's opportunity cost of schooling in two ways. First is through the "complementary effect". Increase in food prices means that households may require extra income to meet the increase in

⁵ Ghana's labour market mimics that of many other developing economies with the presence of large informal sector. In contrast to an organized structure of the formal sector, the informal sector is characterized by unregulated, unlicensed and untaxed activities (Baah-Nuako 1991). Also, the informal sector is often made up of non-capitalist activities and family ownership as the means of production. The informal economy is dominated by small to medium-scale businesses consisting of producers, wholesale and retail traders, and service providers. Mostly, people working in the informal sector are self-employed, though they could be contributing family workers, casual wage workers, home-based workers and street vendors (farmers, artisans and craft-workers, traders, food processors, etc.) (GSS 2014).

food expenditure. Children’s earnings, therefore, present an alternative source of income to cover the higher food expenditure. Hou, Hong and Scott (2016) argue that higher food prices leads to children being pulled into the labour market, in order to provide an additional income to support for the family. This is more evident in household without any coping strategy, such as insurance or assets (Guarcello, Mealli, & Rosati, 2010; Beegle et al., 2006). For an agricultural and net-food supply household⁶, children may even be pulled into the market to sell agricultural produce to support household income. The second path is through the “substitution effect”. Increasing food prices would increase household food expenditure, and this will mean that an income constrained households would have to cut down the amount of money invested into the children’s education. Thus, educational expenses could be a substitute for food expenditure especially for a poor and rural household. Food price inflation is computed by the Ghana statistical services using 2005 as the base year, and it uses information on the market prices of food items such as grains, flours, roots, tubers, plantain, pulse, nuts, seed/oil, fruits, vegetables, meat, poultry, fish, livestock products, etc. In this study, we compute the average district food price inflation by sorting households at their district levels.

Our second instrument is the standard deviation of district returns to primary education. The argument here is that inter-district migration of labour to higher wage districts, due to wage differentials, would influence the local district wage. This approach is repeated for tertiary education using returns to secondary education. Equation (3) therefore is the first stage regression, where $FoodPrice_j$ captures food price inflation in district j , and $Wage_dev_j$ is wage gap of district j .

$$Opp_cost_{ij} = \alpha + \phi FoodPrice_j + \gamma Wage_dev_j + \delta Edu_Returns_j + \eta X_j + \delta C_{ij} + \mu_{ij} \quad (14)$$

Given that we are assuming a normally distributed error term in equation (13), and also fixing a potential endogeneity issue, our identification strategy follows an instrumental variable probit (IVProbit) method. In all specifications, we also adjust for the possible endogeneity emanating from the supply-side within districts by clustering the standard errors at the district levels.

⁶ The GSS reports that more than 51% of Ghanaian households operate or own an agriculture farm, and derive income from the sale of agricultural produce such as vegetables, roots and cash crops, grains, hunting, honey, fruit and berries, milk from cow, eggs, among others (GSS 2014)

6. Data and descriptive statistics

We use data from the sixth round of the Ghana Living Standards Surveys (GLSS-6). This dataset is the most comprehensive household survey on education and labour market outcomes for Ghana. It is collected to be consistent with the World Bank's Living Standards Measurement Surveys (LSMS), with an objective of providing information on the standards of living in the country. The surveys have been available since 1988 (GSS, 2014). The most recent GLSS 6, was collected in 2012/2013. The survey covered 162 out of the 216 districts across ten regions in the country. The district codes are available in the final dataset. In all, 16,772 households made up of 72,372 individuals, were covered during the period October 2012 to October 2013. We extract two different samples for our study. The first sample is made up of a cohort of children who are aged 14-18 years and have completed primary schooling, that is, children who are at the age of attending secondary school and have obtained the qualification to secondary school. We include children who are age 14 in order to capture those who may have enrolled early. This sample contains a total of 1,813 children. The second sample includes 1,214 individuals aged 18-24, and have successfully completed secondary schooling.

The summary statistics in Table 1 suggest that about 84.6 percent of children of secondary school going age are enrolled in school while that for tertiary school age is 71.8. The opportunity cost of time, measured as lost labour market earnings, is greater than the opportunity cost of schooling expenditure at both secondary and tertiary school levels. In terms of labour market expectations, the average returns to secondary education are higher for the informal sector than the formal sector. This could be due to the fact that people with secondary qualifications are more likely to get jobs in the informal sector than in the formal sector. In contrast, the average expectations from the informal economy is lower than expectations from the formal sector among those with tertiary qualifications. With regard to parental education, 8.2 percent of fathers have completed secondary education with less than 2 percent of mothers having done so. The majority of children of secondary school age are girls and are in rural areas while those of tertiary school age are mostly boys who are mostly in urban households. Also, 51.4 percent of these children enrolled late at primary school, and the majority of them live in rural areas. Regarding household characteristics, we observe that an average household head is aged 51, with 28.6 percent of household heads are females.

Table 1: Summary statistic of variables used for the regression analysis

Variable	Definition	Secondary		Tertiary	
		Mean	SD	Mean	SD
Post primary school	Whether the child is in post primary school or not (1/0)	0.846	0.360	0.718	0.450
Ln (opportunity cost)	Log of total opportunity cost of schooling	7.182	0.687	8.493	0.689
Ln (Time cost)	Log of opportunity cost of the child's time in school	6.429	3.67	7.873	0.782
Ln (Money cost)	Log of opportunity cost of the future value of schooling expenditure	6.080	1.459	7.387	1.105
Ln(formal sector)	Log of returns to education in the formal labour market	8.493	0.814	9.44	0.680
Ln(informal sector)	Log of returns to education in the informal labour market	8.522	0.811	8.884	0.839
Boy	Whether the child is a boy or not (1/0)	0.487	0.499	0.558	0.497
Hh_sex_vic	Whether any household member has been sexually abused in the past (1/0)	0.122	0.37	0.137	0.343
Sick_days	Number of day the child has been sick in the past two weeks	0.517	1.968	0.544	1.977
HH_time allocation	Number of minutes spent in the past one week doing household activities	49.90	60.280	48.294	59.838
Log_hh_health_exp	Log of total household health expenditure	2.421	2.296	2.490	2.350
Sleeping rooms	Number of sleeping rooms in the house	3.125	2.121	3.296	2.257
Father sec	Whether the father has completed secondary schooling (1/0)	0.082	0.273	0.118	0.322
Mother sec	Whether the mother has completed secondary schooling (1/0)	0.0132	0.114	0.032	0.176
Age of head	Age of the household head (in years)	51.462	12.538	51.046	14.230
Female head	Whether the household head is a female (1/0)	0.286	0.452	0.283	0.450
Late enrolment	Whether the child enrolled late at primary school	0.514	0.500	0.474	0.500
Rural	Whether the child live in a rural area (1/0)	0.524	0.500	0.431	0.495
Schooling cost per capita income	Total schooling cost as a ratio of per capita household income	0.535	1.859	1.162	3.673
Food price inflation	Average food price inflation in the local district	93.666	4.210	93.772	4.343
Wage deviation	Standard deviation of district wage.	53.971	122.708	4558.25	11338.23

Source: Authors' own computation from GLSS 6.

7. Results and discussion

7.1 Tests for validity of instruments

As hypothesized for our instruments, the findings from all specifications suggest that food price inflation significantly increases the opportunity cost of both secondary and tertiary education. This means that an increase in food prices increases the household demand for the out-of-school options for their children's post-primary education. Similarly, we found that as the district wage gap widens, the opportunity cost of schooling also rises. The intuition is that inter-district migration of labour to where wages are high within the region would increase wages in the local district labour market, and thereby increase the outside options of schooling. This is statistically significant both at the secondary and tertiary levels. The Cragg-Donald F-statistics in all the specifications exceed the critical value of 10, suggesting that we have strong instruments. Also, the endogeneity test in

all specifications suggests that opportunity cost is endogenous and therefore our instrumental variable estimates are consistent compared to our probit estimates. As shown in the probit models, the problem of endogeneity is reflected in the fact that the estimates do not show any significant effect for opportunity cost, and also have the unexpected signs. However, after addressing endogeneity, we notice a significant and expected effect for opportunity cost, which are consistent with theory. We therefore interpret the results from the IVProbit specifications.

7.2 Opportunity cost and post-primary school enrollment

We begin by examining the composite effect of opportunity cost (time and money) on secondary and tertiary school enrollment, as reported in Table 2. The effect is statistically significant at both schooling levels, and the corresponding elasticities are higher at the tertiary school than the secondary school level. Among children of secondary school age, a one percentage point increase in their opportunity cost, reduces the probability of enrollment by 0.062, while that of tertiary school enrollment is 0.073. This suggests that tertiary enrollment tends to be more affected by children's outside options to a larger extent compared to the secondary school enrollment. This finding is consistent with the argument by Psacharopoulos (2014) that individual returns to education is a decreasing function of age, hence, with a significant outside options compared to secondary education.

7.3 Gender heterogeneous effect of opportunity cost and post-primary schooling

Tables 3 and 4 report the gender effect of opportunity cost on schooling decisions. Glick (2008) and Lincove (2012) suggest that girls have a higher opportunity cost of schooling due to the possibility of assisting in household activities, hence price elasticity of education is higher for girls compared to boys. Our findings confirms this proposition only at the secondary school level. At the tertiary education level, the price elasticity is significant for only boys. No significant effect is found for girl tertiary school enrollment. The probability of enrollment among girls of secondary school going age is 0.069 and that for the boys sample is 0.051 as reported in Table 3. In other words, girls are more likely to be out of secondary school when their outside school utility rises for the household. The probability is 0.107 for boys in the tertiary sample. A plausible explanation

is that at secondary school age, girls provide household assistance when the labour market is frictional. However, at the tertiary level, when children become adults, and seek non-schooling utility from the labour market, the market imperfections may favor boys than girls. Hence, boys' schooling responds to higher out-of-school gains unlike girls.

7.3 Expected returns to education and post-primary school enrollment

Given the nature of the labour market in Ghana and many developing countries, we examine the effect of expected returns to education using the average district wage in the formal and informal labour market on secondary and tertiary school enrollment. We hypothesize that households make rational decisions concerning their children's school enrollment by considering how much he/she will be rewarded in the labour market after completing school. Interestingly, we find that only returns to the informal labour market are significant in explaining secondary enrollment, and that formal labour market returns do not play any significant role as shown in Table 2. In other words, a higher return in the informal sector is associated with high probability of secondary school enrollment. As shown in Table 3, this is significant for both boys and girls, and the probabilities do not statistically differ. As reported in the summary statistics, individuals with secondary school qualification receive higher wages in the informal sector than in the formal sector on average.

At the tertiary education level, we notice that expected wages of adults with tertiary qualifications in the informal sector do not have any significant influence on school enrollments. Instead, it is return to schooling in the formal sector that has a significant impact on enrollment. Interestingly, this effect is significant for only boys and the corresponding probability is 0.028. This means that while expected returns from the informal sector is crucial for secondary schooling, tertiary education is influenced by expectations from the formal sector. Thus, household consider formal sector wage on tertiary qualification as a signal for their children's returns to education upon completion. In contrast to Chamarbarbagwala, (2008) and Anderson, King and Wang (2003), we have demonstrated the different effects of formal and informal labour market expectations on households' investment of children's education in a developing country.

Table 2: Unrestricted analysis for opportunity cost and post-primary school enrollments

	Secondary level			Tertiary level		
	Full sample		Marginal effects	Full sample		Marginal effects
	Probit	IVProbit		Probit	IVProbit	
Ln(opportunity cost)	0.239*** (0.087)	-0.940*** (0.306)	-0.062	0.130 (0.128)	-1.230*** (0.349)	-0.073
Ln(formal sector wage)	-0.034 (0.064)	0.012 (0.075)		0.026 (0.080)	0.100* (0.055)	0.015
Ln(informal sector wage)	0.158** (0.067)	0.181*** (0.064)	0.033	-0.005 (0.086)	-0.036 (0.065)	
Boy	-0.085 (0.071)	-0.060 (0.063)		0.177* (0.097)	0.144** (0.059)	0.056
Hh_sex_vic	-0.178 (0.115)	-0.083 (0.109)		-0.185* (0.103)	-0.101 (0.103)	
Sick_days	-0.025 (0.016)	-0.030** (0.014)	-0.008	0.002 (0.022)	0.023 (0.022)	
HH_time allocation	-0.001* (0.001)	-0.001* (0.001)	-0.0004	-0.004*** (0.001)	-0.005*** (0.001)	-0.002
Log_hh_health_exp	0.001 (0.017)	0.013 (0.015)		-0.010 (0.026)	-0.005 (0.026)	
Sleeping rooms	0.045* (0.024)	0.039* (0.021)	0.011	0.052** (0.024)	0.048* (0.025)	0.015
Father_sec	0.201 (0.158)	0.237* (0.134)	0.066	0.157 (0.124)	0.383*** (0.138)	0.117
Mother_sec	-0.185 (0.308)	0.138 (0.329)		0.389 (0.280)	0.565** (0.269)	0.172
Age of hh_head	-0.006* (0.003)	-0.004* (0.003)	-0.001	-0.004 (0.003)	-0.005 (0.004)	
Female_head	-0.065 (0.085)	-0.079 (0.082)		0.027 (0.091)	-0.003 (0.093)	
Enrolled late in prim_sch	0.115 (0.084)	0.001 (0.081)		0.160* (0.095)	0.088 (0.094)	
Rural dwelling	-0.278*** (0.100)	-0.475*** (0.100)	-0.115	-0.146 (0.121)	-0.167 (0.118)	
Edu_exp_per_capita	0.021 (0.021)	0.091*** (0.024)	0.025	0.025 (0.016)	0.044** (0.020)	0.013
Regional effects	Yes	Yes		Yes	Yes	
Constant	-1.104 (0.994)	6.057*** (2.117)		-0.436 (1.113)	11.372*** (2.216)	
<i>Validity tests</i>						
Food price inflation		0.006** (0.003)			0.032*** (0.005)	
Wage deviation		0.001*** (0.0002)			4.95e-06*** (0.000)	
Weak ID test (Cragg-Donald F-stat)		42.63			28.44	
Endogeneity test		10.11***			15.67***	
Wald chi 2	111.84***	100.83***		123.30***	206.12***	
N	1,813	1,813		1,219	1,214	

*Source: Authors' own computation from GLSS 6. * p<0.1; ** p<0.05; *** p<0.01. Standard errors are clustered at district levels. Post estimations for ivprobit are first obtained using ivreg2 command in Stata.*

Table 3: Gender restricted analysis for opportunity cost and secondary school enrollment

	Boys		Marginal effects	Girls		Marginal effects
	Probit	IVProbit		Probit	IVProbit	
Ln(opportunity cost)	0.184 (0.112)	-0.835* (0.440)	-0.051	0.265** (0.120)	-1.181*** (0.284)	-0.069
Ln(formal sector wage)	-0.067 (0.084)	-0.020 (0.076)		0.0002 (0.080)	0.046 (0.111)	
Ln(informal sector wage)	0.169** (0.076)	0.192** (0.078)	0.037	0.162 (0.083)*	0.181*** (0.068)	0.031
Hh_sex_vic	-0.139 (0.157)	-0.170 (0.146)		-0.210 (0.152)	0.046 (0.163)	
Sick_days	-0.034 (0.023)	-0.039* (0.022)	-0.008	-0.025 (0.024)	-0.027 (0.018)	
HH_time allocation+	-0.001 (0.001)	-0.001 (0.001)		-0.001 (0.001)	-0.001* (0.001)	-0.0004
Log_hh_health_exp	0.009 (0.025)	0.025 (0.022)		-0.009 (0.023)	0.002 (0.021)	
Sleeping rooms	0.020 (0.030)	0.021 (0.027)		0.069* (0.037)	0.052* (0.030)	0.016
Father_sec	-0.046 (0.239)	-0.038 (0.214)		0.427* (0.233)	0.458** (0.200)	0.136
Mother_sec	-0.364 (0.428)	-0.260 (0.406)		0.024 (0.579)	0.544 (0.561)	
Age of hh_head	-0.002 (0.004)	-0.002 (0.003)		-0.010** (0.005)	-0.005 (0.004)	
Female_head	0.044 (0.158)	0.032 (0.139)		-0.163 (0.112)	-0.158 (0.109)	
Enrolled late in prim_sch	0.047 (0.117)	-0.094 (0.117)		0.177 (0.123)	0.094 (0.105)	
Rural dwelling	-0.452*** (0.129)	-0.618*** (0.130)	-0.151	-0.148 (0.123)	-0.345*** (0.112)	-0.094
Edu_exp_per_capita	-0.001 (0.024)	0.048* (0.027)	0.013	0.063 (0.045)	0.165*** (0.055)	0.048
Regional effects	Yes	Yes		Yes	Yes	
Constant	-0.442 (1.335)	5.322* (3.016)		-1.874 (1.405)	7.944 (2.621)***	
<i>Validity tests</i>						
Food price inflation		0.010*** (0.002)			0.015*** (0.004)	
Wage deviation		0.001*** (0.0002)			0.001*** (0.000)	
Weak ID test (Cragg-Donald F-stat)		24.03			20.69	
Endogeneity test		4.63**			11.05***	
Wald chi 2	56.81***	71.94***		69.31***	150.84***	
N	883	883		930	930	

Source: Authors' own computation from GLSS 6. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at district levels. Post estimations for ivprobit are first obtained using ivreg2 command in Stata

Table 4: Gender restricted analysis for opportunity cost and tertiary school enrollment

	Boys		Marginal effects	Girls		Marginal effects
	Probit	IVProbit		Probit	IVProbit	
Ln(opportunity cost)	0.298** (0.138)	-1.353*** (0.302)	-0.107	-0.095 (0.171)	-0.800 (0.800)	
Ln(formal sector wage)	0.050 (0.094)	0.150** (0.075)	0.028	0.027 (0.104)	0.033 (0.068)	
Ln(informal sector wage)	-0.074 (0.102)	-0.069 (0.066)		0.080 (0.102)	0.039 (0.117)	
Hh_sex_vic	-0.235* (0.138)	-0.086 (0.157)		-0.140 (0.157)	-0.130 (0.159)	
Sick_days	0.024 (0.036)	0.056 (0.033)		-0.016 (0.025)	-0.009 (0.026)	
HH_time allocation+	-0.003** (0.001)	-0.004*** (0.001)	-0.001	-0.005*** (0.001)	-0.006*** (0.001)	-0.002
Log_hh_health_exp	-0.017 (0.030)	-0.013 (0.024)		0.001 (0.031)	-0.004 (0.031)	
Sleeping rooms	0.058* (0.031)	0.034 (0.028)		0.063** (0.031)	0.070** (0.031)	0.022
Father_sec	0.171 (0.191)	0.664*** (0.248)	0.188	0.110 (0.244)	0.377 (0.283)	
Mother_sec	0.585 (0.377)	0.814** (0.371)	0.231	0.029 (0.464)	0.228 (0.468)	
Age of hh_head	-0.006 (0.005)	-0.003 (0.004)		-0.002 (0.005)	-0.000 (0.005)	
Female_head	0.029 (0.125)	-0.092 (0.146)		0.106 (0.142)	0.024 (0.150)	
Enrolled late in prim_sch	0.338** (0.137)	0.139 (0.132)		-0.019 (0.137)	-0.171 (0.155)	
Rural dwelling	-0.350*** (0.132)	-0.370*** (0.128)	-0.105	0.124 (0.168)	0.087 (0.170)	
Ter_fees/(hh_income/hhsize)	0.020 (0.025)	0.046* (0.028)	0.013	0.031* (0.019)	0.039** (0.018)	0.012
Regional effects	Yes	Yes		Yes	Yes	
_cons	-1.492 (1.451)	12.128*** (2.277)		0.895 (1.852)	7.652 (5.031)	
Wald chi 2	68.42***	142.36***		70.87***	74.13***	
N	680	680		537	537	
<i>Validity tests</i>						
<i>Food price inflation</i>		0.030*** (0.006)			0.033*** (0.007)	
<i>Wage deviation</i>		3.99e-06*** (0.000)			8.52e-06*** (0.000)	
<i>Weak ID test (Cragg-Donald F-stat)</i>		12.10			18.78	
<i>Endogeneity test</i>		16.25***			4.41**	

Source: Authors' own computation from GLSS 6. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at district levels. Post estimations for ivprobit are first obtained using ivreg2 command in Stata.

7.4. The decomposition effect of opportunity cost and post-primary school enrollment

Due to the fact that households may have different utility from their children's time and schooling expenditure, we decompose opportunity cost and examine their relative effects on post-primary school enrollment. The findings in Table 5 suggest that the opportunity cost of schooling expenditure is the only significant component that affects secondary school enrollment. We notice that the average total opportunity cost for secondary school children is GHC 724.76 or USD 387.57 (Bank of Ghana, 2013). This price elasticity is, however, significant for only girls. The implication is that girls are more likely to be affected by the monetary cost of secondary schooling compared to boys. At the tertiary schooling level, we find that it is the opportunity cost of time that significantly influences schooling decisions but not the opportunity of schooling expenditure. This is significant for both boys and girls at the five and one percent significance levels respectively. However, the effect is more evident for boys than for girls. At the tertiary education level, the average opportunity cost of a child's time in school is GHC 3,440.51 (USD 1839.84), which exceeds the annual future value of schooling expenditure, which is GHC 2,604.99 (USD 1,393.04).

Table 5: IV estimates for the decomposition analysis for opportunity cost and post-primary school enrollment

	Secondary school level			Tertiary school level		
	Marginal effects			Marginal effects		
	Full sample	Boys	Girls	Full sample	Boys	Girls
Ln(time)	0.014 (0.679)	-0.094 (0.889)	0.158 (1.023)	-0.323*** (0.275)	-0.448** (0.575)	-0.336** (0.653)
Ln(money)	-0.304 (0.189)***	-0.257 (0.573)	-0.371 (0.124)***	-0.301 (0.954)	-0.276 (1.017)	0.692 (0.997)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi 2	229.12***	364.29***	352.30***	158.36***	87.05***	105.94**
N	1,813	883	930	1214	680	537

Source: Authors' own computation from GLSS 6. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at district levels.

7.5 Heterogeneous effect by household poverty status⁷

Since poor and non-poor households may be heterogeneous regarding their valuation of their children's time in school as well as their level of risk aversion in the educational investments, we do a restricted analysis for both poor and non-poor household as reported in Table 6. The findings from the top panel of Table 6 suggest that opportunity cost only has significant impact on children's secondary school enrollment among non-poor households. The price elasticity is higher for girls than for boys. In other word, girls are more likely to be out of secondary school when opportunity cost increase. After decomposing the opportunity cost, we find that the opportunity cost of schooling expenditure is the major impediment to girls' school enrollment even among non-poor households. In terms of expected returns to education, poor households have the tendency to send boys to school when there is a signal for higher returns to secondary education in the labour market. However, among non-poor households, it is rather the girl child who is enrolled when households' expectations are high. As reported in the bottom panel of Table 6, at the tertiary school level, the impact of opportunity cost on enrollment is higher for poor households; twice as much as that for non-poor households. Also, we find that the interaction term suggests that girls are more likely to be affected by an increase in opportunity cost among poor and non-poor households. This suggests that government subsidies for post-primary education will not only improve girls' education but will also benefit all households.

⁷ Poverty as defined in this study is consumption poverty which is computed by the Ghana Statistical Service (GSS). The poor are defined as those who cannot afford basic consumption needs, such as food and non-food items. The GSS calculates poor and non-poor households by using expenditure of a minimum consumption baskets that one requires to meet his/her food and non-food needs (GSS 2014). Extreme poverty line of 792.05 Ghana cedis (USD 1.10 per day) and 1,314.00 Ghana cedis (USD 1.83 per day) for absolute poverty line per adult per year in January 2013 prices of the Greater Accra region (GSS, 2014) are used to determine poor and non-poor households.

Table 6: IV estimate for household poverty status and the effect of opportunity cost on post-primary school enrollments

	Poor households			Non-poor households		
	Marginal effects			Marginal effects		
	Full sample	Boys	Girls	Full sample	Boys	Girls
Secondary level						
Ln(opportunity cost)	0.077 (1.349)	0.049 (1.469)	-0.009 (3.226)	-0.070*** (0.204)	-0.052*** (0.291)	-0.085*** (0.287)
Ln(formal)	-0.044 (0.038)	-0.050 (0.035)	-0.550 (0.076)	0.004 (0.078)	-0.001 (0.098)	0.100 (0.109)
Ln(informal)	0.032** (0.026)	0.038** (0.021)	0.015 (0.028)	0.030** (0.084)	0.028 (0.130)	0.043** (0.089)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi 2	9510.35***	4020.13***	5987.06***	1756.20***	8789.28***	4939.25***
<i>Decomposition</i>						
Ln(time)	0.023 (2.031)	0.019 (5.842)	0.064 (2.125)	-0.046 (0.747)	-0.055 (0.777)	-0.014 (1.225)
Ln(money)	-0.0003 (1.252)	-0.014 (2.657)	0.012 (0.925)	-0.038*** (0.222)	-0.042 (0.577)	-0.032*** (0.145)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi 2	2825.86***	5685.26***	253.59***	5331.02***	2653.4***	9889.34***
N	533	292	241	1280	592	688
Tertiary level						
Ln(opportunity cost)	-0.078*** (0.336)			-0.026*** (0.446)		
Opp_cost X Male	0.111*** (0.401)			0.079*** (0.285)		
Ln(formal)	0.024 (0.095)			0.008 (0.072)		
Ln(informal)	-0.052 (0.115)			-0.015 (0.075)		
Controls	Yes			Yes		
Regional effects	Yes			Yes		
Wald chi 2	2814.21***			8692.56***		
N	229			985		

*Source: Authors' own computation from GLSS 6. * p<0.1; ** p<0.05; *** p<0.01. Standard errors are clustered at district levels. Due to the small sample size for poor household at the tertiary level, we do not separate analysis for boys and girls, rather we control for an interaction term.*

7.4 Heterogeneous effects among rural and urban households

In Table 7, we demonstrate the differences between rural and urban households in their decisions to enroll their children. We run separate analysis for rural and urban households. The findings suggest that opportunity cost has no significant effect on secondary schooling for boys and girls in rural areas. A possible explanation could be that rural households, which are predominantly farm households (GSS, 2014), may have different valuation of the opportunity cost of children's schooling such as time spent on household farm lands, which is not captured in our measure of opportunity cost. Among children in rural households, their engagement in the labour market might also be low due to market frictions in those areas. A sharp contrast is the significant effect we observe for urban dwellers, with a larger effect for girls than for boys.

Another interesting finding is that expected wages in the informal sector is significant for both boys and girls in rural areas but only significant for girls in urban areas. Similar to our findings on poor households, expected returns has bigger effect for boys in rural households. It, therefore, suggest that poor and rural households have a higher probability of sending their boys to secondary school compared to their girls when there is a signal for higher returns to their education. In the bottom panel of Table 7, the findings for tertiary school enrollment suggest that opportunity cost affects both rural and urban areas, with a sizeable effect for rural dwellers compared to urban dwellers. The interaction term also suggests that the price elasticity is higher for boys in rural households than their counterparts in the urban households. .

Table 7: IV estimates for rural-urban dwelling and the effect of opportunity cost on post-primary school enrollment

	Rural households			Urban households		
	Marginal effects			Marginal effects		
	Full sample	Boys	Girls	Full sample	Boys	Girls
Secondary level						
Ln(opportunity cost)	0.080 (0.551)	0.084 (0.513)	0.075 (0.658)	-0.053*** (0.308)	-0.015*** (0.454)	-0.085** (0.345)
Ln(formal)	-0.009 (0.116)	-0.014 (0.116)	-0.009 (0.145)	-0.013 (0.079)	-0.041 (0.101)	0.002 (0.133)
Ln(informal)	0.039** (0.065)	0.048*** (0.075)	0.030** (0.088)	0.036* (0.118)	0.025 (0.172)	0.048** (0.134)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi 2	1602.85***	3653.19* **	850.44***	597.81***	577.53***	545.11***
Decomposition						
Ln(time)	-0.018 (0.877)	-0.021 (0.948)	0.024 (1.593)	-0.046 (0.744)	-0.066 (0.910)	-0.014 (0.896)
Ln(money)	-0.026 (1.069)	0.026 (1.517)	0.021 (0.924)	-0.025*** (0.109)	-0.019*** (0.099)	-0.030*** (0.105)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi 2	4907.67***	1280.51* **	1178.73***	1523.90***	1343.39***	3034.92***
N	963	502	461	850	382	468
Tertiary level						
Ln(opportunity cost)	-0.065*** (0.467)			-0.028** (0.618)		
Opp_cost X Male	0.057*** (0.431)			0.036*** (0.404)		
Ln(formal)	0.010 (0.065)			0.018 (0.147)		
Ln(informal)	-0.054 (0.089)			0.026 (0.138)		
Controls	Yes			Yes		
Regional effects	Yes			Yes		
Wald chi 2	5904.92***			2313.28***		
N	523			691		

*Source: Authors' own computation from GLSS 6. * p<0.1; ** p<0.05; *** p<0.01. Standard errors are clustered at district. Due to the small sample size for poor household at the tertiary level, we do not separate analysis for boys and girls, rather we control for an interaction term*

8.0 Sensitivity Analysis

In this section, we conduct a sensitivity analysis by redefining the outcome variables in order to determine whether our findings might suffer from selection bias. That is, we drop children who are both working and schooling from our sample to see if our results would change. In the secondary enrollment specifications, as reported in Table 8, the IV estimates suggest that opportunity cost is statistically significant and reduces the probability of secondary school enrollment. Consistent with the earlier predictions, we find that the effect is higher for girls than for boys. With regards to tertiary education, the findings in the bottom panel of Table 8 suggest that householdss with higher out-of-school utility for their children are less likely to enroll in any tertiary school. Again, we find that this is statistically significant for boys only. The findings for market expectations are also consistent with our previous findings. That is, while informal market expectations predict secondary school enrollment, expectations from the formal market drives tertiary school enrollments. The conclusion from the sensitivity analysis is that our results are robust and are not compromised by the definition of our outcome variables.

Table 8: IV estimates for post-primary schooling sample without children attending school while working

	Full sample	Marginal effects	Boys	Marginal effects	Girls	Marginal effects
Secondary level						
Ln(opportunity cost)	-0.847*** (0.271)	-0.082	-0.792* (0.438)	-0.065	-1.088*** (0.317)	-0.094
Ln(formal)	-0.025 (0.097)		-0.066 (0.091)		0.024 (0.123)	
Ln(informal)	0.207** (0.098)	0.053	0.225** (0.107)	0.057	0.200* (0.113)	0.051
Controls	Yes		Yes		Yes	
Regional effects	Yes		Yes		Yes	
<i>Validity tests</i>						
Food price inflation	0.010** (0.004)		-0.009 (0.006)		0.013 (0.005)**	
Wage deviation	0.001*** (0.000)		0.001*** (0.000)		0.001*** (0.000)	
Weak ID test (Cragg-Donald F-stat)	36.30		18.569		18.50	
Endogeneity test	10.86***		4.85**		8.33***	
Wald chi 2	123.28***		69.42***		86.88***	
N	1,373		670		703	
Tertiary level						
Ln(opportunity cost)	-1.452*** (0.410)	-0.060	-1.536*** (0.320)	-0.115	-0.874 (1.236)	
Ln(formal)	0.103 (0.082)		0.133* (0.073)	0.025	0.058 (0.098)	
Ln(informal)	-0.037 (0.066)		-0.035 (0.105)		-0.006 (0.124)	
Controls	Yes		Yes		Yes	
Regional effects	Yes		Yes		Yes	
<i>Validity tests</i>						
Food price inflation	0.030*** (0.005)		0.027*** (0.007)		0.029*** (0.007)	
Wage deviation	4.18e-06*** (0.000) ***		3.31e-06*** (0.000)		7.88e-06*** (0.000)	
Weak ID test (Cragg-Donald F-stat)	20.29		9.73		13.28	
Endogeneity test	5.60**		17.04***		2.76*	
N	1,036		559		477	

Source: Authors' own computation from GLSS 6. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at district levels. Post estimations for ivprobit are first obtained using ivreg2 command in Stata.

8. Conclusion

Post-primary education equips people with the skills and tools to help meet a country's growing demands for highly skilled and educated workers. It also leads to a healthier lifestyle, higher levels of job satisfaction, and more engagement in civic activities and other positive externalities. Contributing to the literature on children's education, this study has used nationally representative household data from Ghana to reveal the role played by opportunity cost of money and time in affecting households' decisions to enroll their children in secondary and tertiary school. In this study, we develop a novel approach for exploiting changes in district food price inflation over the period 2005 to 2013 as well as district wage deviations to obtain exogenous variation in children's out-of-school utility. This approach allows us to address the endogeneity issues of opportunity cost of money and time, and improve the robustness of our findings. Our analysis of the composite and relative effect of opportunity cost to secondary and tertiary school enrollment enables us to examine in more detail the opportunity cost-schooling relationship. Also, decomposing expected returns to education into formal and informal labour market, offers an in-depth understanding of how informal labour market affects schooling decisions, and better reflects the structure of many developing economies. Finally, our analysis by gender of the child, household poverty status and rural-urban divide, demonstrates the heterogeneity in the linkages between opportunity cost and post-primary schooling.

Our findings have shown that the effect of opportunity cost is statistically significant at both secondary and tertiary school enrollments. Notwithstanding, the corresponding elasticities are higher at the tertiary level than at the secondary level. Also, the decomposition analysis has revealed that while the opportunity cost of schooling expenditure is the major constraint on secondary schooling, it is opportunity cost of time that really impedes tertiary schooling. Further investigations on returns to education shows interesting differences. Expected earnings in the informal market is the main driver of secondary school enrollment, while earnings from the formal labour market influences tertiary school enrollment.

Our results also reveal gender differences regarding the opportunity cost of schooling. We find that the composite effect of opportunity cost on enrollment is more evident for girls at the secondary level, but this effect is only significant for boys at the tertiary level. The decomposition of opportunity cost indicates that girls enrollment at secondary school is negatively affected by

schooling expenditure, but is insignificant for boys. The opportunity cost for the child's time in school is negligible for both genders at the secondary school level. At the tertiary level, however, the opportunity cost of children's time is the only significant predictor of enrollment, especially for boys. Similarly, our findings for tertiary schooling suggest that opportunity cost has a higher effect on children from poor households and rural households than among non-poor and urban households. On households' expectations, poor and rural household have the tendency to send boys to school when there is a signal for higher returns to secondary education in the labour market.

From a policy perspective, these findings echo the need for government subsidies to improve secondary school enrollments, especially in countries where secondary education is not a 'pure public good'. Meanwhile, this study also highlights the need to be cautious when developing such policies. As discussed above, different groups react differently to cost, whether it is monetary or time. Policies need to be designed to ensure that they target the population that will react to incentives in order to achieve the desired outcomes.

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